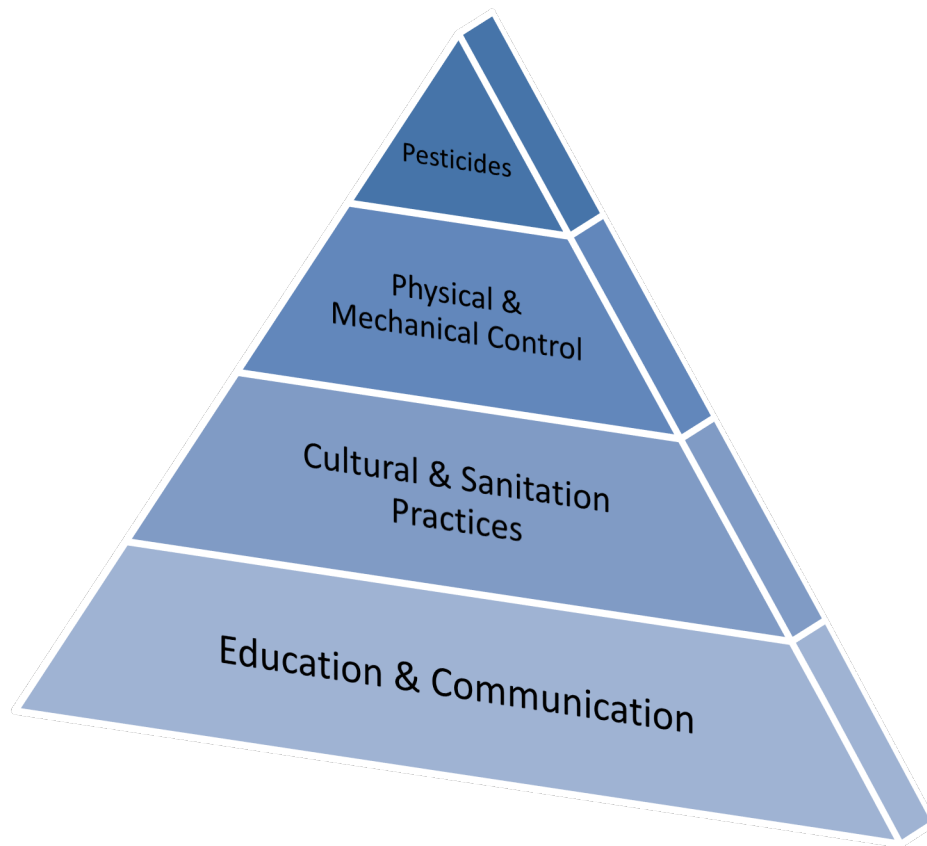


INTEGRATED PEST MANAGEMENT PLAN

MEDFORD SCHOOL DISTRICT 549C



The Medford School District Integrated Pest Management program will rely largely on good cultural and sanitation practices and rely least on pesticides.

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I. INTRODUCTION

There are increasing concerns about health and environmental risks associated with pests and the chemical used for pest control, particularly in schools. With an increased awareness of the health and environmental risks pesticides may pose, alternative pest control methods are identified in the Medford School District Integrated Pest Management (IPM) plan. The pesticides used to control pests, can pose health risks to people, animals, and the environment. Exposure to these pesticides can pose special health risks to children in large part due to their still-developing organ systems. IPM can reduce the use of chemicals and provide safe, economical and effective pest suppression.

Medford School District's written Integrated Pest Management (IPM) program is required by Senate Bill 634.700, which requires districts to adopt an Integrated Pest Management (IPM) plan and policy that also identifies an IPM Coordinator and their responsibilities.

Medford School District IPM program address the following principles:

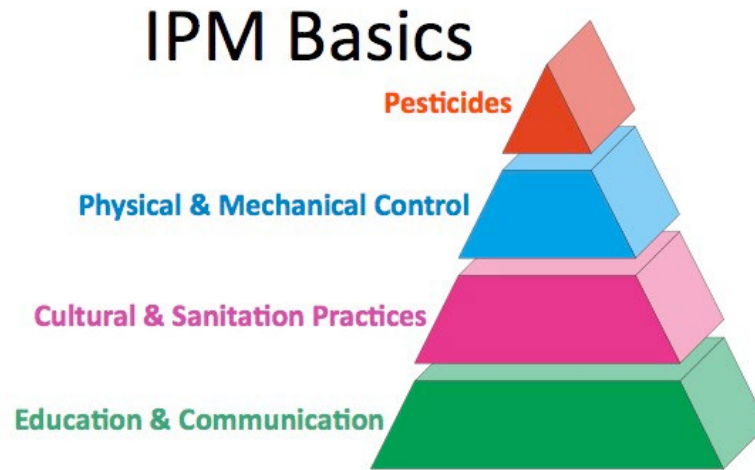
- Ensuring minimal human exposure to health risks.
- Prevention of pest problems.
- Monitoring for the presence of pests and pest damage.
- Establishing the pest population density that can be tolerated or correlated with a damage level sufficient to warrant treatment based on health, public safety, economic or aesthetic thresholds.
- Treating pest populations via biological, cultural, mechanical, and chemical methods that consider human health, ecological impact, feasibility and cost effectiveness.
- Providing for effective monitoring through inspections and standardized record-keeping.
- Evaluating the effects and efficiency of the IPM practices.

II. WHAT IS INTEGRATED PEST MANAGEMENT (IPM)

IPM is an effective and environmentally sensitive approach to pest management using comprehensive information on the life cycles of pests and their interactions with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment. IPM programs take advantage of all pest management options possible including, but not limited to, the judicious use of pesticides.

Understanding pest needs is essential to implementing IPM effectively. Pests seek habitats that provide basic needs such as air, moisture, food, and shelter. Pest populations can be prevented or controlled by creating inhospitable environments, by removing some of the basic elements pests need to survive, or by simply blocking their access into buildings. Pests may also be managed by other methods such as traps, vacuums, or pesticides. An understanding of what pests need in order to survive is essential before action is taken.

A. IPM Fundamental Basics



1. Education and Communication:

The foundation for an effective IPM program is education and communication. District employees will need to identify what conditions lead to pest problems, how to properly monitor and identify pests. A protocol for reporting pests, conditions that are conducive to pests and a record of what actions were taken are an important part of an effective IPM program.

2. Cultural & Sanitation:

Knowing how human behavior can encourage pests helps to prevent them from becoming a problem. Small changes in environmental or sanitation practices can have a significant impact on reducing pest populations. Cleaning under kitchen serving counters, reducing clutter in classrooms, putting dumpsters further from kitchen doors or loading dock areas, proper irrigation, and over-seeding of turf areas are examples of cultural and sanitation practices that can be employed to reduce pests within the Medford School District.

3. Physical & Mechanical:

Rodent traps, sticky monitoring traps for insects, door sweeps on external doors, sealing holes under sinks, proper drainage and mulching of landscapes, and keeping vegetation at least 36 inches from buildings are examples of physical and mechanical pest control practices.

4. Pesticides:

A well thought out and applied IPM will focus on the causes for pest problems and how to solve them, and less on using pesticides as the control. Pesticides will be used only when other forms of control have failed to control the targeted pest.

B. Integrated Pest Management Plan

ORS 634.700 defines an IPM plan as a proactive strategy that:

1. Focuses on the long-term prevention or suppression of pest problems through economically sound measures that:
 - Protect the health and safety of students, staff and faculty;
 - Protect the integrity of district buildings and grounds;
 - Maintain a productive learning environment;
 - Protect the local ecosystem health;
2. Focuses on the prevention of pest problems by working to reduce or eliminate conditions that promote the establishment, feeding, breeding and proliferation of pest populations that create harborage for pests during building operations and maintenance. All measures covered by this IPM will cover all district construction projects and contractors hired to preform work at any district site or building.
3. Incorporates the use of sanitation, structural improvements, habitat manipulation, or of mechanical, biological or chemical control measures that presents a reduced risk or have a low impact for the purpose of mitigating a declared pest emergency.
4. Includes regular monitoring and inspections to detect pests, pest damage and unsanctioned pesticide usage;
5. Evaluates the need for pest control by identifying acceptable pest population density levels;
6. Monitors and evaluates the effectiveness of pest control measures;
7. Excludes the application of pesticides on a routine schedule for purely preventive purposes, other than applications of pesticides designed to attract or be consumed by pests;
8. Excludes the application of pesticides for purely aesthetic purposes;
9. Includes education of school staff on sanitation, monitoring, inspection and pest control measures;
10. Gives preference to the use of nonchemical pest control measures;
11. Allows the use of low-impact pesticides if nonchemical pest control measures are ineffective;
12. Allows the application of a pesticide that is not a low-impact pesticide only to mitigate a declared pest emergency or if the application is by, or at the direction or order of, a public health official.

ORS 634.700 allows for the routine application of pesticides designed to be consumed by pests.

To avoid a proliferation of pests and/or unnecessary applications of pesticides, several steps must be taken before any type of routine or emergency applications are allowed:

- Staff must be educated on sanitation, monitoring, and exclusion as the primary means to control the pest.
- An acceptable pest population density level must be established.
- The use of sanitation, biological and mechanical control measures, with structural remediation and habitat manipulation must be incorporated into the strategy for pest management in the Medford School District.
- Documentation that the above steps were ineffective.
- The instructions and labeling must be read thoroughly to make sure all pesticide used are used in strict compliance with all manufactures labeled directions.

III. IPM PLAN RESPONSIBILITIES

For the Integrated Pest Management Plan to be implemented correctly and successfully, assigned responsibilities need to be completed in a timely and effective manner. Medford School District staffing responsibilities are as follows:

A. IPM Plan Coordinator:

The Medford School District designates the Facilities Manager as the IPM plan Coordinator. The Coordinator is given the authority for overall implementation and evaluation of this plan. The Coordinator is responsible for:

1. Attending not less than six hours of IPM training each year. The training shall include at least a general review of IPM principles and the requirements of ORS 634.700 – 634.750.
2. Communicate the IPM plan essentials to the school community, custodians, maintenance, construction, grounds, faculty, and kitchen staff about the schools.
3. Work with administrators, custodians, and teachers to reduce clutter and food in the classrooms, and the facilities and grounds department is to address and seal up pest entry points and landscape problems.
4. Continually assess and improve monitoring, reporting, and action protocols.
5. Assuring that all notification, posting, and record-keeping requirements contained in section VIII are met when the decision to apply a pesticide is made;
6. Maintaining the approved pesticides list as per section IX.
7. Responding to inquiries and complaints about noncompliance with the plan. Responses to inquiries and complaints will be in writing and kept on record with the Coordinator.

Note: ORS 634.720 states that the Coordinator “must be an employee of the governed district, unit, school or entity, unless the governing body delegates pest management duties to an independent contractor.”

B. Custodial Responsibilities:

1. Attending annual IPM training provided by the IPM Plan Coordinator (or designee).
2. Placing sticky insect traps in hot spots, cafeteria, and kitchen as well as monitoring according to the IPM plan protocols.
3. Keeping records of pest complaints and conditions conducive to pests by using the pest log and reporting to the IPM Coordinator.
4. Sealing up small cracks or holes, when reported by teachers or noticed by custodian, when this can be done in less than 20 minutes, and reporting pest problems that he/she cannot resolve in less than 20 minutes to the IPM Plan Coordinator by using the pest logs.
5. Recording all pest management actions in the pest logs.
6. Reporting non-compliance of staff to the IPM Plan Coordinator.
7. Confiscating any unapproved pesticides (such as aerosol spray cans) discovered during inspections or regular duties and delivering them to the IPM Plan Coordinator.
8. Following up on issues found in the annual inspection report as instructed by the IPM Plan Coordinator. The IPM Plan Coordinator will determine which schools receive annual inspections based on pest and pesticide use history.

C. Facilities Maintenance Responsibilities:

The Staff involved in construction and any type of facilities maintenance are responsible for working with the IPM Plan Coordinator to make sure their daily tasks, projects and operations enhance effective pest management. This responsibility will include but is not limited to the following:

1. Receiving training from the IPM Plan Coordinator (or designee of the Coordinator) on the basic principles of IPM, sealing pest entry points, and sanitation during construction projects.
2. Continually monitoring for pest conducive conditions, perform repairs and seal small holes and cracks that are found during daily work.
3. Working with the Coordinator to develop a protocol and priority list with deadlines for sealing holes and cracks, installing external door sweeps, and other pest exclusion needs.
4. Developing protocols and provisions for pest avoidance and prevention during construction and renovation projects. The IPM Plan Coordinator has the authority to halt construction projects if these protocols and provisions are not being met.

D. Grounds Department Responsibilities:

1. The IPM Coordinator (or designee) will train grounds staff at least once per year. Each

- year before the training, the IPM Coordinator will meet with the Grounds Supervisor to review the annual report of pesticide applications and plan training for all grounds staff. The annual training will review this IPM Plan and data from the annual report related to pesticide applications by grounds crew. It will also review the OSU turf management publications EC 1521, EC 1278, EC 1550, EC 1638-E, and PNW 299 and the matrices in Appendix 1.K. Grounds staff will also be trained in basic monitoring for common pests on grounds.
2. Grounds Supervisor is to provide training to coaches who use athletic fields. This training should provide an overview of basic monitoring and IPM practices for turf to develop an understanding of key pest problems and what to look out for and when to report them.
 3. Keeping tree branches, bushes and all other types of vegetation at least three feet from building surfaces.
 4. Proper mulching in landscaped areas to reduce weeds.
 5. Proper fertilization, over-seeding, mowing height, edging, drainage, aeration, and irrigation scheduling in turf areas to reduce weeds.
 6. When the decision is made to apply a pesticide, following notification, posting, record-keeping and reporting protocols in Section VIII.

E. Kitchen Staff Responsibilities:

1. Attending annual IPM training provided by the IPM Plan Coordinator (or designee).
2. Assuring floors, counters and other kitchen surfaces are kept free of food debris and drink spills. Special effort should be taken around and under food prep and serving line areas of the kitchens to keep these areas free of food and debris.
3. Promptly emptying, removing, and properly disposing of all corrugated cardboard and other packaging materials.
4. Keeping exterior kitchen doors closed.
5. Promptly report all conditions that would require facilities department attention. These problems can include, dripping faucets, leaking drains, dumpster too close to a building, missing door sweeps, doors that do not close correctly, etc. These problems must be recorded in the pest log.
6. Participating in all inspections conducted by custodial staff, site supervisor or IPM Plan Coordinator.
7. Checking sticky trap monitors once a week for cockroaches or drain flies. Any pest found on monitors should be reported to custodial staff and recorded in pest log.
8. Any rodent sightings or evidence of rodents found in the kitchen/food service area will be reported to the custodian and recorded in the site pest control log.

F. School Faculty Responsibilities:

1. Attending annual IPM training provided by the IPM Plan Coordinator (or designee).
2. Keeping their classrooms and work stations free of clutter.
3. Making sure students clean up after themselves when food or drink is consumed in the classroom.
4. Reporting pests and conditions that are conducive to pests too the custodian via, e-mail, or pest logs.
5. Following the first steps of protocol, particularly in regard to ant infestation.

G. School Administration Responsibilities:

1. Scheduling time for teachers to receive annual training.
2. Attending annual IPM training provided by the IPM Plan Coordinator (or designee).
3. Encouraging and supporting staff to keep their rooms/offices clean and free of clutter in accordance with the state mandated IPM Plan.
4. Assuring that all faculty, staff, students, parents and the public receive the annual notice provided by the IPM Plan Coordinator of potential pesticide products that could be used on school property (as per Section VI) as well as working with the IPM Plan Coordinator to make sure notifications of pesticide applications are posted on the site property, school web site and parents' newsletter.

IV. Monitoring

Monitoring provides recent and accurate information that will help make sound and effective pest control decisions. It can be defined as the regular and ongoing inspection of known pest problem areas, or the casual observation by staff members of pest activities. All information gathered during these inspections and monitoring will be documented for use in the pest control solution.

A. Three levels of monitoring

1. **Level 1 monitoring** - Casual observing with no record keeping. With no documentation there is no practical way to track pest problems or formulate a pest control plan. Staff is encouraged to develop a practice of observing their working environment to notice pest problems and situations that could create pests.
2. **Level 2 monitoring** - Casual observing with written documentation of observations. As pests are observed, recording information in the pest log will provide a solid base for a pest remediation plan. (Casual observation with written documentation is useful in the control of pests.) All staff members will receive training to improve their level 1-“casual observing” to level 2 “casual observing with written documentation.”

Staff members will be expected to report pests or conditions that are conducive to pests that they observe during the course of their normal daily work. Level 2 monitoring will be conducted by all school staff members, administrators, kitchen staffs, maintenance and grounds department workers, custodians, etc. Reporting will be done by jotting observations down in the school pest log, or reporting them to the site custodian to be recorded in the pest log.

3. **Level 3 monitoring** - Level 3 monitoring will be conducted by the IPM plan coordinator, site custodial supervisor, and the site custodian. Level 3 inspections will be periodically conducted at all district sites. A method used to identify pest activities is sticky monitoring traps. Custodial staff at each site will be expected to set and monitor the traps and record their findings in the pest log. When sticky monitoring traps are used in the kitchen to monitor pests, kitchen staff will be responsible for the monitoring and reporting.

Sticky traps are not a substitute for pesticides or an alternative for reducing pest populations. These traps are used as a diagnostic tool to aid in identifying the presence of pests, their reproductive stage, likely direction pests are traveling; and in some cases, can be used to determine pest populations.

After receiving training in the use of sticky monitoring traps by the IPM Plan Coordinator, district custodial staff will be responsible for the monitoring of traps placed in pre-determined "pest-vulnerable" areas. These areas can include staff rooms, kitchens, cafeterias, special education or kindergarten classrooms, home economics/life skills classrooms, concession stands, classrooms with animals or plants, custodial closets and storage areas.

Once a month custodians will check the sticky monitoring traps and record their findings in the site pest log. Traps in kitchen areas will be checked once a week by kitchen staff for drain flies and cockroaches and the findings recorded in the site pest log. Sticky traps will be replaced every four months.

In the event there is a problem identifying a pest caught in a trap, a close up digital picture should be taken and sent to the Plan Coordinator for help in identifying the pest. It is very important that all pests be identified correctly so proper pest control protocols can be applied.

Staff members will be informed of trap use, trap location and the reason for monitoring. When any staff member encounters a sticky monitoring trap, these traps should remain undisturbed.

4. **Monitoring-Landscaped Areas**

The following conditions will be monitored at every school district landscaped area on a quarterly or as needed bases. Monitoring will be conducted by the Grounds Supervisor.

- The condition of the plants (vigor and appearance)
- The amount of plant damage
- PH, nitrogen, phosphorus, and potassium levels of turf. Soil testing will be done on a rotating schedule that will have sites tested every 3-4 years.

- Population and types of pests present. These pests might include weeds, insects, mites, moles, etc. During a level 3 inspection, care should be taken to note the presence of any beneficial insects such as, ladybugs, spiders, lacewing larvae, syrphid fly larvae, etc.
- Weather conditions: record any unusually dry, hot, wet, or cold weather in the past few weeks.
- Proper drainage
- Human behaviors that affect the plants or pests, foot traffic that compacts the soil, physical damage to plants caused by people, insistence on having certain plants grow in unfavorable growing conditions, etc.
- Management activities and their effects on the plants and the pest population, pruning, fertilizing, mulching, aeration, treating pests, etc.
- Sticky monitoring traps for insects

V. REPORTING

A. Report pest sighting:

When a staff member observes a pest, or any conditions that are conducive to pests, they must record their observations in the site pest log or send an e-mail to the site custodian to be recorded during the next visit to the pest log.

B. Pest Concerns:

A “pest of concern” is a pest determined to be a public health risk or a significant nuisance pest. These types of pests can include cockroaches, mice and rats (which can spread diseases or act as an asthma trigger), or yellow jackets and bee stings (that can cause anaphylactic shock), all of which are significant nuisance pests.

Cornered nutria, raccoons, cats, dogs, opossums, and skunks can pose a biting hazard to staff and students

When “pests of concern” or evidence of their activity, such as nests, dropping, etc. are observed, these observations should immediately be reported to the building custodian. The custodian must contact the IPM Plan Coordinator immediately.

C. Annual IPM Report

In January of each year, the IPM Plan Coordinator will provide the Medford School District Chief Financial Officer and the OSU IPM Program Coordinator an annual IPM report. The report will include a summary of data gathered from Pest Logs, as well as costs for PMPs and pesticides (including turf and landscape pesticides). Costs for items such as sealants, fixing screens, door sweeps and other items that would not normally be considered part of pest control will not be recorded. See Appendix 3.K for a template for the annual IPM report.

Prevention and management steps taken that proved to be ineffective, and led to the decision to make a pesticide application, will be copied and pasted or incorporated into the annual report of pesticide applications (see section VIII.E)

VI. CORRECTIVE ACTIONS

A. Pest Emergencies (see also Section VIII. C. below)

IMPORTANT: If a pest emergency is declared, the area must be evacuated and cordoned off before taking any other steps. When the IPM Plan Coordinator, after consultation with school faculty and administration, determines that the presence of a pest or pests immediately threatens the health or safety of students, staff, faculty members or members of the public using the campus, or the structural integrity of campus facilities, he or she may declare a pest emergency. Examples include (but are not limited to) yellow jackets swarming in areas frequented by children, a nutria in an area frequented by children, a half a dozen mice or rats running through occupied areas of a school building.

B. Structural Impacts

The site custodial staff is responsible for sealing cracks and holes, etc. that take less than 20 minutes. Any problem that takes longer than 20 minutes to finish will be handled by the district maintenance staff through their regularly scheduled maintenance visits, unless that problem has been determined to be a pest emergency by the district IPM Coordinator. All repair actions taken will be noted in the pest log at each site.

The custodial staff will review pest logs twice a week. Items that cannot resolve in less than 20 minutes should be marked in order of priority. All pest logs will be faxed or e-mailed to the District IPM Coordinator once a week. The district IPM Coordinator will review each log to determine if any further actions might need to be taken.

If the work cannot be completed during the regularly scheduled maintenance visit, the IPM Coordinator will create a work order requesting additional work and a proposed deadline. The IPM Coordinator will monitor the completion of the work order.

If needed, the IPM Coordinator will meet with the custodial, grounds and carpentry supervisors to develop new protocols. The IPM Coordinator will then generate a work order with proposed solutions and deadlines for completion based on the severity of the risk or nuisance. The IPM Coordinator will establish the needed priorities and protocol changes that might be required to handle future and ongoing pest problems and enter it into the IPM Plan as an addendum. Upon completion of the work, the Coordinator and the school custodian will be notified.

The IPM Coordinator will keep records of time and money spent to manage the pests, including copies of original receipts.

C. Landscaped Areas

When pests on grounds reach a threshold established by the IPM Plan Coordinator, action will be taken.

D. Thresholds

The following pest thresholds have been established to set the action levels. When any pest is identified, action levels are required for the safety and health of students and staff.

1. Ants

- Action is required if colony is located near building
- Action is required if 5 ants are identified in one area of the school facility

2. Bats

- Immediate action required if Bat is in facility

3. Birds/Pigeons

- Immediate action is required if a bird is located in the facility
- Action is required to reduce exterior nesting

4. Cockroaches

- Immediate action is required if a cockroach is identified in a school facility

5. Fleas

- Action is required if 5 fleas are identified in one area of the school facility

6. Flies

- Action is required if 5 flies are reported in one area of the school facility

7. Head Lice

- Action is required if head lice are identified in an area of the school facility

8. Rats/Mice

- Immediate action is required if a rat or mouse is reported in or outside of the school facility

9. Spiders

- Immediate action is required if a Black Widow or Brown Recluse is identified in the school facility or school grounds

10. Yellow Jackets and Wasps

- Immediate action is required if a yellow jacket, bee or wasp is reported in the school facility.
- Action is required if 5 or more yellow jackets, bees or wasps are reported together on the school grounds.

VII. INSPECTIONS

A. Routine Inspections

The IPM Plan Coordinator (or designee) will conduct routine inspections of different sites throughout the year. The schedule will be set by the IPM Coordinator. Custodians are required to assist with the inspections. The inspections will typically last one to two hours and will focus on compliance with this plan. An inspection of the kitchen, staff room, and any other place of concern is included. After each routine inspection the Coordinator will write a one-page report on findings and recommendations. The report will be submitted to the school principal and custodian.

B. Annual Inspections

The IPM Plan Coordinator (or designee) will conduct annual inspections at individual schools. Site custodians are required to assist the IPM Coordinator with the annual inspection. The annual inspections will be more thorough than the routine inspections, and will use the Annual IPM Inspection Form (see Appendix 3.B) to guide the inspections. The specific schools to be inspected will be determined by the IPM Plan Coordinator based on a review of the annual number of pest problems and pesticide applications reported in the Annual IPM Report and Annual Report of Pesticide Applications.

Inspections will include:

- Pest conducive conditions inside and outside the building that encourage pest problems, structural deterioration, holes and cracks that can allow pests to enter, and any condition that provide pest harborage.
- The level of sanitation inside and out, waste disposal procedures, and any condition that supply food and water to pests.
- The amount of pest damage, number and location of pest signs, rodent droppings, termite shelter tubes, and cockroaches caught in sticky traps, etc.
- Human behaviors that affect the pests; such as working conditions that make it impossible to close doors or screens, food preparation procedures that provide food for pests, storage areas, eating in classrooms, etc.
- Management activities and their effects on the pest population. These activities can include caulking/sealing, cleaning, setting out traps, treating pests, etc.

VIII. PESTICIDE APPLICATIONS: REQUIRED NOTIFICATION, POSTING, RECORD KEEPING, AND REPORTING

Any pesticide application (this includes weed control products, ant baits, and all professional and over-the-counter products) on school property must be made by a licensed commercial or public pesticide applicator. (At the beginning of each school year, all faculty, administrators, staff, students and parents will be given a list of potential pesticide products that could be used in the event that other pest management measures are ineffective.) They will also be informed of the procedures for

notification and posting of individual applications, including those for pest emergencies. This information will be provided to all the above via school and district websites as well as hard copy available to students and parents.

A. Notification and Posting for Non-emergencies

1. When prevention or management of pests through other measures proves to be ineffective, the use of a low-risk pesticide is permissible. *Documentation of these measures is a pre-requisite to the approval of any application of a low-risk pesticide. This documentation will remain on file with the IPM Plan Coordinator and at the office of the site where the application takes place.*
2. No non-emergency pesticide applications may occur in or around a school while school is in session, unless the IPM Plan Coordinator authorizes an exception. If the labeling of a pesticide product specifies a reentry time, a pesticide may not be applied to an area of campus where the school expects students to be present before expiration of that reentry time. If the labeling does not specify a reentry time, a pesticide may not be applied to an area of a campus where the school expects students to be present before expiration of a reentry time that the IPM Plan Coordinator determines to be appropriate.

B. Notification of Pesticide use

The IPM Plan Coordinator (or a designee of the Coordinator) will give written notice of a proposed pesticide application (via the district and school website, posting on site grounds and hard copy at site office) at least 24 hours before the application occurs.

The notice must identify the name, trademark or type of pesticide product, the EPA registration number of the product, the expected area of the application, the expected date of application and the reason for the application. The Pesticide Application Notification Form is located in Appendix 3.H.

The IPM Plan Coordinator (or a designee of the Coordinator) shall place warning signs around pesticide application areas beginning no later than 24 hours before the application occurs and ending no earlier than 72 hours after the application occurs.

A warning sign must bear the words "Warning: pesticide-treated area", and give the expected or actual date and time for the application, the expected or actual reentry time, and provide the telephone number of a contact person (the person who is to make the application and/or the IPM Plan Coordinator).

The IPM Plan Coordinator must inform the facilities use scheduler of proposed pesticides application so any persons or groups using the district facilities can be notified offering possible re-schedule of the application or of the facilities use.

C. Notification and Posting for Emergencies

Important Notes:

1. *The IPM Plan Coordinator may not declare the existence of a pest emergency until after consultation with the school faculty and administration.*

2. *If a pesticide is applied at a campus due to a pest emergency, the Plan Coordinator shall review the IPM plan to determine whether modification of the plan might prevent future pest emergencies, and provide a written report of such to the Manager of Facilities and Grounds, who will take it to the district administration team and school board if necessary.*
3. *The Medford School District shall review and take formal action on any recommendations in the report.*

The declaration of the existence of a pest emergency is the only time a non low-impact pesticide may be applied.

If a pest emergency is declared, the area must be evacuated and cordoned off before taking any other steps.

If a pest emergency makes it impracticable to give a pesticide application notice no later than 24 hours before the pesticide application occurs, the IPM Plan Coordinator shall send the notice no later than 24 hours after the application occurs.

The IPM Plan Coordinator or designee shall place notification signs around the area as soon as practicable but no later than at the time the application occurs.

Note: ORS 634.700 also allows the application of a non-low-impact pesticide “by, or at the direction or order of, a public health official”. If this occurs, every effort must be made to comply with notification and posting requirements above.

D. Record Keeping of Pesticide Applications

The IPM Plan Coordinator shall keep a copy of the following pesticide product information on file at the office of the IPM Plan Coordinator. A copy will be provided to the site. These records must be kept on file at the site where the application occurred, and at the Medford School District Facilities Department, for at least four years following the application date.

- A copy of the label
- A copy of the MSDS
- The brand name and USEPA registration number of the product
- The approximate amount and concentration of product applied
- The location of the application
- The pest condition that prompted the application
- The type of application and whether the application proved effective
- The pesticide applicator’s license numbers and pesticide trainee or certificate numbers of the person applying the pesticide
- The name(s) of the person(s) applying the pesticide
- The dates and times for the placement and removal of warning signs
- Copies of all required notices given, including the dates the IPM Plan Coordinator gave the notices

E. Annual Report of Pesticide Applications

In January of each year, the IPM Plan Coordinator will provide the Medford School District Chief Financial and the OSU School IPM Program Coordinator an annual report of all pesticide applications made the previous year. The report will contain the following for each application:

- The brand name and USEPA registration number of the product applied
- The approximate amount and concentration of product applied
- The location of the application
- The prevention or management steps taken that proved to be ineffective and led to the decision to make a pesticide application
- The type of application and whether the application proved effective

IX. APPROVED LIST OF LOW-IMPACT PESTICIDES

All pesticides used must be on district approved list and must be used in strict accordance with label instructions.

According to ORS 634.700-634.750, the Medford School District shall adopt a list of low-impact pesticides for use with their integrated pest management plan. The Medford School District may include any product on the list except products that:

- Contain a pesticide product or active ingredient that has the signal words “warning” or “danger” on the label;
- Contain a pesticide product classified as a human carcinogen or probable human carcinogen under the United States Environmental Protection Agency 1986 Guidelines for Carcinogen Risk Assessment; or
- Contain a pesticide product classified as carcinogenic to humans or likely to be carcinogenic to humans under the United States Environmental Protection Agency 2003 Draft Final Guidelines for Carcinogen Risk Assessment.

As a part of pesticide registration under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) and re-registration required by the Food Quality Protection Act (FQPA), EPA Office of Pesticide Programs (OPP) classifies pesticide active ingredients with regards to their potential to cause cancer in humans. Depending on when a pesticide active ingredient was last evaluated the classification system used may differ as described above. The pesticides classification can usually be found in the re-registration eligibility decision (RED) at <http://www.epa.gov/pesticides/reregistration/status.htm> or in the Integrated Risk Information System (IRIS) at <http://www.epa.gov/IRIS/>

The National Pesticide Information Center (<http://npic.orst.edu/>) can be contacted at 1.800.858.7378 or npic@ace.orst.edu for assistance in determining a pesticide cancer classification.

List of “low-impact pesticides” that meet the requirements of ORS 634.700 – 634.750

Product Name	Formulation	EPA Registration #	Active Ingredient
Advion Ant Gel	Bait Gel	352-746	Indoxacarb
Advion Cockroach Gel Bait	Bait Gel	352-652	Indoxacarb
Glyphosate PTO	Liquid	EPA-73220-6	Glyphosate, isopropylamine salt
Ortho Home Defense Wasp & Hornet Killer	Pressurized liquid	1021-1775-239	Tetremethrin d-Phenothrin cyclopropanecarboxylate
Ortho Home Defense Ant & Roach Killer	Pressurized Liquid	239-2695	Bifenthrin ETOC
Speed Zone	Emulsifiable Concentrate	2217-833	Carfentrazone-ethyl, 2,4-D, 2-ethylhexyl ester, mecoprop-p acid, Dicama acid
K-Orthine Dust	Dust	432-772	Deltamethrin
The Andersons 0.25% Granular Dithiopyr Herbicide	Granular	9198-213	Dithiopyr

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Appendix 1: Pest Management for Specific Pest

A. Ants in Schools

Introduction

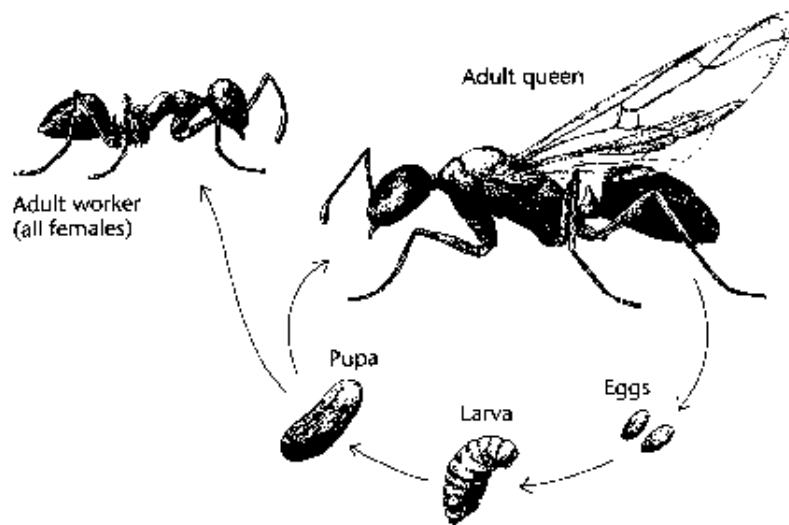
Ants become pests when they invade buildings in search of food or shelter. It is often very difficult and laborious to eliminate most ants from their outside habitat; therefore management should be targeted at preventing ants from invading structures. Unfortunately, prevention is not always successful and control actions must be implemented.

Although ants are often regarded as pestiferous, it should be noted that ants are beneficial in several ways. First, ants are predators of numerous pest insects, including fly larvae and termites. Secondly, ants aerate soil and recycle dead animal and vegetable material thus aiding in the formation of top soil. Additionally, ants are responsible for pollinating plants in some areas. Ants provide a great service to the environment, and management efforts that prevent or control ants are preferred over practices that aim to eliminate ants.

Identification and Biology

Ants are social insects that live in colonies whose members are divided into three castes: workers, queens, males. The responsibilities of the worker caste are to enlarge and repair the nest, forage for food, care for the young and queen, and defend the colony. The queen's primary duties are egg laying and directing the activities of the colony while males serve only to mate with the queens.

Ants pass through four stages of development: egg, larva, pupa, and adult. After mating with males, queens lay eggs that hatch into blind, legless larvae. The larvae are fed and cared for by worker ants. At the end of the larval stage they turn into pupae which do not feed. After a short period of time, adult ants emerge from their pupa stage and become worker ants.



The first step in management of pest ants is proper identification. Since there are many types of ants that may invade a structure it is important to identify the type of ant because most ants differ in their habits and food preferences. The University of Florida offers a poster that combines line drawings, color and scanning electron microscope photographs in an identification key to help individuals identify the most common structure-invading ants.

Damage

Some species of ants such as thief, Pharaoh, and Argentine ants, are particularly prone to infesting food. Inside buildings, these ants are primarily a nuisance since they almost never sting or bite. Since ants walk over many different kinds of surfaces and sometimes feed on dead animals and insects, it is possible that they can carry disease-causing organisms to human food. It should always be assumed that ant-infested food stuffs have been exposed to organisms that can cause spoilage, and the food should be thrown away.

Detection and Monitoring

Visual inspection is the most useful monitoring technique for detecting ants and can be very useful in preventing a developing infestation. A thorough inspection and prevention program is required to locate the ant source.

- Constructing a map of the school on which you can note problem areas and areas needing repair.
- A bright flashlight is mandatory. Kneepads and a mirror are helpful.
- A sealant such as outdoor caulk can be used to seal holes and cracks that ants could use to gain entry to the structure.
- Keep accurate records during the monitoring program to help formulate an IPM plan and evaluate its effectiveness.
- Careful attention should be paid to indoor areas such as kitchens and food preparation areas.
- An ant infestation may indicate that there has been a change in the methods of storing food or food waste that allows increased food sources for ants. Note how food and food wastes are stored in the area, and whether refuse containers are emptied and cleaned regularly. Inspect recycling bins to ensure that recyclables have been cleaned before storage.
- Interact with kitchen staff and custodians to learn more about the problem from their perspective.
- Ants can be attracted to snacks kept in classrooms or teachers break rooms as well as to sweet drinks accidentally spilled on the floor.

Management Options

Habitat Modification

The environment should be modified to reduce ant entryways and access to food. With quality materials and careful work, the alteration will be permanent and make a long-term impact on the number of ant invasions.

Caulking

- Caulk all potential entryways with a silicone caulking compound.
- Use mildew-resistant caulk in moist areas.
- It is not necessary or practical to seal all cracks, but begin with the access point that the current trail of ants is using.
- Always carry caulk when making inspections and seal as many cracks as time allows, especially those around baseboards, cupboards, pipes, sinks, toilets, and electrical outlets. Silicone caulks are flexible, easy to apply, and long-lasting.
- Weather-strip around doors and windows where ants may enter.

Sanitation

Sanitation eliminates food for ants. Thorough daily cleaning of school kitchens and food preparation areas is essential.

- Sweep and mop floors.
- Drain all sinks and remove any food debris.
- If children regularly receive snacks in classrooms, these floors should be vacuumed and/or mopped daily.
- Periodically give all food preparation areas a complete cleaning, focusing on areas where grease and food debris accumulate. These include drains, vents, deep fat fryers, ovens, stoves, and hard-to-reach areas behind or between appliances. Thoroughly clean the area with a powerful vacuum.
- At the end of each day, remove all garbage containing food from the building.
- Use soapy water to wash any bottles, cans, wrappings, and other items that have food residues clinging to them before storing them for recycling.
- If dishes cannot be washed right away, it is very important that they at least be rinsed to remove all food debris.
- Place garbage in sealed plastic bags before it is placed into a rodent-proof dumpster or other storage receptacle.

- Keep garbage cans and dumpsters as clean as possible to deny food to ants, roaches, flies, mice, and rats.

Proper Food Storage

- Food not kept in the refrigerator should be kept in containers that close tightly. Cardboard boxes can be penetrated by ants.
- Keep particularly attractive substances, like sugar and honey, in a refrigerator.
- Although refrigerator storage is usually safe, ants sometimes get into refrigerators and freezers even when the seals appear intact. When this occurs, a light, temporary coating of petroleum jelly on the edge of the refrigerator seal will exclude the ants.
- Screw-top jars are ant-proof only if the lid has a rubber seal since the ants can follow the spiral ridges to get into the jar.
- Glass containers with rubber gaskets or plastic containers with tight-fitting, snap-top lids are also ant-proof.
- Upon arrival to the building, transfer packaged food into plastic or glass containers. To prevent roach problems, do not bring shipping boxes into the food preparation area. Instead, boxes should be broken down and stored away from the kitchen in a cool area until removed for recycling.
- Advise students and teachers not to leave unsealed food items in their desks or lockers.
- Any food kept in offices or classrooms should be stored in ant-proof containers.

Physical Controls

At times when only a few ants are noticed foraging in an area, squashing or crushing the ants may be effective.

Vacuuming

- Use a strong vacuum to vacuum up trails of ants effortlessly and quickly.
- Vacuum a tablespoon of corn starch to kill ants in the vacuum bag.

Detergent Barrier

Temporary "moats" of detergent and water may be useful during heavy ant invasions.

- Containers of food or food waste which must remain open during working hours can be placed in large, shallow pans filled with water mixed with a small amount of detergent.
- Use this technique to protect potted plants from ants that may be attracted to nectar produced by the plant or to honeydew produced by plant-feeding insects. Elevate the pot above the detergent-and-water mixture by placing it on an overturned saucer. Make

sure the limbs and leaves of the plant are not in contact with surfaces that ants could use as bridges.

Chemical Controls

At times, non-chemical methods alone prove insufficient to solve the problem. Integrating a pesticide into your management program may be necessary to gain control of the ant problem.

Pesticides must be used in accordance with their EPA-approved label directions. Applicators must be certified to apply pesticides and should always wear protective equipment during applications. All labels and Material Safety Data Sheets (MSDS) for the pesticide products authorized for use in the IPM program should be maintained on file. Do not apply these materials when buildings are occupied, and never apply them where they might wash into drains or sewers.

When treating ants, all baits and dusts should be placed in cracks, crevices, and in precise areas where ants are active.

Detergent and Water

When ants invade a classroom or food preparation area, use a mixture of soap and water in a spray bottle. This mixture will quickly kill the ants which can then be wiped up with a sponge and washed down the drain. Each classroom, cafeteria, and food preparation area should be equipped with such a spray bottle so teachers and staff can safely deal with emergencies.

Boric Acid

Boric acid is one of the most valuable chemical control tools in an integrated ant management program. It is formulated as a dust, gel bait, and aerosol. It acts as a stomach poison and is relatively non-toxic to mammals. If kept dry, boric acid dust remains effective for long periods of time.

- When applying boric acid dust, wear a dust mask to avoid breathing the material.
- Use a bulb duster to apply a **light** dusting in cracks and crevices. This is recommended over dusting large, open areas.
- Boric acid is approved for crack and crevice treatment in kitchen and food preparation areas.
- Boric acid can be dusted into wall voids and spaces behind and under cabinets.

Diatomaceous Earth and Silica Aerogel

These are insecticidal dusts that can be used for ant control. Diatomaceous earth is made from fossilized diatoms, and silica gel is produced from sand. Both kill insects by desiccation; they absorb the waxy layer from the insect's outer covering, which causes dehydration and death. Although these materials are not poisonous to humans directly, the fine dust travels freely through the air and can be irritating to the eyes and lungs; therefore, use a dust mask and goggles during application.

Diatomaceous earth and silica aerogel are especially useful in wall voids and similar closed spaces. During construction and remodeling these dusts can be blown into such spaces, and in finished buildings they can be applied by drilling tiny holes in the walls. These dusts are also useful in crack and crevice treatments.

Some products combine diatomaceous earth or silica gel with pyrethrins. The pyrethrins provide a quick knock-down of the ants, and the dusts provide long-term control.

Ant Baits

Baits greatly reduce the amount of pesticide that must be used to kill ants. Foraging ants take the bait back to the nest to feed to other members of the colony resulting in colony death. Even if the queen is not killed, baits will usually stop an ant invasion. If a colony has been starved by effective sanitation measures, baits will be more readily accepted.

Always place baits out of sight and reach of children, or, if this is not possible, use baits at night or on weekends and remove when children are in school.

Some ants are very susceptible to baits, some are less so. If you are having difficulty in controlling ants with a bait, the following points may be helpful:

- It is important to correctly identify the species of ant that is invading the school since each species differs in its food preferences. Some baits contain a sweet attractant and others use a protein or oily attractant. Therefore, the attractant in the bait must be preferred by the type of ant identified. If you cannot determine the type of attractant by looking at the label, call the manufacturer for more information. You should also ask if the company has data to support the efficacy of their product against the ant species you are dealing with.
- After setting out bait, observe to see if the target ant is taking the bait.
- Ant colonies have changing nutritional requirements that can pose problems in baiting. A colony that accepted a protein bait one week may be more interested in a sugar bait the next.
- The nesting and foraging environment can also affect bait acceptance. Ants nesting and foraging in dry areas will be more interested in baits with a high water content than will ants nesting in moist environments.
- When there are several competing ant species in one area, ants non-target ants may accept your bait more readily than the pest ant and, in some cases, prevent the pest ant from getting to the bait.
- Do not spray pesticides when using baits. Bait stations contaminated with pesticide are repellent to ants, and sprays disperse the ant infestation, making it more difficult to place baits effectively.
- Place bait stations along foraging trails, but do not disturb ant trails between the nest and the bait. Killing the ants or disturbing the trails prevents the ants from taking the bait back to the colony to kill nest mates.
- Do not apply bait until an ant problem is noticed. If you use baits preventively you may attract ants into the building.
- Some baits come packaged in plastic disc "bait stations" that come with double-sided tape so they can be attached to various surfaces out of view. It is important to remove bait stations once control is attained because the stations may serve as harborage for

cockroaches. Some baits are formulated as granules or gels that can be injected into wall voids through small holes. Gel baits can also be placed near ant trails in inconspicuous places where they will not be disturbed.

B. Bats

Bats, which consume huge quantities of insects, including many that damage crops, are (mostly) our friends. Nevertheless, bats sometimes become a nuisance when they roost in buildings in large numbers. Why do bats roost in buildings? Are they dangerous? What's the best way to handle bat nuisance problems?

Some bats move into buildings because they have lost their natural habitats in caves and trees. They may cause no problems; however, when large colonies roost in buildings, they can cause noise, odors, and piles of droppings. Like other wild animals, some bats contract rabies. Although only very small percentages are infected, any bat found on the ground is more likely to be sick or injured. Neither adults nor children should handle bats, or for that matter, any other wild animal. If there is any possibility that a student or school employee may have been bitten or had direct contact with a bat, the animal should be captured and submitted to the local health department for rabies testing.

Bats that end up indoors by accident often can't find their way out. These can be safely captured by simply waiting until the bat lands on a wall or ceiling, then carefully placing a box or coffee can over it. Slide a piece of cardboard between the box (or can) and the wall (or ceiling) so the bat is contained. If the bat needs to be tested for rabies, call animal control. If no one had direct contact with the bat, it can be turned over to a wildlife-rescue organization in your area or simply released outside away from people and pets.

Bat colonies can roost in attics, under eaves, or in the walls of buildings. These bats can be safely evicted. First, identify the openings bats use to enter and exit the building. Watch the building at dusk to see where the bats are coming out. Fit these openings with a one-way valve that will allow the bats to exit but not to reenter the building. You can make such a valve constructed from 2-inch (diameter) PVC pipe, an empty and cleaned caulking tube with both ends cut off, window screen, or even clear sheets of plastic. (See diagrams at <http://www.dphhs.mt.gov/PHSD/epidemiology/documents/doityourself.pdf>). Check for other openings and seal them to prevent bats from entering through alternative holes. The one-way valve in the bats' opening should be left in place for about a week to make sure all the bats have left, and then seal that opening shut.

This is called "bat exclusion." Bats fly out on their own and are unable to reenter. It is the only safe and effective method for permanently evicting bats from buildings. It is not legal to use pesticides against bats, and poisons often result in sick bats that can end up on the ground where they are more likely to be found by children or pets. Bat "traps" are also inappropriate, since they usually result in overcrowding that kills or weakens bats and, again, increases the possibility of sick bats finding their way to places where they could have contact with people. Only proper bat exclusion techniques help to ensure the health and safety of people, while ridding buildings of nuisance bat colonies. Help protect both human and environmental health with proper bat-exclusion methods.

Bat IPM Plan

If a bat is found on school grounds, secure the area to keep unauthorized personnel from coming into contact with the bat. Only maintenance personnel should remove bats. Although only a small percentage of bats are infected with rabies, certain precautions should be taken when attempting to remove and/or capture a bat. The procedure for removing the bat is as follows:

- Obtain contact information for anyone who may have come into contact with the bat.
- Make sure there are no students or staff around the bat.
- Have the following items available before you approach the bat; a pair of heavy cloth gloves, a small plastic box, lid, and masking or duct tape.
- When attempting to capture a bat, avoid direct skin contact.
- After putting on the gloves, place the plastic box over the bat, slip a stiff object under the box opening and tape it shut.
- Notify the Principal, Area Supervisor, and IPM Coordinators immediately that the bat is secured.

Procedures for Principals:

- **No one in your building is to try to capture a bat.** Your role as the Principal or Building Representative is to protect the students and/or staff in your building by isolating the bat if possible. If the bat is on a flat surface like a floor or sidewalk, attempt to place a can, box, bucket, etc. over the bat to keep it from escaping.
- In all cases, **have someone stay with the bat** and keep track of it until an IPM professional arrives.
- If a bat is spotted in a room or a large area like a gym or band hall, get all the occupants out of the room and secure the door(s).
- If a bat is spotted in a hallway, isolate the hallway and tell the students or staff in adjacent rooms to close their doors and stay in the rooms.
- If a bat is spotted on the outside wall of a building, keep students away.
- If a bat is spotted outside on the ground, near children, or in entryways, keep students away.
- Contact the **Maintenance Department (541-842-3646)** to report the incident. After business hours, contact the on-call supervisor at 541-842-3900.
- If a rabid bat is found in or around any district facility, the Principal and/or IPM Coordinator must be notified. Each facility or campus should then notify all staff and students that a rabid bat has been found on site.

C. BIRDS - Pigeons

The ubiquitous pigeon infests, to a greater or lesser extent, nearly all industrial and urban areas across the United States and the world. In the US, pigeons are non-native and considered an invasive pest species.

Just like rodents, pigeons are considered a public health pest and are not just an aesthetic issue. Pigeons are also considered vectors for zoonotic diseases and ectoparasites.

While the devices are periodically updated, conventional pigeon control is fundamentally represented by just two basic strategies, exclusion and removal. A third strategy focuses on controlling the underlying reproduction of the birds is represented by contraception.

Exclusion	Removal	Population Control
<i>Nets, spikes, electrified strips, wires and coils</i>	<i>Trap and euthanize</i>	<i>Contraception</i>
<i>Effigies and other frightening devices</i>	<i>Shoot</i>	<i>Nest destruction</i>
<i>Repellants (sound, tactile, chemical)</i>	<i>Poison (Avitrol, DRC-1339)</i>	<i>Egg removal</i>

Although all of these tools have their place, pigeons are very adaptable and require an integrated program of pest management (“IPM”). Another manner to categorize pigeon management tools is by their ability to control the birds over time. Nearly all techniques are effective short-term, even a plastic owl. The real question is the long-term value and sustainability of the different methods. For example, while trapping is very effective in removing adult birds, due to the breeding capability of pigeons it has little long-term effect on the population.

Exclusion

Pigeons can be excluded from buildings by blocking access to indoor roosts and nesting areas. Openings to lofts, steeples, vents, and eaves should be blocked with wood, metal, glass, masonry, rust-proofed wire mesh, plastic or nylon netting. Roosting on ledges can be discouraged by changing the angle to 45° or more. Exclusion simply moves the birds from one location to another and does not address the underlying population of birds.

Consistent with IPM practices for rodent or insect management, elimination of feeding, watering, roosting, and nesting sites is critical for long-term pigeon control. Discourage people from feeding pigeons in public areas and clean up food sources. Eliminate pools of standing water that pigeons use for watering.

Frightening Techniques

Noise-making devices are usually disturbing to people but have little permanent effect on roosting pigeons. High-frequency (ultrasonic) sound, inaudible to humans, can have an inconsistent response in birds. Firecrackers and other pyrotechnics may have a temporary effect but have many limitations and often fail to provide long-term control, especially against pigeons. Effigies, models of owls, hawks, snakes, and cats vary in effectiveness, depending on how realistic they are and how often they are moved.

When used as the sole tactic, harassment or exclusion techniques merely encourage pigeons to move somewhere else. As pigeon populations increase, they eventually create a larger

“demand” for habitat. This demand causes pigeons to become increasingly resistant to hazing techniques.

Repellents

Sticky substances (polybutenes) discourage pigeons and other birds from landing on treated surfaces, but are not recommended since they can adhere to and foul the feathers of any bird which comes into contact with them, and may be harmful to smaller species.

Live-Trapping

Live-trapping of pigeons can be an effective method of removing adult birds. Traps must be checked frequently to remove the captured pigeons. Various humane methods are used to dispose of the trapped pigeons, but under no circumstances should they be taken away and released since the pigeon’s homing ability will defeat any trap and release program.

Pigeons breed rapidly – 2 eggs/clutch and up to 6 clutches/year. Left unchecked, just five mating pairs can produce up to 400 offspring in only two years. While removal options often appear to offer tangible and immediate results, due to the bird’s rapid reproduction, these methods do not have a sustainable impact on the overall population.

Contraception

Recently developed contraceptive technology (OvoControl® P) offers an effective new tool for pigeon management; interference with the bird’s reproduction. Due to the rapid turnover of the population and relatively short lifespan of pigeons (2-3 years), a contraceptive tool is very effective in reducing bird numbers. Data shows an 88% decline in the pigeon population over 28 months.

In summary, the management of pigeon populations is often a complex challenge requiring an integrated program of mitigation. Effective programs typically combine different tools consistent with site and customer requirements. Controlling reproduction is essential for the long-term and sustainable control of the underlying population of birds.

D. Cockroaches in Schools

Introduction

Cockroaches consume human foods and contaminate them with saliva and excrement. Infested buildings are easily detected by a characteristic fetid odor that is produced by the cockroach bodies and fecal material. Additionally, cockroach feces and cast skins contain allergens. The allergens can become airborne and cause allergic reactions, asthma and other bronchial problems in persons inhabiting infested buildings.

Cockroach and Biology

Except for size and markings, all cockroaches are similar in overall appearance: flattened, oval shaped insects with long legs and antennae. The most common pest cockroaches in the United States can be divided into two groups: **domestic**-small cockroaches that only live in human structures and **peridomestic**- larger cockroaches that generally live outdoors but occasionally invade structures. The most common domestic cockroach pests are the **German** and **brownbanded** cockroaches. The most common peridomestic cockroaches in the United States are the **American, brown, smokybrown** and **oriental** cockroaches.

In general, cockroaches like to squeeze into warm cracks and crevices the specifics of their habitat differs with the species of cockroach. The German cockroaches prefer moist kitchen and bath room areas while brownbanded cockroaches are most often found in the dryer living and bedroom areas. Additionally, American and oriental cockroaches are generally found in very high moisture habitats (sewers, basements, mulch etc). However, smokybrown cockroaches are more often found in dryer areas like treeholes and attics.

The life cycle of the cockroach begins with the egg case, or **ootheca**. In German and Asian cockroaches the female carries the egg case around with her until just before the eggs hatch. The brownbanded and peridomestic cockroaches deposit the egg case in a sheltered place (see Table). Cockroaches undergo a gradual metamorphosis in their life cycle. An immature cockroach, or **nymph**, looks very much like an adult, but is smaller and wingless. As the nymph grows, it sheds its skin (molts) a number of times. The time it takes a cockroach to develop is influenced to some degree by temperature. The nymphal cockroaches develop more rapidly when it is warm. Thus populations of cockroaches can become extremely large during the summer months.

Cockroaches prefer carbohydrates to protein and fat. They will discriminate among foods if given a choice, but when hungry they eat almost anything. Some products not normally considered food -- starch-based paints, wallpaper paste, envelope glue, and bar soaps --contain carbohydrates, and hence are food for cockroaches.

Cockroaches are generally active at night and remain hidden during daylight. Daylight sightings usually indicate a large population which has overrun available harborage, or a recent emigrant cockroach is seeking shelter.

Damage

Cockroaches have not yet been proven to be involved in the natural transmission of any particular human pathogen (this means that they are not a necessary part of the life cycle of a

disease organism or documented as the cause of any disease outbreak), however, evidence has been collected that clearly indicates that cockroaches can mechanically transmit a long list of disease-causing organisms. Because cockroaches wander at will through all types of organic wastes, then travel over kitchen counters, cooking utensils, food, plates, and silverware, their presence indicates potential contamination of foods and utensils. However, the most important health issue associated with cockroaches is the production of allergens which can cause severe bronchial problems in sensitive individuals and children.

Inspection and Monitoring

Efforts to control cockroaches should begin with a thorough visual inspection and a continuous monitoring program. Cockroaches are rarely dispersed everywhere throughout the building. Once they have located a suitable harborage, they tend to concentrate there, leaving periodically to forage for food and water. Thus, the first step in the visual inspection is to locate potential cockroach harborage sites. This should be followed by monitoring the area to locate specific cockroach concentrations. Monitoring of infestation sites must continue after treatment to determine whether control efforts have satisfactorily reduced the cockroach population.

Visual Inspection

- Construct a map of the premises.
- Mark all the locations where cockroaches are sighted, or where you see signs of their presence, such as fecal matter, shed skins, egg cases, etc.
- Mark any places that are likely harborage or food sources.
- Note any sanitation problems such as food or grease spills, food or grease buildup behind or under kitchen equipment, or improper garbage disposal procedures.
- Note any leaks or condensation.
- Look for cockroach entry points such as holes in walls or floors, or around pipes where they enter a wall, around electrical conduits, in vents, etc.

How and Where to Inspect

When inspecting for cockroaches, define the specific area on your map that is to be inspected. Inspect the entire area in a systematic and logical fashion from floor to ceiling to make sure no potential harborage areas will be overlooked. Be sure to inspect:

- under, behind, and around sinks, toilets, showers, bathtubs, drinking fountains, ice machines, dishwashers, beverage dispensers, floor drains
- the engine compartments of refrigerators, beverage dispensers, toasters, air conditioners, and other equipment
- in and under stoves, hot plates, heaters, and near hot water pipes and radiators
- in and around stove vents, hoods, grease traps
- between equipment and walls, between adjacent appliances

- behind picture frames, mirrors, bulletin boards, wall-mounted shelving
- in false ceilings, vents, light fixtures, ceiling-mounted fixtures, and railings
- in cupboards, linen closets, drawers, filing cabinets, lockers, cluttered areas
- in and under cash registers, computers, telephones, electric clocks, televisions, switchboxes, and fuse boxes
- in and around check-out stands, vegetable bins, and meat counters
- cracks and crevices in walls, baseboards, etc.
- under edges and in corners of equipment, tables, desks, counters, and other furnishings and equipment
- indoor and outdoor trash containers, dumpsters, and recycling containers
- loading docks, and storage areas where incoming food, supplies, equipment, and other potential sources of migrating cockroaches are received and stored

When to Inspect

Most inspections are conducted during daylight hours for the convenience of the inspector. However, since cockroaches tend to remain hidden during the day it is difficult to access the size and location of the population until after dark. Therefore, be sure to schedule at least one inspection after dark when the majority of the population is active. This will give you more information about where the cockroaches are and the level of sanitation at a time when the building is supposed to be clean. Begin your inspection with the lights off if possible. A flashlight covered with a yellow filter (Roscoe #12) will prevent the cockroaches from being disturbed while you look for their harborages and sources of food and water. Then turn on the lights and examine areas where cockroaches were observed. Note this information on your map.

Monitoring with Sticky Traps

A visual inspection may not provide all the information you need about where cockroaches are harboring or how many cockroaches there are; you may need to use sticky traps as well. Many brands of sticky traps are available, but most are of a similar design -- a rectangular or triangular cardboard box with bands of sticky glue inside and, in some models, a dark strip of cockroach attractant.

The best sites for traps are near harborages and along cockroach travel routes. Cockroaches may not find traps in open locations or outside their normal routes of travel. Initially, it is best to put out traps at all suspected harborages, water resources and travel routes. However, avoid placing traps in extremely dusty or moist areas because they will quickly lose their stickiness.

Trap Locations

Keeping in mind the habitats preferred by cockroaches, place the traps in the following types of locations:

- near and under sinks and stoves

- in or near motors of refrigerators and other appliances or vending machines
- in or near electric clocks, switch plates, and conduits
- next to computer equipment (where possible)
- near leaky plumbing fixtures
- near steam pipes or hot water pipes with insulating jackets
- near drains
- in drawers and cupboards
- in closets, on their floors and upper shelves
- in false ceilings or subfloor areas
- in areas where packaged goods and equipment are delivered and stored

Trap Placement

Cockroaches are **thigmotropic** which means they like to travel along edges where vertical and horizontal surfaces intersect (i.e.: where the floor and wall come together). So it is important that traps be placed flush against the vertical surface or the cockroaches may continue to travel behind the trap without ever entering it. Examples of edge intersections include:

- floors and wall junctions
- floors and cabinets or other solid furnishings
- floors and appliances (stoves, refrigerators, vending machines)
- sink counters and walls
- hanging cabinets or shelves and walls

Number and date each trap before you put them out. At the time of placement, mark trap location on your monitoring map. After 24 to 48 hours, pick up the traps, then count and record the number of cockroaches in each trap. Record the date and the number of cockroaches on the monitoring form.

Evaluating Trap Counts

Use the trap counts located on your map to pin-point sites of infestation.

- Traps with high numbers of cockroaches indicate nearby harborages, and this is where management efforts should be concentrated.
- Large numbers of adult cockroaches in the traps can indicate a potential population explosion.

Post Treatment Monitoring to Evaluate Efficacy

After the initial monitoring to pin-point sites of infestation, treatment efforts can be concentrated at these locations. A week or two after treatment, monitors should again be placed at the infestation sites to see how well the treatment efforts are working. Place fresh traps at the locations indicated on your map and count the number of cockroaches in the traps after 24 hours. If the trap catch has dropped considerably the cockroach population has declined and progress has been made. If not, another treatment strategy should be considered and greater efforts must be made to eliminate food, water and harborage resources. In order to assess the continued success of treatments and detect any new infestations, continue to monitor after the IPM program is underway. Vigilance is important and good record keeping will save time and energy.

Continuous Monitoring

To avoid future infestations monitoring should be continued on a quarterly basis. This will alert the Integrated Pest Management Coordinator of a new invasion before a population can become established. Cafeterias and other food-handling locations should be monitored at least once a month because of the constant transport of food and packaging (that may contain cockroaches) in and out of these areas.

Establishing a Communication System

A successful monitoring program depends on clear and frequent communication with principals, teachers, custodians, and food service personnel. These people have first-hand knowledge of pest sightings, sanitation problems and other contributing factors, as well as the history of control measures in their buildings. With a small investment in time, school personnel can be trained to serve as additional sources of valuable information for the monitoring program.

Make sure personnel understand the following:

- the goals of the cockroach IPM program and the role monitoring plays
- their role in the IPM program (what they can do to help reduce the number of cockroaches and the kind of information they can provide)
- how they can communicate with the pest management technicians by documenting activity in the site pest management log.

Management Options

Education

Food service and custodial staff play an essential part of any successful cockroach management program. Provide them with information on how to maintain cockroach-free kitchens, dining rooms, and waste disposal areas by applying the methods described below. Teachers, students, and other staff also play a significant role in maintaining a high level of sanitation in other areas of the school, so they must be informed of their responsibilities in that regard.

Habitat Modification

Cockroaches need food, water, and harborage to survive. By modifying the environment of an infested building, you can reduce cockroach access to these resources. A few well placed alterations will produce a long-term reduction in the capacity of the structure to support cockroaches. It is important to note that the simple act of limiting food, water and harborage resources will dramatically reduce the number of cockroaches an environment can support.

Limiting Areas for Eating

If you expect to contain and limit pest problems (ants and rodents as well as cockroaches), it is very important to designate appropriate areas for eating and to enforce these rules. The fewer designated areas, the easier it will be to limit the pests.

Proper Food Storage

- Food not kept in the refrigerator should be kept in sealed containers. Cardboard boxes and paper are not cockroach-proof.
- Screw-top jars are cockroach-proof only if the lid has a rubber seal since young cockroaches may be able to follow the spiral ridges to get into the jar.
- Glass containers with rubber gaskets or plastic containers with tight-fitting, snap-top lids are cockroach-proof.
- Remove food products from cardboard shipping containers before moving them into kitchens or storage areas. Transfer food packaged in cardboard or paper to plastic or glass container as soon as the food arrives in the building. Do not bring shipping boxes into the food preparation area.
- Advise students and teachers not to leave unsealed food items in their desks or lockers. Any food kept in offices or classrooms should be stored in ant- and cockroach-proof containers.

Eliminating Water Sources

German cockroaches can survive for a couple of weeks without food but they must have regular access to moisture or they will die within a few days. Cockroaches find drinking water in:

- sink traps
- appliance drip pans
- drain pipes
- wash basins and tubs
- toilet bowls and flush tanks
- spills
- condensation on cold-water pipes and windows

- leaky pipes and faucets
- pet dishes and aquariums
- vases
- beverage bottles
- various high-moisture foods

Much can be done to limit this supply by increasing sanitation and making repairs. Clean up spills and dispose of drink containers immediately after use. Keep aquariums and terrariums sealed with tight fitting screened lids. Repair leaks and dripping faucets then drain or ventilate moist areas. Kitchen surfaces should be kept dry when they are not in use, especially overnight.

Eliminating Cracks and Crevices

- Start by caulking where cockroach populations are highest. If cockroaches remain a problem, caulk additional areas.
- Use silicon caulk or mildew-resistant caulk around sinks, toilets, and drains.
- Before beginning the sealing process, vacuum and wash the area to eliminate egg cases, fecal material, and other debris.
- Caulk or paint over cracks around baseboards, wall shelves, cupboards, pipes, sinks, toilets, and similar furnishings in the locations indicated by monitoring trap catch.
- Repair holes in window screens.
- Weather-strip around doors and windows where cockroaches may enter.
- Where gaps can't be sealed, they can be widened to make them less attractive to cockroaches. For example, the crack between free-standing shelving and adjacent walls can be widened by simply moving the shelving one inch away from the wall.

Eliminating Clutter

Clutter creates a complex environment that provides a multitude of harborages in which cockroaches can live and breed. The removal of clutter is one of the most important components of cockroach management. All useless, idle or outdated items should be removed from the premises. Also, the need for in-house storage of food products and paper goods should be kept to a minimum.

Installing Cockroach-proof Fixtures and Appliances

Whenever food preparation areas are scheduled for remodeling, the school district can take the opportunity to install cockroach-proof kitchen appliances and fixtures, such as stainless-steel open shelving units. The round shape of the metal and the general openness of the design offer few hiding places for cockroaches. Free-standing storage units and appliances on castors enable them to be rolled away from walls to facilitate thorough cleaning.

Removing Vegetation

Peridomestic cockroaches live primarily outdoors in tree holes, mulch or vegetation. In cases where these cockroaches periodically invade the school buildings, it may be necessary to remove planter boxes, mulch, vegetation or other landscaping in the adjacent area.

Sanitation

Sanitation disrupts and eliminates cockroach resources. This disruption of the environment can play a significant role in slowing cockroach population growth. Sanitation creates an additional advantage by making the cockroach environment so barren that they have a much greater chance of contacting toxic baits or insecticidal dusts.

Thorough daily cleaning is essential:

- Sweep and mop the floors.
- Drain all sinks and remove any food debris.
- If children regularly receive snacks in classrooms, vacuum and/or mop these floors daily.
- Periodically, give food preparation areas an all-inclusive cleaning, focusing on areas where grease accumulates: drains, vents, deep fat fryers, ovens, and stoves. Steam-clean drains and infested appliances. Thoroughly vacuum the area with a powerful vacuum cleaner (see the section below on vacuuming).
- At the end of each day, remove from the building all garbage containing food to prevent cockroaches from feeding at night.
- Use soapy water to wash any bottles, cans, wrappings, and other items that have food residues clinging to them before storing them for recycling.
- If dishes cannot be washed right away, it is very important that they at least be rinsed to remove all food debris.
- Place garbage in sealed plastic bags before it is placed into a rodent-proof dumpster or other storage receptacle.
- Keep garbage cans and dumpsters as clean as possible to deny food to cockroaches as well as ants, flies, mice, and rats.

Although sanitation does much to prevent and curb cockroach infestation, an existing population cannot not be controlled by sanitation alone.

Physical Controls

Mechanical Barriers

Peridomestic cockroaches can travel up the outside of the buildings and enter through open windows, weep holes, or ventilation ducts. Screening these openings will prevent cockroaches from using these entry points. Screens can also be placed behind grill covers,

over vents and floor drains to prevent cockroach entry. Use caulk around the edges of the screen material to make a complete seal.

Domestic and peridomestic cockroaches can travel within and between buildings on runways formed by electrical conduits, heating ducts and plumbing pipes. Seal openings around these runways with caulk, steel wool or screening material.

Vacuumping

A strong vacuum can be used to pick up live cockroaches as well as their egg cases and droppings. If the vacuum is capable of filtering out very small particles (0.3 microns), it will greatly reduce the amount of cockroach debris that can become airborne during cleaning. Airborne cockroach debris (fecal material, body parts and cast skins) can cause allergic reactions in sensitive people.

If the cockroach population is large, vacuuming is a quick way of reducing the population immediately. Once a large portion of the population has been eliminated it is much easier to effect the remaining cockroaches with your treatment measures.

Trapping

In certain limited situations traps can be used to reduce cockroach numbers. Traps should be placed near suspected harborages and water sources but removed after a few days or they may begin to smell. Although traps will often capture a number of cockroaches they will very rarely, if ever, achieve a significant degree of control.

Chemical Controls

If non-chemical methods alone prove insufficient to solve the problem, then limited use of a pesticide may be warranted.

Pesticides must be used in accordance with their EPA-approved label directions. Applicators must be certified to apply pesticides and should always wear protective gear during applications. All labels and Material Safety Data Sheets (MSDS) for the pesticide products authorized for use in the IPM program should be maintained on file. Do not apply these materials when buildings are occupied, and never apply them where they might wash into the sewer, storm drains or any body of water.

When insecticides are needed, they should be applied as crack and crevice treatments or in a bait formulation. Broadcast spraying of insecticides greatly increases exposure risk and can lead to cockroach resistance when the pesticide residual activity begins to decline and cockroaches are exposed to sublethal doses. Note: Do not use spray formulation insecticides around computers where they may short-circuit the equipment. Plastic bait stations can be placed in and around computer equipment if cockroaches establish a harborage inside.

Control Strategies

The most recent technological advances in cockroach control have been in bait formulations, and insect growth regulators. Other currently used products include desiccating dusts. Each of these treatment methods will be discussed in detail including how they may be incorporated into a complete integrated cockroach management program.

Cockroach Baiting

Cockroach baits consist of a toxicant mixed with a food source. Some baits also contain attractants or feeding stimulants that are supposed to make the bait more attractive to cockroaches than the other food sources that may be available in the immediate area. Current indoor bait formulations are applied as bait stations, gels, dusts or pastes. The bait station is one of the more popular application methods for educational facilities. This is because the stations are easy to put out, they are safe around children and animals and have residual activity. Gel and dust bait formulations are also very safe and are packaged for injection into cracks and crevices which are not easily accessible. Until recently, paste baits were very messy and required application with a putty knife. However, manufacturers have improved these products by repackaging the bait material into plastic syringes that are also suitable for bait gun application. This greatly improves bait placement allowing paste baits to be applied into cockroach harborages like the gel and dust formulations.

Almost all baiting products available for indoor use are formulated using one of the following active ingredients: fipronil (Maxforce/Combat); hydramethylnon (Seige); chlorpyrifos (Raid Max; Ortho); or abamectin (Avert). Combat/ Maxforce are bait products using injectable gel formulations and the bait station delivery system. Siege bait is available as an injectable gel in a syringe and bait gun. Raid Max is available as a bait station. Ortho is a granular formulation for use outdoors. Avert is available as a bait station, a gel aerosol and a flowable bait dust that can be injected into cracks and crevices.

Domestic Cockroach Baiting

- Small amounts of bait placed in numerous locations work far better than large blobs of baits placed in central areas.
- Put bait near harborages and between harborages and water sources. Review the Monitoring section for examples of cockroach harborage, and use the information collected from your monitoring traps.
- Once you have pinpointed harborage areas, place the baits along edges or in places where cockroaches are most likely to travel or congregate.
- Sometimes an inch one way or the other can make all the difference in bait placement. If air currents are moving the bait odors away from the cockroach harborage, they may never find the bait.
- Do not place gel or paste baits in areas where they may get covered over with grease, flour, or dust. In areas where this might be a problem, bait stations should be used.
- Avoid harsh environmental conditions when baiting. In excessively warm areas baits can melt and run. In cold environments the cockroaches do not move far and may miss the bait. In very wet environments the baits may grow mold and become unattractive to cockroaches.
- Check baits frequently to make sure that they have not been completely consumed or inadvertently removed by cleaning.

Peridomestic Cockroach Baiting

Outdoor baiting products are used primarily for the control of peridomestic cockroaches. Spreadable granular baits containing chlorpyrifos or bait stations with hydramethylnon bait are the most common formulations used for peridomestic cockroach control. Spreadable baits are usually applied as a perimeter band around a structure. It is difficult to determine the residual longevity of these products particularly in areas where precipitation is frequent. Even "weatherized" baits have difficulty retaining their residual properties where there is heavy rainfall. This is particularly true in the southeastern United States where precipitation can ruin bait effectiveness within a single day. Bait stations for peridomestic cockroaches are simply larger versions of those used for German cockroach baiting. The problem with this baiting system is that peridomestic species live and breed in outdoors in palm trees, tree holes and other areas where bait stations are not suitable. The large bait stations can be used to capture peridomestic cockroaches caught foraging inside, but this does nothing about the population of cockroaches that continues to breed outdoors.

Insect Growth Regulators (IGRs)

Insect Growth Regulators (IGRs) are a group of compounds which disrupt the normal growth and development of insects. The IGRs are very safe compounds. They generally have very little toxicity to mammals because they act by disrupting the hormonal processes that are specific to insects.

IGRs that mimic the juvenile hormones of cockroaches (and other insects) are called juvenile hormone analogues (JHAs). JHAs are chemical compounds whose structure is very similar to the hormones that immature cockroach produces naturally. These hormones function in cockroaches roughly the same way as they do in humans. They send chemical messages throughout the body that regulate physiological changes. These changes facilitate the development of a juvenile into a reproductive adult. Juvenile hormone analogues disrupt this natural process. Specifically, JHAs interfere with the proper development of last instar cockroach nymphs. Instead of the nymphs molting into reproductive adults they molt into "adultoids", which often have twisted wings and are sterile. As more and more cockroaches are exposed to the JHA, the adultoids begin to predominate. Because the adultoids are unable to reproduce, over time, the cockroach populations begins to decline. JHAs are a very effective method of long term German cockroach control. However, because JHAs eliminate reproduction, but do not kill existing cockroaches, they are very slow acting taking from four to nine months to achieve control. It is for this reason that JHAs are often combined with residual insecticides. In this way most of the population is eliminated by the insecticide yet immature cockroaches that survive are sterilized by the JHA.

Insect Growth Regulators are available in spray formulations or point source dispensers (where the IGR is released on a filter paper contained in a permeable plastic station then transmigrates throughout the infested area). Hydroprene (Gentrol Point Source) is a JHA that is currently available for indoor cockroach control and is labeled for use in kitchens and food preparation areas. Pyriproxifen (Nylar, spray formulation) recently joined the market, but is not labeled for use in kitchens. At this time there are no IGRs available for peridomestic cockroach control.

Inorganic Dusts

Inorganic dusts, such as silica gel and boric acid, have been used frequently for indoor cockroach control. These dusts can be applied with a squeeze-bulb duster into cracks and crevices under sinks, stoves, behind refrigerators, along baseboards, in electrical outlets, cabinets and wall voids. Silica gel is simply finely ground sand or glass that adheres to and absorbs the protective waxes on the cockroach cuticle resulting in cockroach death from dehydration. Boric acid is a stomach poison that is picked up by cockroaches walking across dusted areas. The boric acid adheres to the cockroach cuticle so when the cockroach grooms itself it ingests the boric acid and soon dies.

Summary

German cockroaches are a common pest in the indoor environment. Peridomestic cockroaches live primarily outdoors but often invade structures looking for food, warmth or moisture. The treatment measures for indoor versus outdoor cockroaches is very different so it is extremely important that a problem cockroach population be correctly identified. Once the cockroach and its habitat have been determined, the magnitude and location of the population needs to be evaluated. This can be done by performing a thorough inspection in and around the structure and monitoring with traps. The population information should then be used to choose treatment strategies. A combination of treatments is recommended for a complete approach to cockroach management. Several least toxic treatment choices are available for cockroach control, they include bait products (available for indoor and outdoor use), insect growth regulators (IGRs), inorganic dusts and traps.

E. Fleas in Schools

Introduction

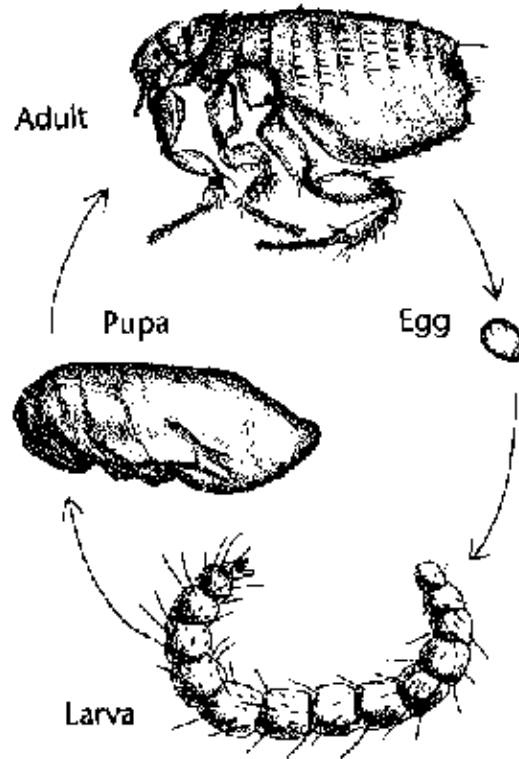
Fleas can be a problem in all parts of the country except in very dry areas. The most common species in school buildings is the **cat flea** (*Ctenocephalides felis*). This flea feeds on cats, dogs, and humans, as well as rodents, chickens, opossums, raccoons, and other animals. The dog flea (*C. canis*) and the human flea (*Pulex irritans*) are less commonly encountered.

Identification and Biology

Adult cat fleas are small (1/16 inch long), wingless insects possessing powerful hind legs that are adapted for jumping and running through hair. The adult body is reddish-brown to black, oval and compressed laterally. Unlike many other flea species, adult cat fleas remain on their host. After mating and feeding, adult female fleas lay oval, white eggs. These smooth eggs easily fall from the host into cracks, crevices, carpet, bedding, or lawn covering. A mature female flea can lay up to 25 eggs per day for three weeks.

Small, worm-like larvae (1/16 to 3/16 inches long) hatch from the eggs within 48 hours. They are eyeless, legless, and sparsely covered with hairs. The larval body is translucent white with a dark colored gut that can be seen through their skin. They feed on adult flea feces, consisting of relatively undigested blood, which dries and falls from the host's fur. They will also eat dandruff, skin flakes, and grain particles. Larvae develop on the ground in areas protected from rainfall, irrigation, and sunlight, where the relative humidity is at least 70% and the temperature is 70° to 90°F. This stage lasts eight to 24 days, depending on the temperature and humidity.

These immature fleas will eventually spin silken cocoons in which they will develop (pupate) into adult fleas. Cocoons are sticky, attracting dirt and debris which will easily camouflage them. Under optimal conditions, new adults are ready to emerge from their pupa cocoons within two weeks. They can, however, remain in their cocoons up to 12 months in the absence of a host or unfavorable climatic conditions. Vibrations and/or elevated temperature stimulate adults to emerge. This ability of flea pupae to wait until a host arrives can result in a sudden increase of adult fleas when they emerge simultaneously from many accumulated flea pupa.



As soon as the adult fleas emerge from the pupa case, they look for a host for their first blood meal. Adults can live one to two months without a meal and can survive up to six months with one. They are the only stage that lives on the host and feeds on fresh blood.

These variations in flea development time account for the sudden appearance of large numbers of adult fleas in "flea season," usually in the late summer and early fall. The flea population has been building up all year long in the form of eggs, larvae, and pupae, but rapid development into biting adults cannot be completed until the temperature and humidity are optimal and host cues signal for adult emergence from the pupal cocoon.

Associated Problems

Flea bites cause irritation, but also serious allergies in animals and humans. Other more serious and less common problems are associated with the cat flea. Cat fleas can carry or transmit various organisms, such as *Yersinia pestis*, which causes bubonic plague; *Rickettsia typhi*, which causes murine typhus; and *Dipylidium caninum*, the double-pored dog tapeworm, which can live in dogs, cats, or humans. Tapeworms are transmitted to a vertebrate host via ingestion of an adult flea carrying a tapeworm cyst.

Detection and Monitoring

Fleas can be a problem in schools even when no pets are kept in the buildings. Adult fleas can be brought in on the clothing of staff, students, or visitors. Other possible sources include urban wildlife such as rats, feral cats, raccoons, opossums, chipmunks, squirrels, or birds that may live in unused parts of the buildings. Detection is as simple as seeing fleas or noticing bites around the ankles of people in the building. Flea dirt, the adult flea feces that dries and falls off the host to serve as food for larvae, may be visible. Tapeworms, transmitted to a human via ingestion of an infected flea, would also signal a flea infestation.

Areas to Monitor

- in and around the cages of pets kept in **classrooms** (also check the pets themselves for signs of fleas)
- places where animals might find harborage, such as basements, crawl spaces, attics, eaves, roof top structures, and secluded shrubbery near buildings

Monitoring Traps

Flea Sock Traps

These are homemade, knee-high, white flannel booties that fit over the shoes and lower pant legs. When you walk through a flea-infested area, fleas will jump onto the flannel and become temporarily entangled in the nap where you can easily see and count them. Long, white athletic socks worn over the shoes and trouser legs will also work, as well as wide strips of sticky-backed paper wrapped around the lower legs (sticky side out). Socks can also provide protection from bites if a person must enter a severely flea-infested area for a short period of time.

Light Traps

These compact (roughly 4x6-inch) traps are composed of a small electric light and a sheet of sticky paper. Adult cat fleas looking for a host may be attracted to the warmth and light of the trap. Research has shown that fleas are most sensitive to green light and are more attracted to light traps if the light is turned off for 10 seconds every five to 10 minutes; therefore, it is important to choose a trap with a green light that can flicker on and off.

Light traps are especially useful for monitoring in office situations where no animals are present and the flea population is likely to be small. Check the traps once a week. If no fleas are caught by the second week, move the trap to another location or remove it. If the traps catch only a few fleas, the infestation is very small and can probably be controlled by the traps alone. In this case, leave the traps in place until no additional fleas have been caught for a week. If 20 or more fleas are caught per trap in a week, this probably indicates a more serious infestation, and time must be devoted to finding the source of the infestation (such as an animal living in or under the building).

Persistent Flea Problems

Persistent flea problems in buildings where there are no pets may indicate the presence of rodents or other wildlife. In this case it can be useful to have the fleas identified by a professional. When the flea species is not the cat flea, its identity can help determine the host animal and where to search to find the animal or its nest.

Management Options

The integrated pest management program incorporates the following strategies and tactics.

Non Chemical Control

Vacuuming

- Vacuuming on a regular basis throughout the year will keep developing flea populations low by picking up adult and egg-stage fleas.
- Vibrations caused by vacuum cleaners will stimulate new adult fleas to emerge from their pupal sacs. These new adults will either be exposed to any residual insecticide on the floor or captured in the next vacuuming.
- Vacuuming is not very effective at capturing flea larvae in carpeting because they coil themselves around the fibers. Vacuuming does, however, pick up the dried blood that larvae feed on.
- Use vacuum attachments to clean cracks and crevices. Caulk or seal these openings permanently.
- Most fleas will be killed when dust in the vacuum bag blocks their breathing apparatus, but to be sure, you can vacuum up a tablespoon of cornstarch. The used vacuum bag should be disposed of immediately.
- Vacuum badly infested areas thoroughly every day until the infestation is controlled.
- When infestations are severe, you may need to supplement vacuuming with steam-cleaning or other controls.

Steam-Cleaning

Steam-cleaning may be warranted when flea populations are severe. This process kills adult and larval fleas and probably some eggs as well; however, since the warmth and humidity from the steam also stimulates the remaining flea eggs to hatch a day or two after the cleaning, some fleas may reappear. If the other steps recommended in this chapter are followed (regular vacuuming, washing, etc.) the few fleas that hatch after steam-cleaning should represent the last of the flea population.

Flea Combs

Classroom pets in a flea-infested room should be combed regularly with a special flea comb that can be purchased at a pet store. Fleas and eggs removed from the animal should be dropped into soapy water.

Laundry

Wash removable floor coverings, such as rugs, located in areas where there are known infestations. Any bedding for classroom pets should be washed regularly.

Heat

Tests have indicated that cat flea larvae die after exposure to 103° F for one hour, and researchers have developed techniques to raise the temperature in a room enough to provide this exposure. The heating process uses a common heating unit modified to include special blowers and flexible ducts. Companies have been using heat to kill termites and woodboring beetles for a number of years, and now some companies are experimenting with

heat to control fleas. One potential problem with this technique is that fleas can burrow down into carpets and upholstery, and perhaps escape lethal temperatures.

Drying or Flooding Infested Areas Outdoors

Outdoors, organic matter can temporarily harbor flea larvae. Either drying out these areas or saturating them with water will kill the eggs and larvae. You can also treat these areas with insect-attacking nematodes or with an insecticide labeled for outdoor use.

Biological Controls

Beneficial Nematodes

Insect-destroying nematodes, (*Steinernema carpocapsae*), are applied to the lawn as a spray and do not affect people, pets, or plants. These microscopic, worm-like organisms live in the soil and kill insects by entering their bodies, feeding on tissue, and releasing harmful bacteria. When they have eaten all they can of the insect, the nematodes leave to search for other prey. They cannot move far (only an inch or two) and die if they find no other insects. The nematodes sold for flea control are native to the United States and are found naturally in the soil all over the country; they will not adversely affect beneficial soil organisms, including earthworms.

Tips for Using Nematodes

- Use the number of nematodes recommended by the manufacturer.
- Treat areas outside where you have found evidence of animals sleeping or areas that you know are regular travel routes for animals.
- Moisture is critical to the effective use of nematodes, so water the area before and after the application.

Chemical Controls

If non-chemical methods alone prove insufficient to solve the problem, then integrating a pesticide into your management program may be warranted.

Pesticides must be used in accordance with their EPA-approved label directions. Applicators must be certified to apply pesticides and should always wear protective gear during applications. All labels and Material Safety Data Sheets (MSDS) for the pesticide products authorized for use in the IPM program should be maintained on file. Do not apply these materials when buildings are occupied, and never apply them where they might wash into the sanitary sewer or into outside storm drains.

Diatomaceous Earth and Silica Aerogel

These are insecticidal dusts that can be used for flea control. Diatomaceous earth is made from fossilized diatoms, and silica gel is produced essentially from sand. Both these products kill insects by desiccation; they absorb the wax and oil from the insect's outer covering which causes dehydration and death. Although these materials are not poisonous to humans directly, the fine dust travels freely through the air and can be irritating to the eyes and lungs;

therefore, use a dust mask and goggles during application. Silica gel and diatomaceous earth are also formulated with pyrethrins (discussed below).

How to Use Diatomaceous Earth and Silica Aerogel

- Apply a light dusting to upholstered furniture that is suspected of harboring fleas. Be sure to get into the cracks and crevices.
- Apply a light dusting to rugs or pet bedding.
- Apply to infested carpeting, leave for a couple of days, and then vacuum up.
- Dust into crawl spaces, wall voids, attics, and other similar spaces where you suspect animals of nesting or resting.
- Do not use in moist environments; neither material works well when wet.

Citrus Oil Extracts (D-Limonene/Linalool)

D-limonene and linalool are citrus-peel extracts that have been used for years as food additives. Products that contain d-limonene kill larval and adult fleas, while those containing both ingredients kill all flea stages. EPA-registered citrus shampoos are mild enough for use on young animals, but veterinarians caution that some cats may suffer if the material is applied in excessive concentrations. Citrus sprays can also be applied to animal bedding but should not be used to spray entire rooms, nor should they be used outdoors.

Borates

Borate products worked into the nap of the carpet can be used to control fleas. This treatment works as an intestinal poison upon ingestion by flea larvae and will continue to kill them for as long as a year. Application of borate treatment by a professional pest control company is recommended, although this product is also sold through veterinarians.

Imidacloprid and Fipronil

Both imidacloprid (Advantage) and fipronil (Frontline) are available through veterinarians as spot-on oils which are applied to the shoulder area of a cat or dog and distribute over the body within a few hours. (Consult a veterinarian before using either of these products on a pet other than a cat or dog.) They are non-toxic to mammals and kill almost all the fleas on the pet within 24 hours of treatment. Both products continue to kill fleas for at least 30 days after treatment. However, fleas may feed and mate before their deaths. This means that while these two products will help reduce a flea population, the fleas are still able to reproduce and lay eggs before they die.

Pyrethrins and Synthetic Pyrethroids

There are a number of flea control premise sprays, foggers, and pet treatments containing pyrethrins and synthetic pyrethroids. These products should be used as a last resort in areas where fleas problems are severe.

Insect Growth Regulators

Insect growth regulators (IGRs) inhibit the development of immature fleas, but do not kill adult fleas. Use of an IGR product (or a borate product) in conjunction with an adulticide (imidacloprid, fipronil, pyrethrins, or pyrethroids) prevent development of immature fleas and kill adult fleas. Methoprene (Precor, Ovitrol) and pyriproxyfen (Nylar, BioSpot) are available in pet sprays, pet collars, and premise treatments. Fenoxycarb (Logic, Torus) is available through professional pest control companies and is for outdoor use only. Lufenuron (Program) is orally administered to the pet.

L. Flies in Schools

Introduction

Many species of flies can be problems in schools. Each kind of fly has a distinct breeding site inside or outside the school building. In order to control pest flies, it is necessary to know which fly is causing the problem and where it is breeding. Common pest flies encountered in schools can be identified by characteristics.

Garbage and Manure-Breeding Flies

Identification and Biology

Flies such as **house flies**, dump flies, blow flies, and **blue** and **green** bottle flies which breed in food wastes (garbage) and/or animal feces are generally referred to as "filth flies."

Sometimes flies are confused with **wasps**; however, flies have two wings, while wasps and all other winged insects have four wings arranged in two pairs. Wasps, unlike flies, fold their wings alongside their bodies when at rest. Most pest wasps are colorfully marked with yellow, red, black, and white, and have narrowly constricted waists. Generally, wasps are less likely to come indoors, are aggressive in their flight around foods, (particularly sweets) and are larger than filth flies. Filth flies are not aggressive and do not bite.

Filth flies pass through four distinct stages in their life cycle: egg, larva (maggot), pupa, and adult. Adult female filth flies look for moist places with the right smell to lay their eggs. This can be in food waste in a garbage can or dumpster, in dog or cat feces, in dead animals, in kitchen drains, in grass clippings allowed to rot in a pile, and even in moist soil that is mixed with garbage. The larva hatches from the egg and grows until it is ready to form a puparium (a kind of cocoon) from which an adult fly will emerge. Once the adult fly emerges, it doesn't grow any larger; small flies do not grow into larger flies.

Damage

Flies that invade cafeterias and kitchens are not only a nuisance, they also present a health hazard because they can contaminate food, utensils, and surfaces.

Detection and Monitoring

It is important to correctly identify the problem flies and pinpoint their breeding sites. Some of their characteristics can help you with identification; alternatively specimens can be taken to a county extension agent who should be able to assist in identification. If they cannot identify the specimen they will be able to refer you to a person who can.

To collect specimens inside, use sticky flypaper or gather dead specimens from windowsills and light fixtures. Outside, trapping is one of the easiest methods of catching flies for identification. If adult flies consistently avoid baited traps, it may indicate that the pest fly is not a filth fly.

Management Options

To manage flies, you must find and reduce breeding sites, install and maintain screens to keep flies out of buildings, kill those flies that do get inside with a fly swatter or flypaper, and reduce or eliminate the odors that attract flies.

In a school with a frequent waste removal program, it is very possible that few flies are breeding on the school property. It is more likely that odors from dumpsters, garbage cans, kitchens, and cafeterias are attracting flies to the school from the surrounding neighborhood. House flies and blow flies, the species that most commonly invade buildings, usually develop outside and follow odors into the building. They can also be pests when students or staff are eating outside. In schools where waste removal is infrequent, fly populations can be breeding at the waste collection site.

Habitat Modification

This is one of the most important aspects of fly control. Without controlling wastes and odors, it is impossible to control filth flies.

Food Waste

- All food waste from the kitchen, cafeteria, and other areas should be separated from other garbage, drained so it will be as dry as possible, and then stored in sealed plastic bags before discarding.
- Place containers with small amounts of food waste, such as milk or yogurt cartons, into sealed plastic bags before disposal. This method will reduce access to flies.
- Promptly fix drains or electric garbage disposal units that leak, or drains that allow food waste to accumulate under sinks or floors. Leaky drains can attract many species of flies. Remove any food waste that has accumulated under sinks or floors or in crawl spaces or basements at the site of the broken drain, and then clean the area thoroughly.

Other Garbage

- In food preparation areas, rinse all cans, bottles, and plastic containers before recycling or discarding.

Exterior Garbage Cans and Dumpsters

- Inform students, teachers, and staff of the importance of placing garbage inside the proper containers. Garbage should not be left lying on the ground.
- To avoid attracting flies into the building, place dumpsters and recycling containers upwind from the outside doors of the school, particularly doors to the kitchen or cafeteria. When dumpsters are downwind, flies are attracted to the waste odors and then find the odor trails that the breeze blows down from the doorways. Following these odor trails, they find their way into the building.
- Wastes should be collected and moved off site at least once a week. Since flies breed faster in warm weather, garbage collection may have to be scheduled twice a week to reduce breeding sites.

- Make sure garbage can and dumpster lids seal tightly when closed and remain closed when not in use. Repair or replace garbage cans with holes or with lids that do not close tightly.
- Regularly clean garbage cans and dumpsters to prevent the build-up of food waste, an ideal place for flies to lay eggs. Use a high pressure stream of water or a brush and soapy water, if necessary. A solution of borax and water will eliminate odors. If possible, dumpsters should be fitted with drains so they can be hosed or scrubbed out as needed. Another option is to require the refuse company to clean the dumpster or replace it with a clean one more frequently.
- Flies can develop in soil soaked with water used to clean garbage cans and dumpsters. Check these areas regularly. If you see maggots, scrape them up along with the soil and dispose of everything in a plastic bag sealed tightly.
- Inspect dumpsters and other outdoor trash receptacles daily and remove any wastes lying on the ground.
- Garbage cans on the school grounds should have removable domed tops with self-closing, spring-loaded swinging doors. Cans should be lined with plastic bags that can be tightly sealed and removed daily.

Animal Feces

Remove droppings promptly and put them into plastic bags that are sealed before disposal. Dog feces that dry quickly may attract adult flies with their odor but are unlikely to host many maggots. Droppings that remain damp because of humidity or rain can serve as an excellent breeding site.

Odor

Flies can detect odors over long distances. Smells of souring milk from hundreds of containers thrown in dumpsters can attract thousands of flies from the surrounding neighborhood. Storing garbage in sealed plastic bags and having cans and dumpsters cleaned and emptied frequently to eliminate odors is very important.

Removing pet feces also helps reduce attractive odors.

Flies attracted to open kitchen or cafeteria doors, or to dumpsters or garbage, will rest on nearby walls, eaves, and rafters. While resting, they leave fly specks, which have a strong fly-attracting odor. These brown- to cream-colored specks should be washed off with an odor-eliminating cleaner (a mild solution of borax and water can be particularly effective) otherwise they will continue to attract flies.

Physical Controls

Screens

Keeping adult flies out of sensitive areas is the most important control measure that can be undertaken. Install screens over windows, doors, and vent holes to prevent flies from entering buildings. Weather-stripping or silicone caulk can be used to insure a tight fit. Torn screens can be repaired with clear silicone caulk. Screen doors should be fitted with springs or automatic closing devices that close the screen door firmly after it is opened. External doors that cannot be screened should be fitted with automatic closing devices, and/or vertical strips of overlapping plastic that allow human access but prevent fly entry. "Air walls" that force air across openings are another alternative to screen doors.

Fly Swatters

In many instances, the old-fashioned fly swatter is the safest and quickest way to kill flies that have found their way into a room. Aim the fly swatter about 1 1/2 inches behind the fly, rather than directly at it, because research has shown that when a house fly takes off from a horizontal surface, it jumps upward and backward. Stiff plastic swatters seem to work better than wire-mesh ones. The fly's unblurred range of vision is about 1 1/2 feet, and the swatter can be moved to this distance before striking.

Flypaper

Sticky flypaper is effective at catching flies because it takes advantage of their natural habit of moving up to the ceiling to rest. It will take several days for a new strip of flypaper to start catching flies. Use a number of strips at a time and replace them when they are covered with flies or when they begin to dry out. Flypaper can be very useful in areas where there are too many flies to kill with a fly swatter, and where aesthetic appeal is not of primary importance. Flypaper is also a useful monitoring tool. Do not place flypaper or sticky strips above or near food preparation areas.

Fly Traps

Fly traps can be used to reduce adult fly populations, capture specimens for identification, and monitor the effectiveness of control programs. Fly traps are not toxic and are more selective than using insecticide. Traps need to be serviced regularly, appropriately placed, and repaired or replaced when damaged.

Chemical Controls

Except for odor-eliminating chemicals (such as borax) and baits, pesticides are not recommended for fly control.

Borates

Low concentrations of borax in water can be used to eliminate fly odors. This solution is particularly effective for removing fly specks from walls and eaves, and for rinsing out garbage cans and dumpsters. These solutions should not be used near ponds, streams, lakes, or other bodies of water, and should not be poured onto plants.

Fruit Flies, Cluster Flies, and Phorid Flies

Identification and Biology

Fruit Flies

Fruit flies are small flies commonly seen flying around ripe fruit, especially bananas. They are about 1/8 inch long and usually have red eyes. They lay their eggs near the surface of fermenting fruits and vegetables and other moist organic materials (including damp mops and cleaning rags as well as residues in bottles, cans, garbage disposals, and drains). Their life cycle, from egg through maggot and pupa to adult, takes little more than a week, and the number of flies that can be produced by a single piece of fruit is enormous. These flies are most often a problem in late summer and early fall, so careful storage of fruit and vegetables is necessary at these times of the year.

Cluster Flies

Cluster flies are larger and darker than house flies and have a distinctive yellowish color caused by the crinkled yellow hairs on their bodies. In the summer, cluster flies lay their eggs in soil where the maggots parasitize earthworms. Soil containing many earthworms is a common source of these flies. In the fall, the adults can be seen clustering on the south and west sides of buildings. As the weather gets cooler, these flies begin looking for sheltered places to spend the winter and often enter buildings.

Phorid Flies

The most common phorid fly, *Megaselia scalaris*, is small (1/16 to 1/8 inch) with a yellowish-brown body and light brown wings. The adults seem reluctant to fly, and they run around on walls, windows, and tables with a characteristic quick, jerky motion. The females are strongly attracted to odors and lay their eggs on or next to decaying material, both plant and animal. Food sources for the larvae are highly varied, from decomposing fruit, vegetables, and meat to open wounds in animals and people, and human and animal feces. The life cycle from egg to adult takes from 14 to 37 days.

Management Options

Fruit Flies

Fruit flies are most active from late summer through early fall. Problems with these flies can be avoided by ripening fruit in paper bags. Seal the bags by folding the top over several times and closing it with a paper clip or clothes pin. Once fruit is ripe, it should be stored in the refrigerator. Careful storage of fruit during the rest of the school year may not be necessary.

If an infestation is discovered, look for and remove the material that is breeding the flies. Begin by searching for the obvious sources, such as ripe fruit and vegetables, and then look at water from refrigerators, humidifiers, or sink drains that may be fermenting; spoiled animal food; or even damp, sour mops or rags. Areas outside the building near windows and doors should be checked for rotting vegetable matter. All breeding sources should be removed and disposed of in a sealed plastic bag. Make sure that screens and windows near food preparation areas are in good repair.

Fruit Fly Trap

To make a simple trap for fruit flies, combine 1 cup of vinegar, 2 cups of water, and 1 tablespoon of honey in a 2-liter soda bottle. Replace the cap, shake the mixture well, and punch holes in the side of the bottle above the liquid so the flies can get in. Using string, hang the bottle about 5 feet above the ground. Periodically, the dead flies should be strained out and the liquid reused.

Cluster Flies

Cluster flies are not as strong fliers as house flies and can easily be killed with a fly swatter or removed with a vacuum. Cluster flies can also be allowed to exit by opening the window. They can find their way into buildings through unscreened doors and windows, openings under siding and around roofs, unscreened ventilating spaces, cracks around windows, and holes where wires penetrate the walls of the building. During warm winter periods, cluster flies hidden in buildings become active and are attracted to windows.

Phorid Flies

Phorid flies breed in diverse sources of organic matter, so it may take considerable sleuthing to find their breeding sites. Once the site is found it must be thoroughly scraped, cleaned, and dried. Large infestations of these flies are often the result of broken drains or garbage disposals that allow organic matter to accumulate in out of the way places such as wall voids, under floors, in basements, or in the soil of crawl spaces.

G. Head Lice

Introduction

The head louse, *Pediculus humanus capitis* De Geer, infests 10 to 12 million people each year in the United States. Pediculosis or "lousiness" is one of the most prevalent communicable conditions in this country. Lice are transferred from person to person by direct contact or by several people using the same combs, brushes, hats, or bedding. Head lice are not found on animals or household pets and are not transmitted from pets to humans. Head louse infestations are normally found on children, but can also be spread to adults. The head louse is not considered to be a serious vector of disease in the United States although severe infestations may cause irritation, scratching and subsequent invasion of secondary infection.

Biology of the Head Louse

Lice have three pairs of legs which makes them true insects. Lice do not have wings or powerful jumping legs so they move about by clinging to hairs with claw-like legs. Head lice prefer to live on the hair of the head although they have been known to wander to other parts of the body. Head lice do not normally live within rugs, carpet, or school buses.

The eggs of lice are called **nits**. They are oval white cylinders (1/16 inch long). The eggs of head lice are usually glued to hairs of the head near the **scalp**. The favorite areas for females to glue the eggs are near the ears and back of the head. Under normal conditions the eggs will hatch in seven to 10 days. The young lice which escape from the egg must feed within 24 hours or they will die. Newly hatched lice will periodically take blood meals and molt three times before becoming sexually mature **adults**. Normally a young louse will mature in 10 to 12 days to an adult (1/8 inch in length). Adults range in color from white to brown to dark gray.

Female lice lay six to seven eggs (nits) per day and may lay a total of 50 to 100 eggs during their life which may last up to 40 days. Adults can only survive one to two days without a blood meal. The nymphs and adults all have piercing-sucking mouthparts which pierce the skin for a blood meal.

The reaction of individuals to louse bites can vary considerably. Persons previously unexposed to lice experience little irritation from their first bite. After a short time individuals may become sensitized to the bites, and may react with a general allergic reaction including reddening of the skin, itching, and overall inflammation.

Prevention of Head Lice

Children should be encouraged not to share combs, hats, and other personal belongings. Daily washing and changing of clothes and keeping hair as short as possible will also help discourage lice; however, head lice should not be solely associated with uncleanness since they may be easily transferred from person to person. Periodic inspections will aid in early detection of any individual lice which are more easily controlled than advanced infestations where dozens of mature lice and possibly hundreds of nits are present. During the early fall months (August through November) children should be inspected weekly because back-to-school seems to be when lice are most commonly transmitted resulting in widespread infestations by December and January. September is National Head Lice Prevention Month.

Control of Lice

Non-Chemical Control

Once an infestation is detected all clothes should be washed in hot soapy water. Pillow cases, sheets, blankets and other bedding material should also be washed and placed in the clothes dryer on "high heat" cycle to kill the lice and their eggs. Any non-washable items such as children's toys should be tightly sealed in plastic bags for at least seven to 10 days to kill adult lice.

Chemical Control

Chemicals are available as prescription or non-prescription drugs to control lice. Over-the-counter products which should be effective include those containing permethrin or pyrethrins (pyrethrum extract) as active ingredients. These drugs are available as creams, lotions, or shampoos. Shampoos are preferred for control of head lice. The application of these insecticidal drugs will kill nymphs, adults, and some eggs. Eggs killed by treatment as well as unaffected eggs may remain attached to hair shafts and should be removed as soon as possible. To remove these eggs it may be necessary to do some "nit-picking" utilizing a special fine-toothed lice comb. Combs and other tools used to remove lice should be soaked in a lice killing solution such as rubbing alcohol after use.

Use of lice sprays to treat objects such as toys, furniture, carpet etc. is not recommended because lice cannot live off the host longer than a couple of days. The same holds true for classrooms Use of these products is considered ineffective and unnecessary.

H. RATS AND MICE

INTRODUCTION

Rats and mice can be a major pest problem in schools. They damage food, books, documents, and clothing. Damage to a structure occurs when rats and mice gnaw on structural components, including wiring, wood, and plastics. The gnawing on wire insulation can result in electrical shorts and fires. Rodents have also been implicated in the spread of dangerous human diseases. In short, structural risks, health risks, and a general lowering of environmental quality accompany any rodent infestation.

BIOLOGY AND IDENTIFICATION

There are several important rodent pest species. Correct identification is imperative. Each species behaves differently and therefore requires different management techniques. Figure 1 will help you to identify a pest rodent.

Rats

There are two main pest rat species, *Rattus rattus*, the roof rat, and *Rattus norvegicus*, the Norway rat. The roof rat is also known as the ship, black, or Alexandrine rat. The Norway rat is also known as the brown, wharf, house, gray, or sewer rat. Use Figure 1 to help you identify these rats. The following points about the behavior and biology of rats are helpful to understand when dealing with them:

- Norway rats will generally build their nests in subterranean or ground level locations. Roof rats, in keeping with their name, prefer to nest in elevated areas, including trees and storm drains.
- Rats require water on a daily basis.
- Rats can travel several hundred feet from the nest to forage for food and water.
- Rats feed on a wide variety of food sources including trash, fruits, vegetables, meats, insects, grains, pet food, tree bark, and plant material.
- Some rats can pass through openings as small as $\frac{3}{4}$ inch in diameter.
- Rats can jump vertically at least 24 inches and horizontally at least four feet.
- Rats can dive and swim underwater for as long as 30 seconds. Therefore, they can crawl up to and swim through the water trap of toilets and drains.
- Rats chew on everything, including wood, metal, glass, plastic, and stone, in order to help keep their large front teeth sharp and shortened.
- Rats are very wary of new items in their environment.

Mice

There is one main species of pest mouse, the house mouse, *Mus musculus*. Other types of mice, such as field mice and voles, can invade a structure but are only occasional invaders and prefer

living outdoors. Often, people confuse immature rats with house mice. The following points are important to remember when dealing with mice:

- Mice can get all of their moisture from their food if a ready water source is not available.
- Mice search their entire home range daily to check for any changes to their environment.
- The home range of a mouse is usually no more than 33 feet from their nest.
- Mice may nest within appliances, in wall and floor voids, in false ceilings, behind counters, and within other similarly protected areas. If they are living outdoors, they prefer to nest in thickly vegetated or covered areas, such as in wood piles, rock piles, or leaf litter.
- Mice can jump upward at least 12 inches from the ground.
- Mice can fit through any opening $\frac{1}{4}$ inch in diameter.
- Mice chew on everything, including wood, metal, glass, plastic, and stone, in order to help keep their large front teeth sharp and shortened.
- Mice are good swimmers but seldom dive below surfaces.
- Mice are very curious and will explore new items in their environment.

In general, rats and mice share many similar characteristics. Understanding these features is a very important aspect of rodent control. The following list gives some of these basic attributes:

- Rats and mice usually search for food at night. If you happen to see a rodent during the day, that might mean there is a lack of food or the rodent population is high.
- Mice and rats can run up almost any vertical surface including cinder blocks, wood, sheet metal, metal pipes, and cables.
- Rodents prefer to travel along edges, using their whiskers as guides. Examples of edges include along the wall/floor junction, beside the foundation of a structure, or along pipes, utility wires, or rafters. Rodents are very wary of open spaces and will seldom cross uncovered areas.
- Rats and mice have poor vision but powerful senses of smell, touch, hearing, and taste.
- Rats and mice have very short generation times and can therefore populate a structure in a short amount of time.

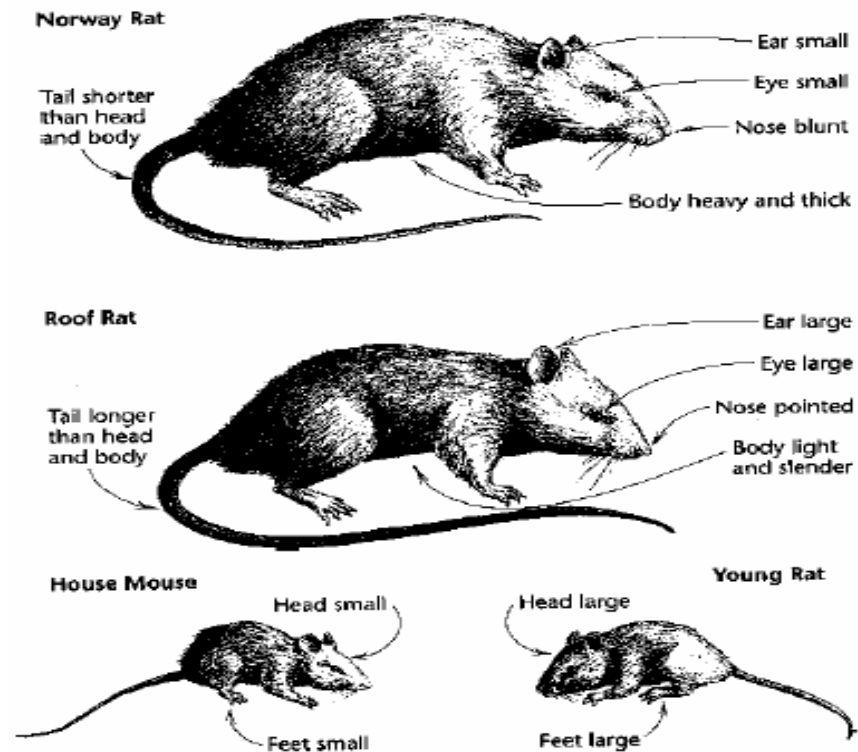


Figure 1. The differences between rats and mice.

PREVENTION

Rats and mice often can be kept from becoming a nuisance by limiting their access to nesting sites and food and water supplies. If rats or mice are killed through control techniques but food and water resources are still available it is likely that new rodents will eventually move in to take their place. The best way to limit rodent resources is through sanitation and maintenance. Below are some of the most effective methods of prevention using sanitation and maintenance:

- Store food (including pet food and grains) in glass, metal, or thick plastic containers with tight fitting lids.
- Promptly and thoroughly clean up any spilled food materials.
- Designate certain places within the school as areas for eating. Help students, teachers, and administrators understand the importance of only eating in these areas.
- Garbage is often the main source of food for rats and mice. Keep all trash receptacles tightly covered and empty them often. Plastic trash bags will not keep rodents out so remove trash daily.
- Remove any ready water sources. Fix leaking pipes, faucets, or irrigation systems. Also, if possible, remove standing water found in ditches, depressions, or other similar situations.
- Remove fallen fruits and nuts from any outside trees.

- Trim trees, bushes, grass, vines, or any other plants at least 12 to 18 inches away from the structure.
- Seal any holes and cracks within the siding of the building that can be used by rats or mice to gain access into the structure. In a rodent management program, the best materials to use when sealing large holes and cracks include ¼ inch hardware cloth, 19-gauge or thicker sheet metal, plaster, or mortar. Smaller holes can be sealed using caulk or copper wool. Remember to look for holes in the building not only in the first three feet above the ground. Rats and mice will also enter a structure via the eaves, the roof, the attic vents, and where pipes and wires penetrate the walls and roof.
- Weather strip around doors and windows and if possible use raised metal doorsills.
- Seal air conditioning units well. These units provide warmth, a nesting site, and a ready source of water.
- Repair broken sewer pipes. Rats will dig into and use broken sewer pipes as an entryway into a structure.
- Cap drains with perforated caps that are firmly attached to the floor.
- Clean up storage areas and other cluttered spaces, thus reducing nesting sites and protected places where rodents feel comfortable moving around.
- Remove wood piles, rock piles, and any other outdoor heaps of materials that may provide nesting sites for rats or mice.

MONITORING AND INSPECTION

Detection and monitoring are important in controlling mouse and rat problems. When inspecting an area for a rodent infestation, the following points will be helpful:

- Remember that you are trying to find five main things: nesting areas, food sources, water sources, access points, and signs of rodent activity.
- Search piles of trash, clutter, or debris for rodent nests.
- Inspect for feces and urine. Use Figure 2 to identify the source of a fecal pellet.
- Inspect for rub marks or other indications of activity. Since rodents pass over the same spot within their territory over and over again, they leave behind rub marks where body oils and dirt collect.
- Look for holes and cracks through which rodents can pass both inside and outside.
- If you feel rodents may infest an area, lightly dust the edges of the area with chalk dust or talcum powder. After a period of time, return and look for footprints and drag lines (made by tails) that indicate rodent traffic.
- Inspect at night when rodents are most active. Use a powerful flashlight and watch for movement. Listen for gnawing sounds, squeaking, and rodent movement.
- Temporarily close suspected holes and entryways with dirt, paper, or aluminum foil. After a few days, return to see if the material was removed or chewed through.

LEAST TOXIC CONTROL METHODS

The purpose of integrated pest management (IPM) is to reduce two things: the pest population and the amount of pesticides needed to accomplish that goal. With the exception of emergency situations, all other available control methods should be used prior to using a pesticide. Using poisons has several important risks that must be considered. These dangers will be addressed in the section titled "Poisons". Before any poisons are used in an IPM program, sanitation, maintenance, and other less toxic control measures should be utilized.

Physical Removal

One of the most common forms of rodent control is the removal of individuals by trapping.

Rodent traps fall into three main categories: snap traps, live traps, and glue boards.

Snap traps make use of a trigger-induced killing mechanism. Upon being triggered by the presence of a rodent feeding on bait, the mechanism instantly snaps shut onto the mouse or rat, killing the individual. There are different sizes of traps, larger ones for rats and smaller models for mice. This type of trap is the most effective type of trap for use in dusty locations.

Live capture traps are available, but leave the unpleasant job of killing the rodents to you. These traps may or may not utilize bait to attract the rodents.

Glue boards are also an option. These are helpful in that they not only trap rodents but also can retain rodent hairs and fecal pellets of escaped rodents, allowing you to monitor the presence of rodents. Glue boards do not kill mice nor rats so should be inspected often in order to prevent unnecessary suffering of trapped individuals. Glue boards should be fastened to a base with nails or wire in order to prevent partially trapped individuals from dragging the traps away.

The following points will help your trapping program be more effective:

- Always place traps flush against edges since rodent follow edges as they move from place to place.
- Place traps near active holes and cracks and near clutter and other protected areas where rodents may frequent.
- Place traps near fecal pellets and rodent urine.
- Place traps near gnaw marks, rub marks, or other signs of rodent activity.
- Secure all traps so those partially caught individuals cannot drag the trap to an unknown location.
- You may wish to bait your trap with food or nest material. Examples of effective food baits include hot dog, bacon, nuts, or sugary substances such as gumdrops or raisins. Cotton may be used as effective nest material bait.
- As for the number of traps to use, there is not a definite number. Usually the more traps you can safely set, the better. Place traps wherever you find activity and try placing traps every three to four feet along a wall. Concentrate traps in one area at a time. After the area has been cleared of rodents, move on to the next area.
- One of the most important things to remember about traps is when first placed they are foreign objects to the rodents. Rats and mice will treat foreign objects differently. Rats are

wary of unfamiliar objects while mice are more curious. Therefore, depending on the rodent species, trapping may be instantly effective or may require patience.

- Whenever removing live or dead rodents, wear gloves to protect yourself from harmful microorganisms.

Chemical Management

Sometimes sanitation, maintenance, and physical removal alone may not be enough to control an existing rodent problem. If mice and rats persist or if an emergency situation warrants control of a problem via other methods, chemical pesticides may be needed. All pesticides should be applied according to labeled directions. Applicators must wear protective clothing. Pesticides should never be applied where they might runoff into storm drains or sanitary sewers. Whatever the control method you choose, it is imperative that you keep clear, accurate records of all actions taken.

There are several important negative aspects to the use to rodent poisons. The use of rodenticides has been overused. Because of this overuse some mouse and rat populations have developed resistance to the toxicants. In addition, the use of rodenticide can be a dangerous exercise. Rodents can pick up the toxic baits and move them to other areas of the school. Baits can end up in cafeteria food, in student lockers, and in wide-open areas where curious students may pick up and handle them. Therefore, rodenticides should only be used to handle emergency situations where rodents are out of control and other management techniques are insufficient alone.

Baits should not be used indoors. Intoxicated rodents that are disoriented may inadvertently wander into public areas. Additionally, rodents that have been baited indoors often die in hidden, difficult-to-reach areas. The result is a dead, decaying, malodorous body that cannot be removed. The dead body also attracts new pests like flies and other insects.

The following suggestions will make the use of toxic baits more effective and safe:

- Only use rodenticides outdoors.
- Place all rodenticides in locked, tamper resistant bait stations and secure all bait stations so they are immovable.
- Since rodents often move and hide their food, some forms of baits may be safer to use. Water baits and secured blocks of paraffin bait cannot be removed and stored by rodents.
- Use baits over long holidays when students are absent from the building.
- For rats, bait stations should be placed about every 15 to 30 feet apart. For mice, they should be about every six to eight feet apart.
- Place baits along the edges of walls, near rodent entryways, and in areas where known rodent traffic exists.
- Remember to have patience since rats must become accustomed to changes in their environment. It may take a few days until the rats feel comfortable trying the baits.

- Monitor frequently the amount of bait consumed. Replenish any missing bait until management goals have been reached.
- Remember to always wear gloves when handling any sick or dead rodents.

Baiting Tips

Rodent populations may have a food preference for a variety of items. They may be feeding on ketchup packages, bread, candy bars or fruit. If that is the case, you may use those items for bait. Generally, roof rats prefer fruit and nuts, and Norway rats prefer fish (sardines) or meat. Other baits include chocolate or dry oatmeal. Peanut butter works as a bait for both rats, but peanut allergies of the building inhabitants should be considered. You may want to use multiple baits to provide a variety of choices. For instance, you may set several traps with chocolate, several with peanut butter (or meat), and several with dry oatmeal. Another tip is to “bait” some traps with cotton balls or a ball of string. Pregnant females will scavenge for these items to make a nest.

Location /Situation	Suggested thresholds	Nonchemical Control Options	Preferred Chemical Treatment(s)
Cafeteria.	One rat justifies setting traps, improving sanitation, and rodent proofing the building.	Sanitation and clutter control will do a great deal to manage rodents.	Rodenticides should not be used indoors as it can result in rodents dying inside walls and ceilings, where odors prevail. Outdoors—rodenticides can be used, but should be placed in a tamper-resistant bait station and secured to a concrete block. Boxes should be checked at least monthly and bait replaced to avoid staleness in the bait.
Food Storage Areas.	See above.	Exclusion (rodent proofing) the building with hardware cloth, or concrete patches.	See above.
Gymnasiums.	See above.	Identify runways by rub marks, urine trails, or by using a thin layer of talcum powder.	See above.
Concession Stands.	See above.	Secured snap traps set at right angles to rodent runs. Traps should be checked often. Note: Traps should not be set where children may contact them.	See above.

I. Spiders in Schools

Introduction

Although diminutive in size, spiders have invoked fear and revulsion in humans throughout history. Fears about spiders are largely unwarranted for they provide a great benefit to mankind by consuming vast numbers of insects in and around our homes. It is only a few species of spiders which are considered truly dangerous to humans. Therefore, it is important to be able to differentiate between relatively harmless spiders and those which should be avoided and/or controlled.

The species of spiders that cause the most concern in the home or school environment are the black widow, brown recluse, and the aggressive house/hobo spider. These spiders are potentially dangerous to humans, and bites from these spiders may cause severe reactions or even death. However, these spiders will usually only bite if provoked, and only under certain circumstances.

First Aid for Spider Bites

If possible, capture the spider so the specimen can be taken to a doctor. Proper treatment may depend on identifying the species. Even the squashed remains of the spider can be useful for identification purposes.

Wash the area around the bite, calm the victim, and consult a doctor as soon as possible. Those particularly at risk are the very young, the elderly and sick, or people with high blood pressure. Although the illness and lesions from bites of the three spiders discussed in this chapter can be serious, deaths are rare.

Avoiding Spider Bites

The three dangerous spiders described in this section have particular nesting and hiding places which are described below. If any of these spiders is common around your school, it is important to be cautious when working near these places. Maintenance and custodians should be careful about where they put their hands when doing outdoor work, and wear gloves and a long-sleeved shirt when working around woodpiles and other items stored outdoors that are likely to harbor the spiders.

Make sure students and staff can identify any dangerous spiders in your area and know their likely nesting and hiding places. Children should be taught not to tease spiders in their webs or poke at them, and to not put their hands in dark crevices without looking first. The dangers of spider bites should be explained without exaggeration to avoid unnecessary fears.

Nesting and Hiding Places for Three Problem Spiders

Black widows like dry, undisturbed places such as lumber and rock piles, stacked pots or baskets, rodent burrows, water meters, the underside of bricks and stones and dry crawl spaces. Females stay in the web.

Brown recluse spiders prefer undisturbed places for their webs, hunt primarily at night and will take refuge in clothing and bedding; often found in unused closets and storerooms, behind

furniture, and in baseboard cracks and crevices. Outside, it can be found in foundation cracks, cracks in the soil, and window wells.

Aggressive house spiders prefer dark, moist places with cracks and crevices for its funnel-shaped web; is a poor climber so is rarely seen above ground level. Males wander (especially from June through September) and sometimes become trapped in clothes, toys, bedding, or shoes. Inside, this spider is likely to be found in basements and on ground floors between stored items, in window wells, in closets, and behind furniture. Outside, it can be found in areas similar to both the black widow and brown recluse.

Removal of a Non-Dangerous Spider

For those spiders that are considered non-dangerous, it may be best just to leave them where they are found. However, if this is considered unacceptable, the spider may be removed without harming it. This may be done by inverting a container of some sort over the spider, sliding a stiff piece of paper over the mouth of the container, and then releasing the spider outside.

General Spider Management

- **Non-chemical control:** Employing non-chemical control is usually considered most effective. Specifically, this would include eliminating hiding or harborage sites. One recommendation is to store boxes off the floor and away from walls, sealing them tightly with tape to preclude access by spiders (and insects as well). Removal of debris and excess clutter will also reduce the number of harborage sites available. Debris and stacks of firewood should be moved a distance from schools or homes and elevated off the ground as much as possible. Vegetation should be removed from the sides of buildings and grass should be kept mown. For spiders already in residence, removal of their webs and egg sacs discourages subsequent infestation. Vacuuming is an excellent way to accomplish removal. Exclusion practices may also be employed. Examples of this are maintaining tight fitting screens in windows and the sealing of entrance sites such as doors and cracks in walls. Additionally, it is recommended that sufficient ventilation be maintained in attics and basements to reduce moisture, thus reducing the amount of prey insects available as a food source for spiders.
- **Chemical control:** A wide variety of chemicals are available for the control of spiders. However, chemical control is most effective when conducted by a certified pest control operator. Misapplied chemical treatments may cause more harm than the real or perceived threat from spiders. Examples of some of the treatment methods that professionals might use are contact, spot, crack & crevice, space, and perimeter treatments.

Black Widow Spiders

Identification and Biology

All of the adult females of the three most common species of black widows in the United States (the northern widow, *Latrodectus variolus*; the **black widow**, *L. mactans*; and the "western" widow, *L. hesperus*) are large (body size is 1/2 inch or larger). They are typically shiny black spiders with a red hourglass design on the underside of their abdomen. Because their webs are near the ground and the spiders hang upside down in the web, their distinctive marking is readily apparent. The adult male, which is not dangerous, is small and patterned with whitish streaks, bars, or dots on the top of the abdomen.



Southern Black Widow Spider

The female black widow spider spins an irregular, tangled web, with a tunnel in the center. The webs are typically constructed in quiet, undisturbed locations that are usually, but not always, close to the ground.

The female spends her life entire life in the web and retreats into the tunnel when disturbed. Her eggs are placed in white, spherical sacs within the web. After hatching, the young spiders stay near the sac for a few hours to several days and then climb to a high point, wait for suitable air currents, and spin a silken thread so they can float on the breeze like a kite. This method of "ballooning" distributes them over a considerable distance. Once they land, the spiders begin to construct their own webs. The abdomen of a young black widow is patterned with red, white, and yellow, but has the black legs and general appearance of the adult.

Bites

Black widows are shy, retiring creatures that bite reluctantly and then only in self-defense when threatened. However, when a female is defending her egg sac, she can become quite aggressive. After the bite is inflicted, it may not initially cause pain. However, after a few minutes, the bite site becomes quite painful. Symptoms from the bite of a black widow include headache, general body ache, nausea, shortness of breath, intense muscle pain, and rigidity of the abdomen and legs. If reactions are mild, no treatment is usually administered. However, if symptoms do become severe, diazepam may be administered for muscle pain and cramps. The bite of the black widow is usually more serious for a small children and the elderly.

Detection and Monitoring

Monitor for black widows at night with a flashlight or head lamp. This is the time when they move to the center of their webs and will be most visible. When making your inspections, focus on areas that are dark and undisturbed during the day, but not necessarily close to the ground. Look in and around the following places:

- Small crevices anywhere from the foundation to the eaves of buildings
- The undersides of outdoor wooden furniture (for example, beneath the seats in the corners where the legs are braced)
- Piles of wood, bricks, stones, or similar materials
- The openings of rodent burrows
- Water meters

- Cellar doors
- Outhouses
- Storage rooms

Black widow webs have high tensile strength and, with little experience, can be identified by the way they "pop" when broken. An experienced pest manager can use this information to find webs during the day.

Management Options

Physical Controls

To achieve some kind of permanent control of black widow spiders, you must attempt to eliminate not only the spiders but their preferred habitats as well. If this is not accomplished, another black widow may locate the same habitat and move in. If black widows regularly build their webs in certain locations indoors, try to modify these areas by increasing the light, caulking crevices, or reducing the insect population the spiders are feeding upon. As previously mentioned, check window and door screens for holes that allow access for insects, and make sure that foods and organic wastes are stored properly to prevent insect infestations. To reduce or eliminate possible web sites outdoors, debris and litter should be removed and discarded. All crevices in foundations and walls that are child-height and wide enough to stick a finger into should be caulked closed.

Brown Recluse Spiders

Identification and Biology

Brown recluse spiders (*Loxosceles* spp.) are identified by their long thin legs, an oval-shaped abdomen which is light tan to dark brown color, and a very distinctive violin-shaped mark on their back. This marking gives rise to their other common name, violin spiders. Their overall size is 3/4 inch to 1 1/4 inches. The males are slightly smaller than the females. There are many species of brown recluse spider in the United States. They are found mostly in the Midwestern and south-central states, the Southwest, and Puerto Rico. As the common name "recluse" suggests, these spiders are shy, retreating from humans when possible, and preferring dark, undisturbed places on or near the ground for web-building. Unlike the black widow, brown recluse spiders hunt for prey some distance from their webs. They usually come into contact with humans because they have taken temporary refuge in clothing or bedding. Items left lying undisturbed on the floor, such as supplies, toys, or clothing, are perfect daytime refuges for these spiders. Such objects should be shaken out thoroughly if they have been on the floor for any length of time, particularly in regions where the brown recluse is prevalent.

Bites

Brown recluse spiders avoid areas of human activity. Bites are rare and are usually the result of unused rooms suddenly being put to use, or accidental contact resulting from pressing the spider between the body and either clothing or sheets. The bites are almost always very unpleasant, producing an ulcerous wound called a necrotic lesion that turns dark within a day and takes a long time to heal. Young children, the elderly, and the infirm are most likely to be

affected severely. Victims should seek medical attention, but should only allow a doctor to excise the affected tissue in extreme cases.

Detection and Monitoring

The brown recluse spider wanders at night searching for prey. It seeks dark, uninhabited areas for protection. Brown recluse spiders are usually found on floors and baseboards. Only rarely are they seen on desks and tables and they are never found on walls.

Searches for this spider should concentrate on uninhabited areas close to the floor, particularly in boxes, around piles of paper, clothing, and debris, in closets, and under furniture. Periodic checks outdoors should focus on storage sheds, piles of debris or wood, cracks in the soil or in foundations, walls, and window wells, especially if small children play near these places. Employing traps in monitoring is also useful in establishing the extent of brown recluse infestations, and is helpful in providing a measure of control.

Management Options

Physical Controls

Because these spiders prefer undisturbed places for nesting and hiding, periodic, thorough cleaning can help reduce their numbers. Floors should be kept well-vacuumed. Boxes of paper and other items stored in closets, or anywhere else that is dark and undisturbed, should be handled carefully when first inspected. If brown recluse spiders are suspected, the boxes can be placed in a bin-type freezer for 48 hours to kill the spiders before the boxes are unpacked. A small hand-held, battery-powered vacuum can also be used while checking through stored items. If a spider is vacuumed up, the vacuum bag can be placed into a plastic bag and then into a freezer.

Outside, remove piles of debris, wood, and rock. Fill cracks in walls and foundations with mortar or caulk. Inside, clothing and other objects should be removed from floor areas in closets, locker rooms, and other storage spaces. Because most bites are received when putting on shoes or clothing that has lain on the floor, clothes normally stored near the floor should be moved to a higher location. Shake out clothes if they were on a floor overnight. Hanging shoes or placing them in sealed plastic bags reduces the likelihood of being bitten. Wearing leather gloves while searching through stored items can help prevent bites.

Aggressive House Spider

Identification and Biology

The aggressive house spider (*Tegenaria agrestis*) is a fairly large (1 3/4 inches, including legs), fast moving spider. Its legs are long and hairy and its body is brown with darker markings on its oval abdomen. This spider builds a funnel-shaped web in moist, dark places. The aggressive house spider waits in its funnel, and when it feels vibrations rushes out to grab its prey.

This spider mates in the summer and early fall, and the female lays eggs in the fall in silken sacs that are placed behind or beside the web. Eggs hatch in the spring and the spiderlings develop for a year before they are sexually mature.

The aggressive house spider is found throughout the Pacific Northwest, Idaho, and Utah and appears to be rapidly expanding its range.

Bites

Very few people are bitten by this spider and even fewer develop severe symptoms. Bites most commonly occur from July to September when males are wandering in search of females. Often bites occur when the spider is squeezed between clothing and a person's body. The bite of an aggressive house spider can produce symptoms similar to those produced by a brown recluse. The initial bite may not be painful, but within a few minutes a hard, sensitive area develops. Other symptoms include severe headache, nausea, weakness, and joint pain. Later, the area blisters, oozes serum, and eventually scabs over. The lesion may take months to heal.

Detection and Monitoring

The distinctive funnel-shaped web of the aggressive house spider is easy to spot in dark, moist locations at ground level or in basements. Specially designed traps may be useful in detection and possibly control.

Management Options

Physical Controls

As with other spiders, regular, thorough vacuuming behind furniture and stored articles, under baseboard heaters, and in closets will help eliminate spiders and their webs. Repair torn screens and broken windows, and ensure that doors are able to close tightly without gaps. If this spider is common in your area, do not store shoes, clothing, or bedding at ground level where spiders could become entrapped. Outside, caulk holes and crevices in foundations or walls and eliminate piles of debris, lumber, and rocks, as much as is possible. Cut or eliminate long grass growing near foundations. Wear protective clothing when working outside in areas that might harbor spiders and inspect items that you pick up. Always check articles that you bring into the school from outside storage sheds to make sure you don't bring in spiders or their egg sacs.

J. Yellowjackets and Hornets in Schools

Introduction

Yellowjackets and hornets are both beneficial and problematic wasps. They are important predators and scavengers, helping to control pests and recycle organic materials. Although often grouped together with bees, yellowjackets pose a more serious threat to people. Yellowjackets can sting repeatedly whereas a bee can sting only once. Multiple stings from yellowjackets are common because they aggressively defend their nest when it is disturbed.

Identification and Biology

"Yellowjacket" and "hornet" are the common names given to wasps in the genera *Dolichovespula*, *Vespula*, and *Vespa*; but for the sake of simplicity, we will use the term "yellowjacket" in the following discussion. Note that these common names are not reliable indicators of whether or not they are pests.

Distinguishing Bees, Wasps, Yellowjackets and Hornets

	Appearance	Habits	Nests	Feeding Behavior
Bees	Hairy, stout bodies with thick waists; workers & reproductives are winged	Noisy flight; sting mainly while defending nest; foraging workers seldom sting	In hives, trees, or buildings	Collect pollen and nectar, feed pollen to young & share food with other adult bees
Wasps	Bodies vary; all winged	Colorful, rapid fliers; solitary & social varieties	Aerial or ground nests; can also be in structures	Scavengers and/or predators
Solitary wasps	Thin- or thick-waisted	Visit flowers & other vegetation; relatively docile	In mud, or in holes in ground	Predators; provision nests with prey for young to feed on
Yellowjackets and Hornets	Stout, colorful	Rapid fliers; aggressive; individuals capable of inflicting multiple stings; social in large colonies which they defend vigorously	Multi-layered, papery nests mostly in ground, although some aerial or in structures; nests have an outer papery covering called an "envelope"	Mostly beneficial predators, but scavenger species become pestiferous
Paper (umbrella) wasps	Long bodies with thin waists, long dangling legs	Social; search vegetation for prey; visit flowers for nectar; not particularly aggressive	Single layered, papery nests without an envelope; attached to fences, eaves, boards, branches; shaped like an umbrella	Beneficial predators; feed prey to developing young in nest

Yellowjackets are relatively short and stout with and hold their legs close to their body, compared with other wasps. **Paper wasps**, for example, are more slender and have long dangling legs. All yellowjackets are striped either black and white or black and yellow. They are

rapid fliers, and are more aggressive than other types of wasps. Their nests are always enclosed with a **papery envelope** and can be found in the ground, hanging from eaves or tree branches, and occasionally in wall voids.

The queen yellowjacket begins her nest by building a small comb of chewed wood. She lays eggs in the cells and, after the eggs hatch, tends the larvae herself. Once the larvae develop into adult workers, they expand the nest into tiers, built one on top of the other. Yellowjacket colonies seldom exceed 15,000 workers with a single queen, although they can become larger and can include multiple queens in perennial colonies. In the late summer or early fall, new queens and males are produced. After mating, the queens seek a sheltered place to spend the winter and, except in perennial colonies, all the worker wasps die. The nest is not reused and eventually disintegrates. Early in the warm season, colonies are small and yellowjackets are usually not a problem. Later in the season when colonies are at their peak, these insects become pestiferous. In their search for protein and carbohydrate sources, they are attracted to garbage cans, dumpsters, lunch counters, and playgrounds, where they scavenge for food.

Stings

Insect stings are the leading cause of fatalities from venomous animals, and most of these stings are inflicted by honeybees. The people who die from yellowjacket or bee stings are people who experience large numbers of stings at once or who suffer severe allergic reactions to the inflammatory substances in the insect venom. These allergic reactions include soreness and swelling, not only at the site of the sting, but also on other parts of the body that may be distant from the site. Other symptoms include fever, chills, hives, joint and muscle pain, and swelling of the lymph glands and small air passageways. In severe cases, the individual may suffer a sudden drop in blood pressure and lose consciousness. While many individuals who experience allergic reactions have become sensitized over time by previous stings, half of all fatalities occur in individuals stung for the first time.

Non-allergic reactions to stings include localized pain, itching, redness, and swelling for hours to a day or two after the event.

Nest Disturbance

Yellowjackets that are foraging for food will usually not sting unless physically threatened, such as being struck or caught in a tight place. But if they feel their nest is in danger, they will vigorously defend it. All wasps defend their colonies, but some yellowjackets are more sensitive to nest disturbance and more aggressive in their defense. Disturbing a yellowjacket nest can result in multiple stings. This can occur when someone accidentally steps on an underground nest opening or disturbs a nest in a shrub or building. Sometimes merely coming near a nest, especially if it has been disturbed previously, can provoke an attack.

Wasps in underground nests can be disturbed simply by vibrations. Thus mowing lawns or athletic fields can be hazardous, and operators may need to wear protective clothing when mowing during the late summer season when colonies are large. It can be very frightening to be the victim of multiple wasp stings. The first response may be to run away, however the best strategy is to back slowly away from the colony until the wasps stop attacking you. It is important to educate children about the beneficial role of these wasps (they feed on pest insects, particularly caterpillars) and to remind them repeatedly of ways to avoid stings. Since problems

with yellowjackets are most common in late summer and fall, teachers can be provided with this information at the beginning of the fall term. See **tips on avoiding and treating stings**.

Detection and Monitoring

If there is a chronic problem with yellowjackets around outdoor lunch areas or school athletic fields, inspect the area methodically to locate the nests. Nests can be found in the ground, under eaves, and in wall voids of buildings. Ground nests are frequently (but not always) located under shrubs, logs, piles of rocks, and other protected sites. Entrance holes sometimes have bare earth around them. Nest openings in the ground or in buildings can be recognized by observing the wasps entering and leaving.

Management Options

The objective of a yellowjacket management program should be to reduce human encounters with the wasps, but not to eliminate them from the entire area since they are beneficial predators of insects. The two most productive and least environmentally destructive ways to do this are to modify the habitat to reduce yellowjackets' access to food in the vicinity of human activities, and to use physical controls such as trapping and nest removal. Area wide poison-baiting should be used only as a last resort when other methods have failed and stings are frequent.

Physical Controls

Habitat Modification

Since garbage is a prime foraging/predation site for yellowjackets, garbage containers on school grounds should have tight fitting lids. The receptacles should be emptied frequently enough to prevent the contents from impeding the closure of the lid. The lids and containers should be periodically cleaned of food wastes. Disposable liners can be used and replaced when soiled or damaged.

When these practices are not followed, school garbage (and the flies around it) becomes a food source for yellowjackets in the area. With a large number of wasps around garbage containers, students may become afraid to get close enough to place garbage all the way inside, and spilled food attracts more wasps.

Dumpsters should be cleaned frequently by washing them with a strong stream of water. If the dumpster service company has a cleaning clause in their contract, make sure it is enforced. To limit yellowjacket infestations inside the school buildings, repair windows and screens and caulk holes in siding. Building inspections for yellowjackets can be done at the same time as inspections for other pests such as rats, mice, termites, etc. Inspections should be conducted monthly to ensure that developing nest are found before they get large enough to be problematic.

Trapping

Trapping with a sturdy trap and an attractive bait can significantly reduce yellowjacket numbers if a sufficient number of traps are used. There are a variety of traps on the market. In general, cone-type traps are more useful for long-term (many weeks) trapping. In some

schools, unbaited yellow sticky traps (like those used to catch whiteflies) affixed to fences near underground nests have provided sufficient control to protect children from stings.

A homemade, cone-type fly trap can be used to catch yellowjackets simply by using the captured flies inside the trap as bait. The yellowjackets enter the trap to get the flies and become trapped themselves (see **tips on this kind of trapping**). You can also try using baits such as dog food, ham, fish, and other meat scraps, or, toward the end of the warm weather, sugar syrups, fermenting fruit, and jelly.

Take care to place traps out of the children's reach as much as possible. However, the traps should be placed near the nest if it can be found, and/or near the area where the yellowjackets are troublesome. Teachers can be instructed to make a short presentation on the purpose of the traps to satisfy the curiosity that students will undoubtedly have. Show students the traps, explain how they work, and try to impress upon them the importance of the traps in maintaining the safety of the playground.

When traps are full they can either be placed in a freezer for a day to kill the wasps or enclosed in a heavy-duty plastic garbage bag and placed in the direct sun for several hours. A third way of killing the wasps is by submerging the traps in a bucket of soapy water until the wasps drown.

The traps should be out only during the period that yellowjackets are a problem, usually late summer and early fall. When the traps are taken down for the year, they should be cleaned with soap and water and stored.

Nest Removal

A nest can be destroyed through physical removal (vacuuming) or by using a pesticide (see Chemical Controls). Either way, great care must be exercised because any disturbance around a nest can cause multiple stings. It is best to have a professional pest control operator (PCO) or other experienced person remove the nest. Nest removal should take place at night when the children are out of school and the yellowjackets are inside the nest. When illumination is needed, use a flashlight covered with red acetate film so it will not disturb the wasps.

Adequate protective clothing and proper procedure can minimize problems and stings. It is important to wear protective clothing when removing wasp nests. Complete body coverage is essential because yellowjackets and other wasps can find even the smallest exposed area. Use clothing made for beekeepers. This includes:

- A bee veil or hood that either contains its own hat or can be fitted over a light-weight pith helmet or other brimmed hat that holds the veil away from the head. A metal-screen face plate that extends around the head is a desirable feature. Check the veil carefully for tears before each use.
- A bee suit or loose-fitting, heavy-fabric coverall with long sleeves. This is worn over regular pants and a long-sleeved shirt to provide extra protection from stings.
- Sturdy high-topped boots with pant legs secured over the boots with duct tape to prevent wasps from getting into trousers.

- Gloves with extra-long arm coverings so sleeves can be taped over them to protect the wrists.

Vacuumping

Vacuumping is particularly effective when:

- nests occur in wall voids,
- in environmentally sensitive areas where nests should not be treated with insecticides, or
- in emergencies where nests have already been disturbed.

Vacuumping out entire nests is not recommended unless it is done by a PCO experienced in handling stinging insects.

In some cities there are pest control companies that will perform this service for free so they can collect the wasps to sell to pharmaceutical companies for their venom. If the school is interested in this, take time to find a reputable company.

Chemical Controls

If non-chemical methods alone prove insufficient to solve the problem, then integrating a pesticide into your management program may be warranted.

Pesticides must be used in accordance with their EPA-approved label directions. Applicators must be certified to apply pesticides and should always wear protective gear during applications. All labels and Material Safety Data Sheets (MSDS) for the pesticide products authorized for use in the IPM program should be maintained on file.

When an insecticide is considered necessary for the control of yellowjackets, the best approach is to confine it to the nest itself. Anyone applying insecticides should use special clothing that protects against the chemical as well as against wasp stings. Insecticides should be applied in the evening or very early morning when children are absent, the wasps are inside the nest, and cooler temperatures reduce insect activity.

A number of insecticides are registered for use against yellowjackets, the following are most appropriate for use in schools:

Dusts

Residual dusts can be very effective at controlling nests found in wall voids and underground nests. The extent of wall void nest should be determined by listening for activity behind the wall surface. Once the boundaries of the nest have been determined, holes can be drilled into the wall and an appropriately labeled residual dust can be applied. The subsequent holes can be plugged with steel wool to prevent the wasps escape. Outdoor ground nests can be similarly controlled by approaching the nest at night and dusting the entrance; this procedure should be followed by plugging the entrance with dusted steel wool.

Silica Aerogel and Pyrethrins

Silica aerogel combined with pyrethrins is an effective insecticidal dust that can be used to destroy an underground nest or a nest in a wall void. Silica aerogel is made from sand and works by absorbing the outer waxy coating on insect bodies. Once this coating is gone, the insects cannot retain water and die of dehydration.

Products with Components That "Freeze" Wasps

Pyrethrins can be used to quickly knock down guard wasps at the nest entrance and to kill yellowjackets in an aerial nests when they must be destroyed in the daytime. These aerosol products are designed to project a stream of spray 10 to 20 feet and contain highly evaporative substances that "freeze" or stun the yellowjackets.

Do Not Use Gasoline

Gasoline should never be poured into underground nest holes. This dangerous practice creates a fire hazard, contaminates the soil, and prevents the growth of vegetation for some time. A ground application of gasoline poses greater harm to children and the environment than a yellowjacket nest.

Avoid Area-Wide Poisoning

Mass poisoning is seldom, if ever, necessary, and is expensive due to the labor involved in the frequent mixing and replacement of bait. The effectiveness of bait mixtures is also questionable, since the baits face considerable competition from other food sources that are more attractive to scavenging yellowjackets.

K. Grounds Pests

Introduction

The Grounds Supervisor will under the IPM Coordinator’s direction will implement the IPM plan for athletic fields, landscaped areas and play structures. Emphasis will be placed on safety for students, teachers, and staff. Landscaped areas will be designed to promote low maintenance with a limiting environment for weed growth. If weeds are present, the first strategy will be to remove weeds with mechanical methods.

As a last resort, pesticides may be used for controlling various weeds including those found in turf, flower beds, along fence lines, and within cracks in sidewalks, parking lots, and streets. Use of pesticides in most areas is effectively reduced to Round Up. In order to prevent a pest population from requiring significant and repeated post-emergent herbicide applications, a pre-emergent herbicide may be applied.

1. Weeds

Grounds Pests - ATHLETIC FIELD/TURF WEEDS - IRRIGATED

MATRIX OF HIERARCHICAL STEPS TO MANAGING PESTS - Level 1 is the preferred first action, Level 2 is the preferred second action, Level 3 is the preferred last action.

This matrix is to be used in conjunction with Medford School District's IPM Plan

This is a matrix that identifies a pest problem or issue and defines approved practices for proper control.

The IPM Plan Coordinator (or designee) must approve any additional strategies before they are used.

Site personnel must always consult the IPM Coordinator prior to taking action against pests on District property.

Although irrigation, top dressing, over seeding, fertilization, and aeration are the dominant variables in maintaining quality turf, there are instances in which fields are so infested with broadleaf plants that they are no longer usable for athletic events. The uneven playing surfaces caused by the mix of grass and broadleaf weeds, such as plantains, create significant variations in footing. Sometimes the fields are just difficult on which to play; sometimes they are unsafe for play. Besides the uneven playing surfaces the presence of a large number of weeds also improves the habitat for gophers, which prefer this vegetation for food, resulting in a very uneven surface for running with large mounds and deep holes. These render the field unplayable, and have resulted in a number of injuries to people who try to play on them. Facilities has embarked on a more aggressive gopher and mole control program. Eliminating their preferred food source (the roots of broadleaf vegetation) improves the effectiveness of this program. (See: Gophers & Moles matrix)

LEVEL 1: Action approved for school supervised volunteer or district staff						
ACTION	Threshold	DONE BY:		IPM RESPONSE		
		VOLUNTEER	STAFF	CODE	COMMENTS	
SITE INSPECTION	Presence/Complaint	X	X	T	Small number of localized weeds	
INSPECT & ADJUST IRRIGATION SYSTEM	Presence/Complaint	X	X	T/P	Adjustment by appropriate staff	
HAND CULTIVATING	Complaint	X	X	P	Baseball diamonds	
INCREASED MOWING	Complaint/work order/site inspection	X	X	P	Reduces seeds	
OVER SEEDING	Complaint/work order/site inspection	X	X	P/S	Helps grass compete with weeds	
FIELD RENOVATION/REPAIR IRRIGATION, TOP DRESSING, OVER SEEDING, FERTILIZATION, AERATION	Complaint/work order/site inspection	X	X	P/S	Could be routine maintenance if labor is available District specified fertilizer Compost maybe used as fertilizer if budgets allow	
LEVEL 2: Action approved for licensed applicator, (district staff or contractor)						
ACTION	Threshold	VOLUNTEER	STAFF	CODE	COMMENTS	
SPRAY APPLICATION	Presence/Complaint		X			
LEVEL 3: District and Site approved action for licensed applicator (district staff or contractor) required						
ACTION	Threshold	VOLUNTEER	STAFF	CODE	COMMENTS	
NO CURRENTLY APPROVED TREATMENT						

IPM (Integrated Pest Management) RESPONSE CODE REFERENCE

P - Prevention

E - Exclusion

S - Structural Modification

T - Tolerance

X = Person who may respond to action items listed

2. Poison Oak

Grounds Pests - POISON OAK

MATRIX OF HIERARCHICAL STEPS TO MANAGING PESTS - Level 1 is the preferred first action, Level 2 is the preferred second action, Level 3 is the preferred last action.

This matrix is to be used in conjunction with Medford School District IPM Plan

This is a matrix that identifies a pest problem or issue and defines approved practices for proper control.

The IPM Plan Coordinator (or designee) must approve any additional strategies before they are used.

Site personnel must always consult the IPM Coordinator prior to taking action against pests on District property.

Poison Oak can spread rapidly without proper detection. This native plant is problematic in that, when contacted by skin, the leaves release a substance called urushiol, in oil form, which causes severe contact dermatitis in most people. It may also have dangerous (to the point of life-threatening) systemic impact on a limited number of people. There is the obvious danger of severe allergic reaction to poison oak. A secondary problem can be just as dangerous: children (and adults) can scratch skin infected by the poison oak with finger nails that contain bacteria. There is a very real danger of life-threatening staph, strep, and other bacterial infections.

LEVEL 1: Action approved for school supervised volunteer or district staff						
ACTION	Threshold	DONE BY:		IPM RESPONSE		
		VOLUNTEER	STAFF	CODE	COMMENTS	
SITE INSPECTION	Complaint	X	X	T	Inform site staff Instruct children: no play area Proximity to exposure	
HAND/MACHINE REMOVAL/PRUNE DIG OUT	Complaint/work order/site inspection Localized patch 1' x 1'	X	X	p	Dig out preferred	
LEVEL 2: Action approved for licensed applicator, (district staff or contractor)						
ACTION	Threshold	VOLUNTEER	STAFF	CODE	COMMENTS	
ASPHALT	Complaint/work order/site inspection		X	E/S	Walkway through area	
CONCRETE	Complaint/work order/site inspection		X	E/S	Under benches Fence lines	
GLYPHOSATE T & O	Complaint/work order/site inspection Localized patch 2' x 2'		X	P	Follow notification-posting-reporting requirements in IPM Plan Localized patch 2' x 2'	
GLYPHOSATE T & O	Complaint/work order/site inspection Greater than 2' x 2'		X	P	Follow notification-posting-reporting requirements in IPM Plan	
LEVEL 3: District and Site approved action for licensed applicator (district staff or contractor) required						
ACTION	Threshold	VOLUNTEER	STAFF	CODE	COMMENTS	
GLYPHOSATE T & O	Complaint/work order/site inspection Greater than 2' x 2'		X	p	Follow Notification Guidelines Spray before leaves turn red	

IPM (Integrated Pest Management) RESPONSE CODE REFERENCE

P - Prevention

E - Exclusion

S - Structural Modification

T - Tolerance

X = Person who may respond to action items listed

3. Gophers and Moles

Grounds Pests - GOPHERS AND MOLES

MATRIX OF HIERARCHICAL STEPS TO MANAGING PESTS - Level 1 is the preferred first action, Level 2 is the preferred second action, Level 3 is the preferred last action.

This matrix is to be used in conjunction with the Medford School District's IPM Plan

This is a matrix that identifies a pest problem or issue and defines approved practices for proper control. The goal is the safest, least toxic, and cost-effective methods of control.

The IPM Plan Coordinator (or designee) must approve any additional strategies before they are used.

Site personnel must always consult the IPM Coordinator prior to taking action against pests on District property.

Uneven athletic turf is often caused by the burrowing of moles and gophers. This can result in injuries to users of these fields, and a general deterioration of the quality of the turf surfaces. Dogs, often allowed by their owners to run loose on district fields increase the hazards by digging into the burrows.

LEVEL 1: Action approved for school supervised volunteer or district staff					
<u>ACTION</u>	<u>Threshold</u>	<u>DONE BY:</u> <u>VOLUNTEER</u>	<u>STAFF</u>	<u>IPM RESPONSE</u> <u>CODE</u>	<u>COMMENTS</u>
SITE INSPECTION	Complaint	X	X	T	Area not actively used
REDUCE DEEP ROOTED WEEDS/PLANTS THROUGH CULTIVATION PRACTICES (Gophers only)	Complaint/work order/site inspection One fresh mound in playing field	X	X	P/E	Effective for gophers only: Top Dress, Irrigating, Fertilize, Re-seeding
LEVEL 2: Action approved for licensed applicator, (district staff or contractor)					
<u>ACTION</u>	<u>Threshold</u>	<u>VOLUNTEER</u>	<u>STAFF</u>	<u>CODE</u>	<u>COMMENTS</u>
TRAP	Complaint/work order/site inspection		X	P	Use in any weather No trapping when students are present without on-site monitoring. Trap location needs identification.
BISHYOROXYCOUMARIN	Complaint/work order/site inspection		X	P	Follow notification-posting-reporting requirements in IPM Plan Use in wet season - Early in morning before students arrive
LEVEL 3: District and Site approved action for licensed applicator (district staff or contractor) required					
<u>ACTION</u>	<u>Threshold</u>	<u>VOLUNTEER</u>	<u>STAFF</u>	<u>CODE</u>	<u>COMMENTS</u>
NO CURRENTLY APPROVED TREATMENT					

IPM (Integrated Pest Management) RESPONSE CODE REFERENCE

P - Prevention

E - Exclusion

S - Structural Modification

T - Tolerance

X = Person who may respond to action items listed

Appendix 2 - Training Outlines

A. CUSTODIAL STAFF TRAINING

1. Concerns about Pests and Pesticides
 - a. Pests which are Public Health Risks
 - b. Pesticide Risks
2. Introduction to Integrated Pest Management (IPM)
 - a. IPM Defined
3. Benefits of IPM to custodial staff
 - a. Recognition of your important role within the school district
 - b. More effective, efficient, and long-lasting solution to specific pest issues
 - c. Reduced pesticide use
 - d. Improved children's health
 - e. Long-term cost savings for school and school district
 - f. Better organized working environment
4. Pest basics
 - a. Food
 - b. Water
 - c. Shelter
5. Role of custodial staff in a school IPM program
 - a. Custodial staff are critical to the success of a district's IPM program
 - b. Awareness of pest conducive conditions
 - c. Reduction of pest conducive conditions
 - d. Use of insect monitoring traps
 - e. Communication
 - i. Report pests in pest log
 - ii. Report maintenance needs
 - iii. Regular communication and follow up with facilities staff/IPM Coordinator
 - f. Sanitation
 - g. Cultural changes
 - h. Attend annual IPM training provided by the IPM Plan Coordinator
 - i. When to take action against a pest: appropriate pest-response action for custodial staff
6. Requirements of ORS 634.700 – 634.750 (IPM plan, Coordinator, no pesticides applied without license, etc.)

B. MAINTENANCE/CONSTRUCTION STAFF TRAINING

1. Concerns about Pests and Pesticides
 - a. Pests which are Public Health Risks
 - b. Pesticide Risks
2. Introduction to Integrated Pest Management (IPM)
 - a. IPM defined

3. Benefits of IPM to schools
 - a. More effective, efficient, and long-lasting solution to specific pest issues
 - b. Reduced pesticide use
 - c. Improved children's health
 - d. Long-term cost savings for school and school district
 - e. Better organized working environment
4. Pest basics
 - a. Food
 - b. Water
 - c. Shelter
5. Role of maintenance/construction staff
 - a. Monitoring for pest conducive conditions
 - b. Working with Coordinator to develop priority list, deadlines for pest exclusion needs
 - c. Working with Coordinator to develop protocols and provisions for pest avoidance and prevention during construction and renovation projects
 - d. Attend annual IPM training provided by the IPM Plan Coordinator
6. Requirements of ORS 634.700 – 634.750 (IPM plan, Coordinator, no pesticides applied without license, etc.)

C. GROUNDS STAFF TRAINING

1. Concerns about Pests and Pesticides
 - a. Pests which are Public Health Risks
 - b. Pesticide Risks
2. Introduction to Integrated Pest Management (IPM)
 - a. IPM defined
3. Benefits of IPM to schools
 - a. More effective, efficient, and long-lasting solution to specific pest issues
 - b. Reduced pesticide use
 - c. Improved children's health
 - d. Long-term cost savings for school and school district
4. Grounds Pest Basics
 - a. Food
 - b. Water
 - c. Shelter
5. Grounds Pest Specifics
 - a. Review of OSU turf management publications
 - b. Review of model plan appendix 1-g
 - c. Mulching landscaped areas
 - d. Aeration of turf
 - e. Irrigation scheduling
 - f. Gophers, Moles, Voles
 - g. Other pests

6. Role of Grounds Staff
 - a. Keeping all vegetation at least three feet from buildings
 - b. Proper aeration, mulching, irrigation scheduling, etc.
 - c. Attend annual IPM training provided by the IPM Plan Coordinator
 - d. Pesticide application notification, posting, record keeping, and reporting
7. Requirements of ORS 634.700 – 634.750 (IPM plan, Coordinator, no pesticides applied without license, etc.)

D. KITCHEN STAFF TRAINING

1. Concerns about Pests and Pesticides
 - a. Pests which are Public Health Risks
 - b. Pesticide Risks
2. Introduction to Integrated Pest Management (IPM)
 - a. IPM defined
3. Benefits of IPM to Kitchen Staff
 - a. Reduced potential for pest-vectored diseases
 - b. More effective, efficient, and long-lasting solution to specific pest issues
 - c. Reduced pesticide use
 - d. Improved children's health
 - e. Long-term cost savings for school and school district
4. Pest Basics
 - a. Food
 - b. Water
 - c. Shelter
 - d. Kitchen and pantry are often the most pest-prone area of a school
5. Role of Kitchen Staff in a School IPM Program
 - a. Awareness of pest conducive conditions in kitchen, pantry, dumpster area
 - b. Reduction of pest conducive conditions in kitchen, pantry, and dumpster area
 - c. Communication
 - i. Report pests in pest log
 - ii. Report maintenance needs
 - d. Sanitation
 - e. Cultural Changes
 - f. Education
 - i. Maintain IPM awareness among all kitchen staff
 - ii. Participation in IPM inspections of kitchen
 - iii. Attend annual IPM training provided by IPM Plan Coordinator
 - g. When to take action against a pest: appropriate pest-response action for kitchen staff
6. Requirements of ORS 634.700 – 634.750 (IPM plan, Coordinator, staff cannot use pesticides)

E. FACULTY/ADMINISTRATION TRAINING

1. Concerns about Pests and Pesticides
 - a. Pests which are Public Health Risks
 - b. Pesticide Risks
2. Introduction to Integrated Pest Management (IPM)
 - a. IPM defined
3. Benefits of IPM to Faculty
 - a. More effective, efficient, and long-lasting solution to specific pest issues
 - b. Reduced pesticide use
 - c. Improved children's health
 - d. Long-term cost savings for school and school district
 - e. Better organized working environment
4. Pest Basics
 - a. Food
 - b. Water
 - c. Shelter
5. Role of Faculty in a School IPM Program
 - a. Awareness of pest conducive conditions in your classroom and teacher's lounge
 - b. Reduction of pest conducive conditions in your classroom and teacher's lounge
 - c. Monitoring & communication
 - i. Report pests in pest log
 - ii. Report maintenance needs
 - d. Sanitation
 - e. Cultural changes
 - f. Education
 - i. Involve students in classroom pest management (monitoring, sanitation, cultural changes)
 - ii. Attend annual IPM training provided by IPM Plan Coordinator
 - g. When to take action against a pest: appropriate pest-response action for faculty
6. Requirements of ORS 634.700 – 634.750 (IPM plan, Coordinator, teachers cannot use pesticides)

Appendix 3 - Record Keeping and Monitoring Forms

A. Detailed Inspection Log

School:		Date:	Time:
Area/Room Inspected:		Person Monitoring:	
Previous Problems:		Action Taken:	
Pests Observed and Estimated Number:			
Conditions Found: (i.e. sanitation problems, structural deficiencies)			
Recommended Actions:			
Assigned To:			
Comments:			

B. Integrated Pest Management Inspection Form

Integrated Pest Management Inspection Checklist (Pests and Pest Conducive Conditions Checklist)

School District _____

School or Site	
Date	
Inspected by	

Entryways	Yes	No	Not Sure	N/A
Doors closed when not in use				
Doors shut tight and close on their own				
Door sweeps installed so no ¼" gaps				
Cracks & crevices around door are sealed				

If pests are present in the area, write what kind here _____

Notes:

Outside Areas	Yes	No	Not Sure	N/A
Area free from trash, old vehicles, other pest attractants				
All trash cans have secure lids				
Trash cans cleaned regularly				
Site has good drainage and is free from standing water				
Bushes, shrubs, trees at least 18" from building				
Tree branches not overhanging roof				
All dumpsters located away from building				
All dumpsters clean				
No gaps between windows or screens and frame				
Eaves and roofs free from birds, wasps, etc.				
Play structures free from wasp harborage areas				

If pests are present in the area, write what kind here _____

Notes:

Kitchen and Food Preparation Area	Yes	No	Not Sure	N/A
Free of unauthorized pesticides				
Trash emptied daily				
Door sweeps installed so no ¼" gaps				
Floor at every corner is clean and without signs of pests				
Area is free of standing water				
Floor drains and floor sinks are clean				
All faucets close properly and have no leaks or drips				
Under stoves, sinks, and dishwasher kept clean				
No open holes or other access to outside				
Any cracks in walls or floors are sealed properly				
Windows have screens on them				
Vents are free of grease and dirt				
Storage is kept off the floor on wire rack shelving				
Food is put away and stored properly in sealed containers				
Cardboard boxes present				
No long term storage of anything in cardboard boxes				
Pest monitors (sticky traps) are present and dated				
Pest log is posted				
Breaker boxes free of evidence of pests				

If pests are present in the area, write what kind here _____

Notes:

Custodial and Custodial Closets	Yes	No	Not Sure	N/A
Area is free of unauthorized pesticides				
Mops are clean and hanging up when not in use				
Closets are free of trash and food				
Custodial closets are in good order and organized				
Trash cans and maid carts are emptied daily and clean				
Break area is clean and free of food, crumbs and trash				
Storage areas free of items stored in cardboard boxes				
Break area free of cloth covered couches and chairs				
Custodians are trained in the IPM process				
IPM records (including pest logs, monitoring trap data, pest management actions, etc.) are on file				

If pests are present in the area, write what kind here _____

Notes:

Boiler Rooms and Fan Rooms	Yes	No	Not Sure	N/A
Free of unauthorized pesticides				
Room is free of standing water				
Room is cleaned regularly				
Room is free of trash and food				
Room is free of storage, especially in cardboard boxes				
Floor drains are clean				
Plumbing is free of leaks and condensation				
Cracks or holes in floors and walls are sealed properly				
Outside air intakes are properly screened & free of trash				

If pests are present in the area, write what kind here _____

Notes:

Teachers Lounge	Yes	No	Not Sure	N/A
Room is free of cloth couches and chairs				
It's clean behind and under microwave				
It's clean under and behind vending machines				
It's clean inside, under, and behind the refrigerator				
All counters clean and free of food bits and such				
Floor at every corner is clean and without signs of pests				
Under sink is kept clean				
Cupboards clean and any food is in sealed containers				
Free of unauthorized pesticides				
Pest monitors (sticky traps) are present and dated				
Pest log is posted				

If pests are present in the area, write what kind here _____

Notes:

Classrooms or Offices	Room #	Yes	No	Not Sure	N/A
Free of unauthorized pesticides					
Free of clutter					
Indoor plants healthy and free of pests					
Desks, closets, and cubbies clean and free of food, clutter					
All food items are stored in sealed plastic containers					
Animal or bird cages are clean in and around the area					
Any pet food is stored in sealed plastic containers					
Sinks are free of dripping or standing water					
Gaps or holes under sinks or counters have been sealed					
Holes or gaps to the outside are sealed					
Outside windows and doors close tight and have no gaps					
Window screens (if any) are in good repair					
Nothing (except short-term) is stored in cardboard boxes					

If pests are present in the area, write what kind here _____

Notes:

Classrooms or Offices	Room #	Yes	No	Not Sure	N/A
Free of unauthorized pesticides					
Free of clutter					
Indoor plants healthy and free of pests					
Desks, closets, and cubbies clean and free of food, clutter					
All food items are stored in sealed plastic containers					
Animal or bird cages are clean in and around the area					
Any pet food is stored in sealed plastic containers					
Sinks are free of dripping or standing water					
Gaps or holes under sinks or counters have been sealed					
Holes or gaps to the outside are sealed					
Outside windows and doors close tight and have no gaps					
Window screens (if any) are in good repair					
Nothing (except short-term) is stored in cardboard boxes					

If pests are present in the area, write what kind here _____

Notes:

Classrooms or Offices	Room #	Yes	No	Not Sure	N/A
Free of unauthorized pesticides					
Free of clutter					
Indoor plants healthy and free of pests					
Desks, closets, and cubbies clean and free of food, clutter					
All food items are stored in sealed plastic containers					
Animal or bird cages are clean in and around the area					
Any pet food is stored in sealed plastic containers					
Sinks are free of dripping or standing water					
Gaps or holes under sinks or counters have been sealed					
Holes or gaps to the outside are sealed					
Outside windows and doors close tight and have no gaps					
Window screens (if any) are in good repair					
Nothing (except short-term) is stored in cardboard boxes					

If pests are present in the area, write what kind here _____

Notes:

Other Room:	Yes	No	Not Sure	N/A
Free of unauthorized pesticides				
Room is free of standing water				
Room is free of trash and food				
Room is free of storage, especially in cardboard boxes				
Any food items are stored in sealed plastic containers				
Free of clutter				
Cracks or holes in floors and walls are sealed properly				
Outside windows and doors close tight and have no gaps				
Window screens (if any) are in good repair				

If pests are present in the area, write what kind here _____

Notes:

G. Pesticide Application Plan

School/District Site: _____

Address: _____

Date of planned application: _____ Day of week: _____
(Weekend or during vacation is best)

Which pesticide(s) will be used? _____
(Choose for safety and effectiveness. Attach MSDS if available.)

Location on Site/Size of area(s) to be treated:

Who will do the pest control? (Circle one) District Staff Contractor

Name(s) _____

License #(s) _____

Firm (if applicable) _____

For interior treatment:

Does the building have active ventilation that can be left on after the application? YES / NO

If not, who is responsible for opening windows at least six hours before staff/students reenter?

For all applications:

Who will post the building or treated grounds with: (1) date of application; (2) pesticide used; and (3) when the area can be used again? _____

Will pesticides be kept on school grounds? Where? _____
(Read label carefully!) Keep pesticides locked up and away from occupied areas.

Approved by Integrated Pest Management Coordinator: _____ Date _____

Facilities Site Supervisor: _____, informed _____

Facilities Grounds Supervisor: _____, informed _____

H. Pesticide Application Notification Form

Pesticides will only be used when other forms of control have failed and the targeted pest have become a health or safety concern.

Location: _____

Address: _____

Site area of pesticide application: _____

A pesticide application is scheduled for:

DATE _____ TIME _____

Pesticide Common Name: _____

Pesticide Trade Name: _____

Type of Pesticide Product: _____

EPA Registration Number: _____

Expected Area of the pesticide application: _____

Expected date of application: _____

Reason for Application:

Pesticide Application Reviewed and Approved by:

Integrated Pest Management Coordinator:

Date

I. Pesticide Application Posting Sign

WARNING

PESTICIDE-TREATED AREA

A pesticide application is scheduled for/was performed on:

SITE: _____

AREA OF APPLICATION: _____

DATE: _____ TIME: _____

Expected / Actual reentry time: _____

Pesticide Common Name: _____

Pesticide Trade Name: _____

Type of Pesticide Product: _____

EPA Registration Number: _____

For further information regarding this notice please contact:

**Medford School District
Facilities Supervisor at 541-842-3900**

J. Pesticide Application Record

School: _____ Date of Application ____ / ____ / ____

PESTICIDE APPLICATION RECORD

Name	Phone	
License No.	Certificate No.	
Address		
City	State	Zip Code

Pesticide Product Used

Product (Brand) Name	EPA Registration No
Product type (granular, liquid, etc.)	

Attach following documents

Copies of all required notices, including dates the notices were given

Pesticide Label MSDS

Date and time for placement and removal of warning signs	Placement:	Removal:
--	------------	----------

Application Information

Time began	Time ended		
Temp	Wind Speed & Direction		
Amount of Product Applied			
Total Product Volume or Weight	Total Area of Application(s) (acres, feet, etc.)		
Product Concentration (amount per area; note units)			
Location(s) of application			
Type of Application			
Backpack <input type="checkbox"/>	Bait <input type="checkbox"/>	Boom Sprayer <input type="checkbox"/>	Crack/Crevice <input type="checkbox"/>
Other (describe)			
Did the application prove effective? Explain:			

K. Template for Annual IPM Report

Medford School District 549C

Date: _____

Report completed by IPM Plan Coordinator
Report submitted to the Medford School Board and the OSU School IPM Program Coordinator

Notes:
Prevention and management steps taken that proved to be ineffective and led to
The decision to make a pesticide application will be copied and pasted or incorporated into
the annual report of pesticide applications.

Short Written Summary of Overall Pest Management for the Year:

DATA FROM INDIVIDUAL SCHOOLS

Name of School _____

Pests, pest-conducive conditions, actions taken, Costs (taken from pest logs):

Number of Pest Sightings Reported:

- Small ants _____
- Bats _____
- Cockroaches _____
- Spiders _____
- Yellow Jackets _____
- Other _____

Number and Type of Pest Conducive Conditions:

- Standing water in Kitchen _____
- Window screens missing or torn _____
- Gap under external door _____
- Other _____

Number of Actions Taken:

- Sanitation – Cleaned up Area _____
- Reduced Clutter _____
- Set rodent traps _____
- Sealed up hole or crack _____
- Fixed screen _____
- Installed external door sweep _____
- Pesticide Application _____

Breakdown of prevention and management steps taken that proved to be ineffective and led to the decision to make a pesticide application:

Pest Problem and Date(s) _____

Prevention and Management Steps and Date(s):

Why Prevention and Management Steps Ineffective:

Pesticide Applied and Date: _____

Costs (from Pest Logs):

- Sticky traps
- Mouse traps
- Rat traps
- Pest Management Professional
- Pesticides

Total:

Costs (from Grounds Records):

- Propane Fuel for flame weeders
- Mole Traps
- Pest Management Professional
- Pesticides

School/Site Total IPM Costs:

Appendix 4

Hiring an Outside Contractor

To control pest problems, the Medford School District uses both pest control services and trained school maintenance employees. Each approach has advantages and disadvantages therefore the IPM Coordinator will decide which one best suits the school district's resources and needs.

A. Pest Control by In-House Personnel

Advantages

1. Compared to contracted pest control services, school pest management personnel may find it easier to communicate and develop a rapport with students, teachers, staff and other school employees. Cooperation with all individuals in the school is needed for the program to succeed.
2. When a school employee performs pest control services, schools may find it efficient to incorporate some pest control activities with other maintenance activities performed by certified in-house employees, as long as the employee is a certified pest control operator.
3. Because in-house personnel are always around the schools, they are more likely to identify pest problems before they become too serious.
4. When in-house personnel perform pest control, there is no need to develop a bid invitation and therefore the potential difficulty of choosing a pest control firm based on reliability rather than simply on lowest bid.
5. Maintenance or buildings and grounds supervisors have greater control over personnel selection and performance, and subsequently the quality of pest control services.

Disadvantages

1. There is need to find safe storage sites for pesticides and pest control equipment. The potential liability of the district in regard to pesticide use is probably higher in an in-house program.
2. If a re-entry time interval is needed which is greater than that listed on the label, overtime expenses could be incurred.
3. Certifying an employee to apply pesticides in a school will require time and a charge for the certification exam. In addition, all pesticide applicators will need to maintain ongoing certification by attending continuing education events.

B. Contracted Pest Control Services

Advantages

1. Professional pest control personnel usually have a broader range of experience, ongoing training, and greater familiarity with the full range of treatment techniques and potentially expensive equipment available to safely and effectively control pests. By contracting with

an outside pest control company, the School district eliminates or reduces the need to train and maintain pesticide applicator certification for employees, although schools are encouraged to have certified applicators who can better evaluate the quality of the work performed by the contractor.

2. Using contracted services can reduce potential liability of the school system with regard to the use and storage of pesticides. The need for locating a special storage site for pesticides is eliminated.
3. There are times when pest control activities must be performed after-hours or on weekends to meet reentry interval requirements. By hiring a contractor the school district avoids the need for overtime expenses.
4. Contracted pest control services can provide school administrators with the flexibility of using specialized and professional labor on an "as-needed" basis, as opposed to investing in the development of in-house capabilities that may not be used on a continuous basis.

Disadvantages

1. Communication between contracted individuals and school employees may not be as easily developed as in an in-house program.
2. School districts must develop a bid invitation for contracted services and choose a pest control firm based on IPM expertise and reliability rather than simply on lowest bid.

C. Bid Specifications – Important Things to Remember

What to Look for When Choosing and Evaluating an IPM Contractor

- Is the contractor prevention-oriented or reactive-oriented?
- Is the contractor knowledgeable about the damage caused by each type of pest?
- Does the contractor inspect for pest-conducive conditions and monitor population levels at least monthly?
- Does the contractor use a flashlight during inspections?
- Does the contractor use monitoring traps for insects?
- Are the traps checked and changed according to IPM Plan schedule?
- Does the contractor explain ways to prevent further pest outbreaks?

Importance of Pest Management Bid Specifications

Thorough, stringent bid specifications help reduce the problem of unrealistically low bids by firms that are unable or unwilling to provide the quality of work your school district should expect. The election of a pest control company should not be based solely or primarily on lowest bid. Just as with other important purchases/contracts, the quality of the expected service is extremely important.

Essential Items in IPM Bid Specifications

Some elements for IPM bid specifications are listed below:

- **On-site inspections:** Prospective bidders should conduct a thorough on-site inspection before submitting a bid. This allows potential bidders to view firsthand the facilities and pest problems, so bidders can make a realistic estimate of service needed and the time required for these services.
- **IPM Plan:** The bid should spell out exactly which sections of the district's IPM Plan will be carried out by the contractor, and how these will be coordinated and communicated with school staff.
- **Minimum service times:** The minimum amount of time that a pest control technician should take per scheduled visit can be defined by the school district in the bid. Bidders should understand that minimum service times are an expectation of the contract, and any failure of the contractor to meet these minimum service times should be grounds for cancellation of the contract by the school district.
- **Monitoring tools:** The contractor should use appropriate monitoring tools (flashlight, sticky insect monitoring traps, etc.) and procedures mentioned in the IPM Plan on a regular basis to find pest infestations and assess the need for corrective action.
- **Approved Pesticides:** Only products from the district's list of approved pesticides shall be used. Districts should receive from the bidder copies of labels and Material Safety Data sheets (MSDS) for all pesticides to be used on the school district property.
- **Reduced-risk formulations and methods:** The use of baits, bait stations, and crack and-crevice or void treatments are the only approved treatments indoors. Aerosol, broadcast, pot, and baseboard treatments are prohibited except when a pest emergency as defined in the district's IPM Plan is declared. All applications must follow the requirements and protocols outlined in the Plan.