SECTION 1

Introduction to California School IPM

1.1 What is Integrated Pest Management (IPM)?

Integrated pest management (IPM) is an approach to pest control that uses regular monitoring and recordkeeping to determine if and when treatments are needed. It employs a combination of strategies and practices to keep pest numbers low enough to prevent unacceptable annoyance or damage. IPM does not eliminate the use of chemical pesticides, but instead uses them only when needed. There are many definitions of IPM; the Healthy Schools Act (Food and Agricultural Code section 13181) defines IPM as:

> "...a pest management strategy that focuses on long-term prevention or suppression of pest problems through a combination of techniques such as monitoring for pest presence and establishing treatment threshold levels, using non-chemical practices to make the habitat less conducive to pest development, improving sanitation, and employing mechanical and physical controls. Pesticides that pose the least possible hazard and are effective in a manner that minimizes risks to people, property and the environment, are used only after careful monitoring indicates that they are needed according to pre-established guidelines and treatment thresholds."

At its most basic, IPM is a common-sense pest management approach that requires pest management action only when necessary and with the least-hazardous method. Many pest management methods, such as biological, cultural, physical, educational, and chemical methods, can be used in a least-hazardous IPM program. Educational methods are used to enhance pest prevention, and to build support for the IPM program. Chemical controls are used only when needed, and in the least-hazardous formulation that is effective against the pest.

Pest prevention begins with correct identification of the pest and knowledge of its needs and entry points. Available food, water, hiding places, and entry points must be eliminated for long-term suppression of a pest. Use of least-hazardous IPM has been shown to dramatically reduce the use of chemical pesticides, while providing better, longer-lasting control of pests.

Box 1-1: What is a pesticide?

A pesticide is any substance intended to control, destroy, repel, or attract a pest. Some common pesticide types include herbicides (for control of weeds and other plants), insecticides (for control of insects), disinfectants and sanitizers (to control disease-causing microorganisms on inanimate objects), and rodenticides (for control of rats, mice and other rodents).

Box 1-2: Principles of IPM

1. Perform thorough in-field or on-site assessments of each pest problem.
2. Establish scouting or inspection procedures to monitor pest population levels and severity of the pest problem.
3. Use appropriate control action thresholds, if available, for each (combination of) pest problem(s) to determine when corrective action(s) must be implemented.
4. Determine corrective action(s) when a control action threshold is reached. Use the following objectives in the selection of specific reduced-risk practices: least disruptive of natural controls, least hazardous to human health, least toxic to non-target organisms, least damaging to the environment, most likely to produce a permanent reduction in the supportive environment for the target pest(s), and most cost-effective considering both short- and long-term objectives.
5. Establish and maintain an accurate record-keeping system to catalog monitoring information and document management procedures.
6. Evaluate the effectiveness of the IPM program and make adjustments as needed.

1.2 Why implement an IPM program?

IPM is an accepted method of pest management in schools (Stauffer et al., 1998; Grant and Woodsen, 2001). Using least-hazardous IPM techniques can save time, money, and energy, as well as decrease the use of pesticides. In a 2007 California Department of Pesticide Regulation (DPR) survey of California school districts, 57% of the respondents stated that IPM reduced or had no impact on cost (Cowles, et. al, 2008). IPM practitioners prevent pest problems by eliminating the conditions that allow pests to flourish, detecting pests early before the population grows, and by establishing records so that outbreaks can be predicted. Other school concerns, such as sanitation, maintenance, and energy usage can be addressed with proper IPM practices.

Using fewer pesticides in an IPM approach addresses the growing concern for the health and safety of school children and other building occupants. Many parents, community organizations, and advocacy groups have become more aware, and more cautious, of pesticide use around children. A desire to know that schools are using pesticides safely and judiciously has been expressed to legislators all over the United States and as a result, laws concerning pesticide use in schools are in place in several states including California.

1.3 What is DPR's role in California school IPM?

In 1993, DPR began a pilot program to work with interested school districts to provide them information about IPM practices and assist them in developing an IPM program. DPR also conducted an extensive survey of school districts in 1996 to gain information about their IPM policies and practices (Simmons et al., 1996). Governor Davis felt that IPM in schools was important enough to add a school IPM program to DPR's budget in July 2000, as part of his Children's Health Initiative. Governor Davis later signed Assembly Bill 2260 (the Healthy Schools Act of 2000, Education Code sections 17608–17613 and Food and Agricultural Code sections 13180–13188) into law on September 25, 2000. This law, authored by Assembly Member Kevin Shelley, put into code DPR's existing voluntary school

IPM program and added some new requirements regarding pesticides, such as notification, posting, and recordkeeping for schools, and enhanced pesticide use reporting. The law was subsequently amended to prohibit the use of certain pesticides (Assembly Bill 405, Chapter 566, Statutes of 2005) and include private child day care facilities (Assembly Bill 2865, Chapter 865, Statutes of 2006). In response to AB 2865, DPR established a Child Care IPM program to specifically focus on outreach and education to child day care facility providers. This guidebook addressess IPM in the school district setting. A guidebook addressing IPM in the child care setting is available from the University of California at San Francisco's California Childcare Health Program http://www.ucsfchildcarehealth.org/. The Healthy Schools Act makes IPM the preferred pest management method in California schools. Most provisions of the law took effect January 1, 2001.

Through its school IPM program, DPR is committed to facilitating voluntary establishment of IPM policies and programs in schools throughout California, while assisting school districts with implementation of the new Education Code requirements. DPR also works with other boards and departments of the California Environmental Protection Agency and with the California Department of Education to tie IPM into related areas such as school gardens and environmental education.

1.3.1 DPR's School IPM Advisory Group

In 2000, DPR created a School IPM Advisory Group, consisting of representatives from 31 key school organizations and other interested stakeholders. This group meets to advise DPR about School IPM program elements. The advisory group's recommendations are helpful in ensuring that the program achieves its goals. See the DPR School IPM Web site at www.cdpr.ca.gov/schoolipm for the current list of School IPM Advisory Group members.

1.3.2 DPR's School IPM Web Site

DPR has established an IPM in Schools Web site at www.cdpr.ca.gov/schoolipm as a source of information on school IPM. The site includes home pages customized for parents/teachers, school administrators, maintenance and operations staff, and pest management contractors. Resources available include summaries of the Healthy Schools Act, frequently asked questions, new regulations on school pesticide use reporting, an exhaustive listing of pest prevention techniques, sample notification letters to parents about expected pesticide use, a worksheet to determine whether specific pesticide products are exempt from HSA requirements, and many other items. The Web site also allows school districts to compare the health and environmental impacts of management practices used for specific pests, and to identify the active ingredients associated with pesticide products schools may use. In addition, the Web site provides extensive links to other IPM resources.

1.3.3 School IPM Training

The Healthy Schools Act directs school districts to designate individuals (sometimes known as IPM coordinators) to carry out requirements of this law. DPR offers voluntary train-the-trainer workshops so that those who carry out the IPM program understand principles of IPM and can train their staff. These regional workshops showcase model IPM programs and provide hands-on experience.

1.3.4 Assisting Districts to Establish IPM Policies and Programs

Some school districts already are working with DPR to establish IPM programs. Currently, DPR is working with California Department of Education and has information on its Web site about model programs. In addition, DPR publicizes its school IPM program at meetings attended by maintenance and operations directors and their staff, school administrators, educators, and parents.

1.3.5 School IPM Guidebook

This guidebook is the result of an effort to tailor an existing school IPM guidebook to conditions in California. The Healthy Schools Act requires DPR to include specified IPM program elements. These program elements are covered in Part 1.

1.3.6 Evaluating IPM Adoption in Schools

Baseline and follow-up surveys help DPR to measure IPM adoption in schools, to evaluate what kind of outreach school districts need, and to see whether this outreach has been effective.

1.3.7 Pesticide Use Reporting Form

The Healthy Schools Act requires DPR to prepare a school pesticide use reporting form to be used by licensed pest control businesses when they apply any registered pesticides at a school. Licensed pest control businesses must submit the form to DPR at least annually. This form can be downloaded from the DPR School IPM Web site at www.cdpr.ca.gov/schoolipm or requested by emailing school-ipm@cdpr.ca.gov.

1.4 What are the requirements of the Healthy Schools Act for school districts?

All public school districts are required to comply with the Healthy Schools Act. These requirements include annual written notification with specified information on pesticides to all school staff and parents or guardians of students; the opportunity for interested staff and parents to register with the school district if they want to be notified of individual pesticide applications at the school before they occur; posted warning signs at each area of the school where pesticides will be applied; and records kept of all pesticide use at the school for four years. Sample letters and posting signs are included in **Appendix A** to help schools comply with these requirements.

1.4.1 Notification (Education Code section 17612(a))

Each school district is required to "annually provide to all staff and parents or guardians of pupils enrolled at a schoolsite a written notification of the name of all pesticide products expected to be applied at the school facility during the upcoming year." This notification must include the active ingredient(s) in each pesticide product and the Internet address used to access information on pesticides and pesticide use reduction strategies developed by DPR (pursuant to section 13184 of the Food and Agricultural Code). The notification may contain other information deemed necessary by the school district. Adding information about the target pest and the application method can be helpful to parents or staff unfamiliar with pests and pesticides, although this is not required by the Healthy Schools Act.

Recipients of the annual pesticide notice may register with the school district if they wish to receive notification of individual pesticide applications at the school facility. People who register for such notification must be notified of individual pesticide applications at least

72 hours before the application. This notice shall include the product name, the active ingredient or ingredients in the product, and the intended date of application. If a pesticide product is not included in the annual notification but is later intended for use at the school site, the school district must provide written notification of its proposed use at least 72 hours before application.

These notification requirements are intended to be inexpensive for school districts. Annual notification to parents and guardians may be included as part of any other written communication provided to individual parents or guardians. Registrants can be notified by U.S. mail, e-mail, or telephone. Notice through first-class mail is not required. If districts contract for monthly or periodic pest management services, people on the registry may be notified of each pesticide application by the contractor, if this is agreed to as part of the contract.

The notification procedures described above are not required for pest control measures taken during an emergency condition, but the school district shall make every effort to provide the required notification for an application of a pesticide under emergency conditions.

1.4.2 Posting (Education Code section 17612(d))

School districts are required to post a warning sign in each area of a school site where pesticides will be applied. The sign must prominently display the term "Warning/Pesticide Treated Area," and will include "the product name, manufacturer's name, the United States Environmental Protection Agency's product registration number, intended date and areas of application, and reason for the pesticide application."

The warning sign must be visible to everyone entering the treated area and must be posted 24 hours prior to the application and remain posted until 72 hours after the application. One option is to silk screen the text onto metal signs with blanks for the product name, manufacturer's name, and other information. Specifics of each application can then be filled in with a grease pencil.

1.4.3 Exemptions to Notification and Posting Requirements

The requirements for notification and posting change in a pest control emergency. See section 4.2 of this guidebook, under "Declaring an Emergency Under the Healthy Schools Act," for more details. "Emergency conditions" are defined in the law as "circumstances in which the school district designee deems that the immediate use of a pesticide is necessary to protect the health and safety of pupils, staff and other persons, or the school site." (Education Code section 17608[c]) In an emergency, staff, parents, and guardians need not be notified 72 hours in advance; however, every effort must be made to provide the notification. The warning sign must be posted immediately upon an emergency application and remain posted until 72 hours after the application. (Education Code section 17612.2(c)).

Pesticides used in an emergency should pose the least possible hazard to people, property, and the environment, and be used only after the emergency has been documented (including type of problem, associated risks, and pest management alternatives considered but not used). Pesticide products selected for use must be registered with DPR to control the pest and be effective for the intended purpose.

The Education Code (section 17610.5) notification and posting requirements described above do not apply to "a pesticide product deployed in the form of a self-contained bait or trap, to gel or paste deployed as a crack and crevice treatment, to any pesticide exempted from regulation by the United States Environmental Protection Agency pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Sec. 25 (b)), or to antimicrobial pesticides, including sanitizers and disinfectants." (For more information on exempt pesticides, see DPR's School IPM Web site at www.cdpr.ca.gov/schoolipm or **Appendix B**.)

The notification and posting requirements do not apply to schools operated by the Division of Juvenile Justice. The Healthy Schools Act however does require that "the school administrator of a school operated by the Division of Juvenile Justice shall notify the chief medical officer of that facility at least 72 hours prior to application of pesticides. The chief medical officer shall take any steps necessary to protect the health of pupils in that facility." (Education Code section 17612.2 (e)). See **Appendix C** and **Appendix D** for more details.

The notification and posting requirements described above do not apply to activities by participants in the state program of agricultural vocational education. School farms are regulated by another set of posting and notification requirements (California Code of Regulations 6618). The notification and posting requirements do not apply to agencies that have a cooperative agreement with the Department of Public Health (Education Code section 17613).

1.4.4 Other Requirements for Schools

In addition to the activities outlined above, the law adds certain requirements to the Education Code (sections 17608–17613) to be implemented by all California schools:

Each school shall maintain records of all pesticide use at the school for four years and make the records available to the public upon request. Records can be computerized but paper copies kept in a file provide easy access. Records can simply be a copy of the posted warning sign with the amount of the pesticide used noted on the copy.

Each school district shall designate an individual (who may be the IPM coordinator) to carry out the requirements of the Healthy Schools Act, outlined above.

In addition, AB 405 prohibits the use of certain pesticides at schools because they are registered for use in the State of California either: (1) conditionally, (2) as an interim registration, or (3) under an experimental use permit (EUP), and contain either a new active ingredient or are intended for a new use.

All pesticide products that DPR has canceled, suspended, or required phaseout of use are also prohibited. The list of pesticide products prohibited under AB 405 is available at http://apps.cdpr.ca.gov/schoolipm/school_ipm_law/prohibited_prods.pdf. To assist school districts, DPR has posted on its Web site samples of the annual notification and the register, and a template of the warning sign. These documents can be downloaded at www.cdpr.ca.gov/schoolipm. These forms are included in **Appendix A**.

1.5 What are the Healthy Schools Act requirements for licensed pest control businesses?

This law (Food and Agricultural Code section 13186) requires that:

Licensed pest control businesses shall report pesticide applications at schools annually (no later than January 3rd of each year) to the Director of DPR beginning with applications made on or after January 1, 2002. A downloadable copy of the Pesticide Use Reporting form for School Sites can be found in the laws and regulations section at www.cdpr.ca.gov/schoolipm or email school-ipm@cdpr.ca.gov.

SECTION 2

Adopting an IPM Program

One of the characteristics of an IPM approach that makes it so effective is that the basic decision-making process is the same for any pest problem in any location. The strategies and practices may change, but the steps taken to decide when action is needed, and which methods are appropriate, are the same each time. Thus, the pest manager does not need to memorize reams of pest control "recipes" for specific pests. Instead, it is an understanding of the components of an IPM program that must be mastered.

2.1 How to Develop an IPM Program

There are key components to the development of an IPM program. The adoption of an IPM policy by school administration is the most important, followed by educating key decision-makers about the need for the program and identifying the roles and responsibilities of the various members of the school community. IPM operations involve designing and implementing IPM programs for specific pests; training the pest management, custodial, grounds maintenance, and teaching staff in IPM methods; and institutionalizing the IPM program.

BOX 2-1: Components of an IPM program

Technical components include:

- Pest monitoring.
- Pest identification.
- Determining injury and action levels that trigger treatments.
- Timing treatments to the best advantage.
- Spot-treating the pest (in order to minimize human and other non-target organism exposure to pesticides).
- Selecting the least-disruptive practices.

Administrative components include:

- Adopting an IPM policy.
- Establishing a recordkeeping system.
- Evaluating the effectiveness of treatments to fine-tune future actions.
- Educating all people involved with the pest problem and with efforts for resolution.

Each of these components is discussed in detail in later sections of this manual.

2.1.1 Adopting an IPM Policy

The first step towards implementation of an IPM program is the adoption of an IPM policy by the school board. See section 2.2 on "Developing an IPM Policy Statement for School Pest Management." A model school IPM policy and some California school IPM policies are provided in **Appendix E.**

2.1.2 Educating Key Decision-Makers

The key to a successful program is education of the school board, superintendent, business operations manager, principals, PTA officers, and other decision-makers about benefits from adopting an IPM approach.

Box 2-2: Identifying Pest Management Roles*

In successful school IPM programs, students, staff, parents, pest managers, and decision-makers all have important roles. These functions and responsibilities are identified below.

Students and Staff—The Occupants

Students and staff play major roles in keeping the school clean. Sanitation should not be viewed as only the custodian's job. If students and staff learn the connection between food, garbage and pests such as cockroaches, ants, flies, and rodents, they are more likely to take sanitation measures seriously and comply with them.

The Pest Manager/IPM Coordinator

The pest manager (often called the IPM coordinator) is the person who observes and evaluates the site (or directs others to do so) and decides what needs to be done to achieve the pest management objectives. This person is often the school site designee who is responsible for complying with the requirements of the Healthy Schools Act. The pest manager designs the IPM program and keeps accurate records of the amount and location of all treatments.

Decision-Makers

Generally, people who authorize the IPM program and control the funding for the pest management program are people involved in the school administration, such as a superintendent or assistant superintendent of schools. However, a person indirectly involved with the site may become a pest management decision-maker, e.g., the Health Department inspector. On other occasions, the purchasing agent or contracting officer for a school system or district may be a major decision-maker for a school site. Decision-makers also determine if the pest manager is performing at an acceptable level and if the pest management objectives are being met. Decision-makers must also provide the necessary level of financial commitment for any IPM program to succeed.

*Adapted from U.S. EPA, 1993

2.1.3 Identifying Pest Management Roles and Responsibilities

It is critical to have the support of representatives from all segments of the school community and that they be involved from the beginning in setting up the IPM program. This includes school board members, administrators and their staff, teachers, students, parents, custodians, food service workers, ground maintenance personnel, school nurses, and pest control professionals. When the respective pest management roles of those involved directly or indirectly with pests in the school system are identified and agreed upon, and when these people communicate well with each other, an effective IPM program can progress. A discussion of pest management roles and responsibilities is provided in **Box 2-2**.

2.2 Developing an IPM Policy Statement for School Pest Management

Schools need a clear policy statement to secure agreement about how pest control will be performed. The policy statement should include a statement of pest management goals, a set of roles and responsibilities for occupants, pest management personnel and key decision makers, and a set of pest management guidelines.

Districts develop and adopt written policies on many topics, including pest management, and make them available to all interested persons. Policies serve as direction for the operation and successful and efficient functioning of the district's schools. The Board policies provide direction to the district. Policies include the general goals and acceptable procedures for the school district. District policies are framed in terms of state laws and regulations and other

Box 2-3: Tips for Starting an IPM Program

The following suggestions can help overcome barriers and smooth the transition to IPM implementation.

- Require staff training in IPM. When writing the IPM policy document, include a requirement for the continuing education of pest management personnel. Ensure that budgetary allocations are made to assist them in obtaining the information, skills, and equipment they need to carry out the policy.
- Start small. Begin IPM implementation in one location (e.g., a kitchen in a single school or a section of lawn at a single school) and include short-term objectives. For example, when dealing with a number of pest problems, identify one of the pests likely to respond quickly to an IPM approach, such as cockroaches, so a short-term objective can be realized. Test the IPM practices and fine-tune them. When the program is working successfully in one area, or against one pest, expand the program further.
- Develop a list of resources. Know where information is available when needed, and know when to seek outside help. County Cooperative Extension personnel, teaching staff in the biology or entomology departments of a nearby university, staff at the local zoo, and even the high school biology teacher can help identify pests and their natural enemies. Ask these people if they know of experts in the particular pest problem. Gradually compile a list of people to call for advice. **Appendix G** can be the beginning of a resource list.
- Always post the telephone number for the local poison control center in a prominent place.
- Build a library for pest management personnel, staff, and students to use. Cooperative Extension publications are usually free or inexpensive and can be good sources of information on pest biology. Even though these publications do not always recommend the least-hazardous approach, they are still useful. The recommended reading section of this manual, **Appendix H**, lists many useful books.
- Don't change everything at once. To the degree possible, retain communication and accountability procedures already in use. Tailor new recordkeeping and reporting forms to fit existing agency formats.
- Recycle existing equipment to uses consistent with IPM methods rather than immediately eliminating the equipment.
- Share the process. Involve members of the student body and staff, especially pest management personnel, in the day-to-day IPM program process as early as possible so they will understand and support the program during the sometimes-difficult transition period.
- Emphasize communication and plan for future training. During the IPM transition period, keep all personnel informed about what is planned, what is currently happening, the expected outcome, and what will happen next. Prepare written records and visual aids that will remain in the school when persons associated with development of the IPM program are no longer there.
- Publicize the program. Develop good rapport with district public relations personnel and with the local news media. For interviews and photo sessions, include pest managers, custodians, and landscape maintenance personnel as well as principals, school board members, and the superintendent.
- Involve the community. Form an IPM advisory committee (see section 2.4 for more information) composed of interested parents, school staff, community organizations, health specialists, and pest control professionals. They can help make IPM implementation a budgetary priority in the district, and can donate or locate resources that may not otherwise be available to the school.

*Adapted from Flint et al., 1991

regulatory agencies within state and federal levels of government.

The district also develops written administrative regulations and procedures, when such are required, to carry out the provisions of policies adopted by the board.

The California School Boards Association (CSBA) (http://www.csba.org) develops and provides sample policies and administrative regulations for its members, which include most of the school districts in the state. Contact CSBA to see the CSBA Sample Board Policy Business and Noninstructional Operations Environmental Safety (BP 3514(a)) and CSBA Sample Administrative Regulation Business and Noninstructional Operations Integrated Pest Management (AR 3514.2(a)), which include provisions and procedures that fulfill the requirements of the Healthy Schools Act.

See **Appendix E** for a model policy and examples of school board policies and administrative regulations from several Californian school districts.

2.3 IPM Operations

The operation of an IPM program involves designing IPM programs for specific sites and pests, delivering IPM services, and evaluating program costs. Fully developed, multi-tactic IPM programs are generally implemented in three stages, although components of each stage often overlap.

Monitoring and pest action thresholds should take the place of routine pesticide applications, and preliminary pest management objectives should be developed.

Box 2-3 outlines tips for getting programs started. The initial IPM program focuses primarily on moving away from routine use of pesticides by instituting a pest monitoring program to collect data and establish pest treatment (action) thresholds based on pest population levels (see sections 3 and 4 in part 1). A pilot program can be initiated at one school site, so new skills can be gained and techniques fine-tuned before the program is expanded throughout the system. Pesticides may remain the primary control agents used during this stage, but applications are made only when pest numbers reach action levels. Spot treatments rather than area-wide applications are stressed, nonvolatile baits and dusts are substituted for vaporizing sprays, and less hazardous soaps, oils, and microbial materials replace compounds that are more hazardous. At the same time, a planning process is established to set pest management objectives, identify the fundamental causes of pest problems in the school system, and assess methods to address these causes with primarily non-chemical solutions.

Pest management plans are formalized as a program becomes more mature. A concerted effort to maximize pest proofing, non-chemical pest suppression and education should be made as well as incorporating physical, mechanical, biological, and educational strategies and practices into the pest management program. Most pests found in school buildings can be attributed to faulty building design, lack of structural repairs, accumulation of clutter and paper, poor food handling and poor waste management practices. To achieve permanent solutions to pest problems, pest management staff must devote time to educating building maintenance and custodial staff, food handlers, and teachers and students about their role in attracting or sustaining pests, and enlisting their participation in solving the problems.

A similar process is needed to solve outdoor pest problems. For example, pest managers need cooperation from physical education and coaching staff to reduce stress on athletic turf that leads to weed problems. Landscape maintenance staff need encouragement to locate pest-resistant plant materials, increase diversity in the plantings to attract natural enemies of pests, and experiment with non-chemical pest control methods. Assistance from playground supervisors is needed to ensure that food debris and other wastes are placed inside waste receptacles where pests such as rats and yellow jackets cannot gain access to them.

The primary activities during this stage include developing site-specific pest management plans and educating all participants about their roles and responsibilities in helping to implement the IPM plans.

2.3.1 Developing Site-Specific Pest Management Plans

Written plans help move school pest control from a reactive system to a prevention-oriented system. Annual plans enable pest managers to prioritize use of resources, justify planned expenditures, provide accountability to IPM policies, and coordinate with other components of the school system. These plans emphasize repairing buildings, changing waste management procedures to deny food, water, and shelter to indoor pests, and modifying plant materials and landscape maintenance practices to relieve plant stress and improve plant health.

Costs of these repairs and changes may fall within ongoing operating expenses in existing budgets, or may require a one-time expenditure. In the long-term, however, these activities will reduce overall pest control costs as well as other maintenance and operating budget expenses.

2.3.2 Educating Participants

Food service and custodial staff, clerical and administrative staff, teaching staff, and students must be educated about their role in reducing pest presence and the necessity of a cooperative effort to control a pest.

Everyone must understand the basic concepts of IPM, who to contact with questions or problems, and their role in the program. Specific instructions should be provided on what to do and what not to do.

Teachers and other staff should be notified that applying pesticides (except those pesticides exempt from Healthy School Act requirements in **Appendix B**, such as baits) on school sites falls under the Healthy Schools Act and must meet all posting, notification and record-keeping requirements. They should be provided with clear instructions on how and to whom to report a pest problem, rather than attempting to control the pest themselves. One option is to provide teachers and others with "pest alert" cards on which they can write the date, location, and pest problem. The card can be returned to the teacher with a notation of what was (or will be) done about the problem and what, if any, assistance is requested of the teacher and students (e.g., better sanitation in the classroom).

If information on IPM can be woven into the current curriculum, students and teachers will better understand their roles and responsibilities in the program, but more than this, students will carry these concepts into their adult lives. The following ideas are just a few of the ways that this information can be included in

the school curriculum:

- Involve science classes in identifying pests and beneficial insects, and in researching IPM strategies.
- Involve art classes and English classes in developing simple fact sheets and other educational materials on various school pests. Use information from the individual pest management sections in this manual.
- Involve vocational classes in making site plans of the school to use for monitoring, site inspections for structural defects that may exacerbate pest problems, and suggestions for structural modifications to eliminate the problems.
- Involve journalism classes in reporting on the new IPM program.
- Use some of the innovative curricula available that emphasize IPM (see **Appendix F** for a list).

A mature IPM program may become institutionalized. This includes developing ongoing incentives and reward systems for achieving IPM objectives, establishing an IPM library of educational materials and staff training programs, and writing operations manuals that describe IPM policies and procedures to be followed by pest management personnel.

2.3.3 Develop Incentives and Rewards

Involve staff in establishing benchmark objectives (e.g., 20% pesticide reduction the first year, testing of boric acid in wall voids in place of broadcast spraying for cockroaches, raising of mowing height on turf to shade out weeds).

Reward staff for innovations and for achieving objectives (e.g., a letter of commendation, recognition at a staff awards picnic, article in local news media, travel authorization to an out-of-town IPM conference.).

Provide IPM educational materials and staff training programs.

IPM programs are information-intensive rather than treatment-intensive. This necessitates motivating pest control staff to try new approaches and broaden their professional skills.

Build an IPM library of literature and training videos, and provide time for staff to attend training seminars or take courses in pest identification.

2.3.4 Prepare an IPM Operations Manual

Written policies and procedures are needed to ensure clarity about responsibilities, authorized activities, permitted materials, and other program elements. A manual serves as an accountability mechanism, and helps ensure program continuity despite personnel changes. A loose-leaf binder that allows for addition or deletion of materials over the years is a convenient format. In addition to official policies and procurement practices, the manual should specify the following:

- Pest management objectives.
- The overall IPM process for managing each pest.
- Biological and ecological information on the pest and its natural enemies.
- The monitoring system for each pest (and natural enemies when appropriate).
- Injury levels (i.e., damage by pests) and action thresholds for pests.
- The method of recordkeeping system to be used (e.g., paper or electronic).

- How to interpret field data.
- How to obtain, use, and maintain equipment and supplies required to carry out monitoring and treatment activities.
- The range of treatment practices authorized for use against the pest and how to employ them.
- A list of pesticides authorized for use in the district and the Material Safety Data Sheet (MSDS) for each pesticide.
- Safety procedures and resources for emergencies.
- How to evaluate treatment effectiveness.

2.3.5 Building Support for the IPM Program

Once an IPM policy has been adopted by a school board, implementation is usually the responsibility of the IPM coordinator, who will instruct the in-house pest control staff or outside contractors (see section 2.7 on contracting for pest management services and **Appendix I** for sample IPM contract specifications).

Change never comes easily, and a number of predictable obstacles may exist within a school system—both psychological and institutional—to be overcome when initiating IPM programs. At the same time, even if the public has been involved with development of a policy, there are likely to be occasional complaints and controversies, especially as pests, pest control practices, and public concerns change.

For more information on how to develop a program and how to overcome barriers to adoption, read the UC IPM Publication 12 "Establishing Integrated Pest Management Policies and Programs: A Guide for Public Agencies" (see **Appendix J**).

2.4 Community-Based School District Advisory Committee

Many school districts have established an IPM advisory committee to assist with developing and implementing the district's pest management policy. This committee can be very useful in making suggestions, doing research, and bringing in new information, but it need not have authority to make policy. It is helpful if the committee also has an independent pest management expert (preferably one trained in IPM). This group can be a valuable resource for tracking and evaluating the progress of the IPM program in meeting the district-wide pest management goals. Involving diverse representatives of the community in policy development is a good way to draw together vast support for the policy and program later. Periodic reevaluation and advice of the committee on implementation will be very helpful to ensure that the district's IPM goals and objectives are achieved while providing the best support possible for constituent groups within the district. The committee can help make IPM implementation a budgetary priority in the district, and can donate or locate resources that may not otherwise be available to the district.

Ideally the advisory committee should include concerned parents, school administrators, faculty, staff, pest control operators, maintenance and operations staff, other professionals with pest management experience, physicians with toxicological expertise, environmental organizations, health advocates, interested organizations, and other members of the community.

The committee should meet at least once each year. Regularly scheduled IPM committee

meetings are necessary to monitor and evaluate progress, correct inefficient procedures that hinder meeting the stated goals of the school IPM policy statement, and educate concerned individuals involved with the program.

2.5 Community-Based Standard for Notification and Posting

More stringent standards for notification and posting than those required by the Healthy Schools Act can be recommended by stakeholders such as the community-based advisory committee, the IPM coordinator, interested parents, or the School Board. The law states that each area of the schoolsite where pesticides will be applied must be posted. It does not, for instance, specify how many signs are required or exactly where those signs should be placed. The law also does not describe exactly how parents are to be notified of pesticide applications. The stakeholders mentioned above may develop and recommend more detailed procedures to the School Board regarding posting or notification of pesticide applications.

2.6 Selecting and Training an IPM Coordinator

2.6.1 Healthy Schools Act Responsibilities of the IPM Coordinator

Under the Healthy Schools Act of 2000, Education Code section 17609(d), each school district is required to appoint a "school designee" who is responsible for carrying out the requirements of the Healthy Schools Act at the schools within the district. These duties include notification, posting, and recordkeeping. See section 1.4 for the requirements of the Healthy Schools Act. If the school district decides to implement an IPM program, the school designee may be known as the IPM coordinator. Often the director of maintenance and operations is chosen as the designee or IPM coordinator. For districts where the IPM coordinator is not experienced in least-hazardous IPM, a professional IPM consultant may be hired to assist in implementing a least-hazardous IPM program.

2.6.2 Other Responsibilities of the IPM Coordinator Within an IPM Program

The IPM coordinator will acquire a number of responsibilities, some of which are not directly related to pesticide applications. The school district must ensure that the IPM coordinator is trained in least-hazardous IPM concepts and methods, as defined by the Healthy Schools Act. The IPM coordinator's duties may include some or all of the following:

- Serving as a primary contact for pest control matters and coordinating all pest control decisions for the school district.
- Leading the development and implementation of an IPM policy and program.
- Scheduling and facilitating pest management advisory committee meetings.
- Monitoring pest problems or areas where pest problems may occur (see section 3).
- Recording monitoring data.
- Setting pest management action levels.
- Recording all pest sightings by school staff and students.
- Facilitating communication about pest management among all personnel levels in the district.
- Having school pests accurately identified

(this can be accomplished with the aid of the County Department of Agriculture, University of California Cooperative Extension, and the entomology or botany departments of local universities or community colleges, see also **Appendix K**, How to Collect and Preserve Specimens for Identification).

- Devising IPM plans for school pests.
- Making decisions about appropriate pest management actions.
- Recording all pesticide use and other pest management actions.
- Evaluating the effectiveness of pest management procedures and revising IPM plans accordingly.
- Ensuring the completion of work orders for structural repairs and housekeeping and sanitation measures intended to reduce or prevent pest problems.
- Training staff in IPM practices and researching staff training opportunities.
- Coordinating with principals and district administration to carry out the education and IPM training provisions of the district's IPM policy.
- Coordinating the collection and dissemination of current information on pest management and pesticides or pest-related health and safety issues to staff and faculty.
- Overseeing pest management contractors.
- Informing contractors of the district's IPM policy and pest management procedures.
- Assuring that all of the contractor's recommendations on maintenance and sanitation are carried out where feasible.
- Ensuring that pest management implications are considered when planning new construction or site modifications.
- Meeting with the press and/or community groups about pest management issues.

An individual selected to be a school IPM coordinator must be knowledgeable in many areas. The school district should ensure that the IPM coordinator is trained in IPM concepts and methods. The IPM coordinator must be conversant in the following:

- The nature and benefits of IPM.
- IPM policy implementation.
- Components critical for success of an IPM program.
- Recordkeeping, notification, posting requirements pursuant to the Healthy Schools Act.
- Pest control measures including prevention, and mechanical, cultural, biological, and chemical controls.
- Pest identification and reporting.
- Monitoring and inspection for pest problems.
- Program evaluation and quality control.
- Communication and interaction with the school community.
- Communication with mass media, the community, and parents.
- Community outreach and interaction.
- Liability issues in pest management and the operation of schools.
- Bids and contracts.
- Pesticide Safety Information Series leaflets, published by DPR.

2.7 IPM Contract Performance Specifications

Integrated pest management conducted by professionals should lead to a safe school free from significant pest problems and potentially harmful pesticide residues. Hiring a professional service to conduct pest management relieves the school district from the responsibility of having trained staff, storing potentially harmful chemicals, and continually maintaining a set of complex records. However, hiring a professional service does not exclude the importance of communication, follow through, and making sure that the contracting process achieves the desired result. This includes hiring a pest management company that is truly service-based and experienced in least-hazardous integrated pest management.

There are several categories of pest management services available for hire, primarily general pest control (indoors and around the perimeter of a structure), termite inspection and control, vertebrate pest control (birds and mammals such as skunks, ground squirrels, and feral dogs and cats), and weed management. There are also IPM consultants that schools can contract with to help develop an IPM plan, educate school personnel and evaluate pest control contractors. Clearly, not all companies offer the same range of service. More often than not, companies (usually the smaller companies) are not licensed in both agricultural and non-agricultural categories. Companies licensed by the structural pest control board usually do termite management, general pest management, and some vertebrate pest management (rats, mice, and some birds). Companies licensed by DPR generally do weed management and some vertebrate pest management. Finally, DPR licenses companies that do maintenance gardening and some insect and weed management. Note that when it comes to mold in buildings, different licenses are required. Consideration should be given to what is likely to be encountered in the task. For example, assume mold is the problem to be remedied, but in the process of reconstruction, dry rot is found. Does the process stop because the company is not licensed to handle dry rot or can the company handle both types of problems? The pest manager must determine whether the contractor is qualified to handle both problems.

2.7.1 In-House or Contracted Services?

IPM programs can be successfully implemented by "in-house" school employees or by contracting with a pest control company. A combination of in-house and contracted functions may also suit the needs and capabilities of the school system. Each approach has advantages and disadvantages. Individual school systems must decide what is best for them given their unique circumstances. Whether using in-house or contracted services, pest management personnel should be trained to:

- Understand the principles of IPM.
- Identify pests and associated problems or damage.
- Monitor infestation levels and keep records.
- Know cultural or alternative methods.
- Know recommended methods of judicious, least-hazardous pesticide application.
- Know the hazards of pesticides and the safety precautions to be taken.
- Know the pesticide label's precautionary statement(s) pertaining to exposure to humans or animals.

2.7.2 In-House Services

One of the most important tasks for an in-house program is training staff to function within an IPM framework. Universities and State Cooperative Extension Services have the expertise to meet most IPM training needs. The Department of Pesticide Regulation has a School IPM training program to help train school districts. This guidebook is the basis of this training program. A Web site is also available with information and links for School IPM. See www.cdpr.ca.gov/schoolipm.

2.7.3 Contracted Services

Pest control firms should work with the pest manager and the responsible school official to solve pest control problems. Use of an outside pest control firm may increase costs but eliminate the need to hire and train personnel and store pesticides. The contract should specify the use of least-hazardous IPM principles and practices in meeting pest management objectives.

When choosing a pest control firm, request references that attest to their knowledge and experience with least-hazardous IPM, as well as previous experience in schools. Contact the local Better Business Bureau for information about whether they have received complaints about a pest control company. State regulatory agencies can also provide information on pesticide applicator certification.

The pest management services contract should include IPM specifications. Contracts should be written to provide expected results. Pest management objectives specific to the site should be jointly developed, agreed upon, and written into the contract. Any special health concerns (such as those for old or young persons, for pets, or for individuals who are allergic) should be noted and reflected in the pesticides that can be used, or excluded from use.

If the school district is considering or has decided to use a contractor to implement an IPM program, the sample contracts in **Appendix I** can be used or adapted.

2.8 The IPM Decision-Making Process

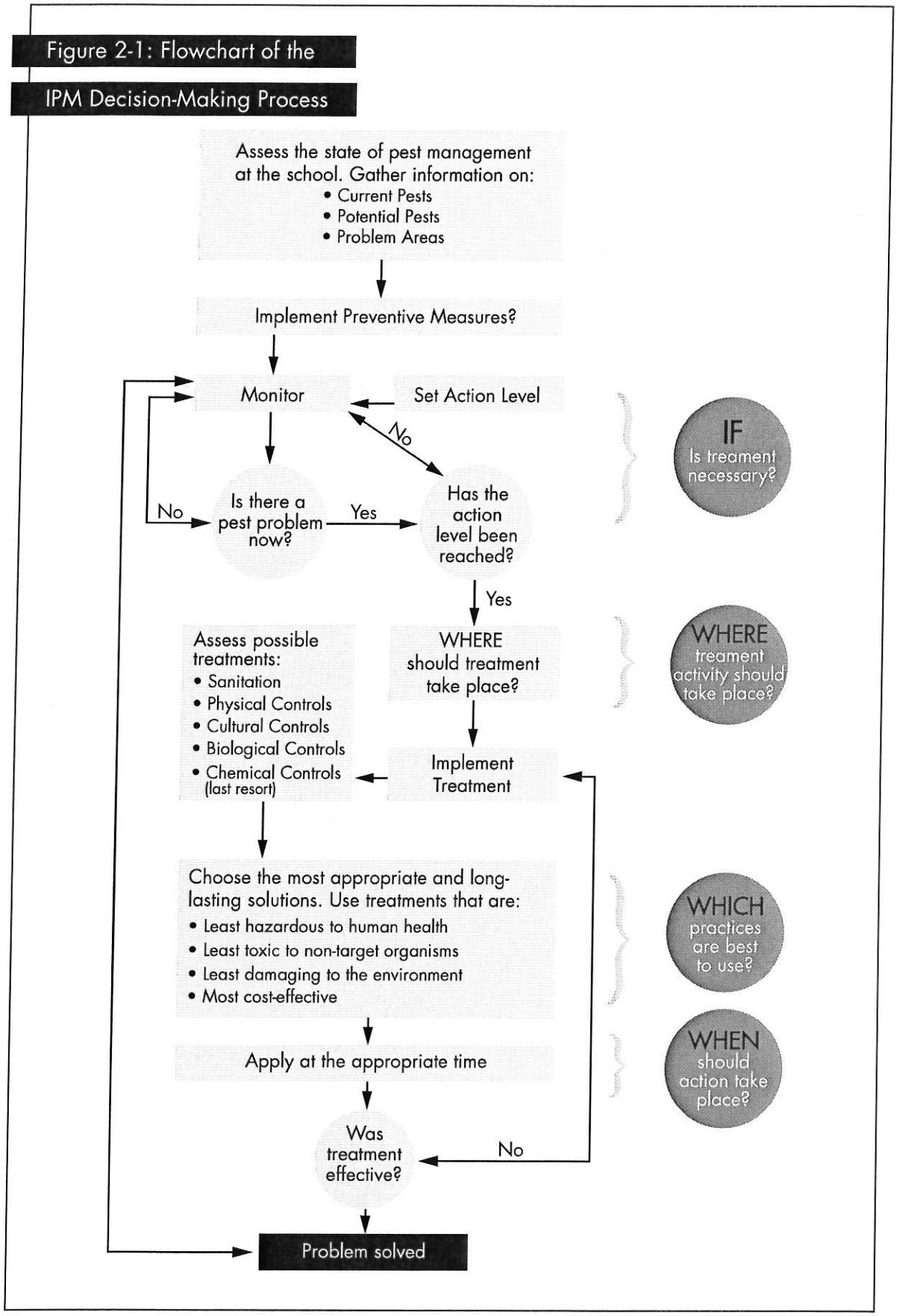
This decision-making process, basic to IPM, helps answer four key pest management questions: IF treatment action is necessary, WHERE treatment activity should take place, WHEN action should take place, and WHICH mix of treatment practices are the best to use. See **Figure 2-1** for a flowchart of the IPM decision-making process.

2.8.1 IF Treatment Action Is Necessary

Instead of taking action at the first sign of a potential pest, the IPM process begins with asking whether any actions at all are needed (see section 4 for a discussion of injury and action levels). Sometimes, even a fairly large population of pests can be tolerated without causing a problem. In other cases, the presence of a single pest organism is considered intolerable. In still other cases, what is considered a pest by one group in society may be considered innocuous by another.

Example: Occasionally when the weather is hot and dry, field cockroaches (Blattella vaga), small brown roaches that resemble the German cockroach, visit schools. Field cockroaches actually prefer to live outdoors in leaf litter and are only occasional indoor guests. By monitoring them with sticky traps, you'll see that their population is not increasing and they do not become established indoors.

Figure 2-1: Flowchart of the IPM Decision-Making Process



Example: Large rodent droppings and grease trails suggest there is a rat in a crawl space under the eaves. Even one rat can be a problem because it can gnaw on electric wires causing fires and leave fleas that can transmit pathogens to humans. Treatment action is usually required even if only one rat is suspected.

2.8.2 WHERE Treatment Activity Should Take Place

If it is decided that some treatment action is necessary, the IPM process encourages pest managers to look at the whole system for the best place to solve the problem. Treatment should take place where actions will have the greatest effect.

Example: When Argentine ants invade classrooms, it's tempting to douse them with an aerosol spray. Only a fraction of the worker ants are actually out foraging at any one time, and if these foragers are instantly killed, the pesticide doesn't poison nest mates and queens. It is more effective to eliminate indoor ant trails with soapy water and place self-contained baits outdoors. Ants will aggregate around the baits, so if you locate these indoors, you'll attract even more ants from outlying areas in the place where you don't want them.

2.8.3 WHEN Action Should Take Place

The timing of treatments is important. Often there is an optimal time in the life cycle of the plant or the pest to apply control measures. Conversely, there may be times when treatments actually increase pest problems. The human social system will also affect the timing of treatments. The IPM process encourages managers to discover the best timing for treatment actions (see section 5.2, "Timing Treatments") since long-term success of any treatment depends on timing.

Example of timing in the life cycle of a plant: Yellow starthistle, Centaurea solstitialis, is an annual weed that grows in disturbed areas. As with many weed species, mowing before the plants flower is much more effective than battling seed head-laden plants later in the season.

Example of timing in the life cycle of a pest insect: In the spring, yellowjacket queens are busy establishing nests. It's much more effective to trap these queens and the first flush of foraging workers then, rather than waiting until summer or fall when putting out traps will barely make a dent in the population.

Example of timing in the social system: When switching to IPM, it is essential to coordinate the IPM program plan with the overall budget process of the school district. For example, improving rodent and fly management may require modifications in food storage facilities or in the disposal of kitchen garbage. Substantial repair to windows or plumbing may be needed. Requesting funds for activities such as minor construction or new containers must be done at the appropriate time in the school district's budget development process.

2.8.4 WHICH Mix of Treatment Practices Are the Best to Use

There are three guiding principles to use when choosing treatments: conserve and enhance naturally occurring biological controls; use a multi-tactic approach; and view each pest problem in its larger context.

Conserve and Enhance Naturally Occurring Biological Controls

In a landscape setting, when we kill the natural enemies of pests, we inherit their work. In many cases, the combined action of all natural enemies present may result in substantial pest control. Even when they are not able to do the complete job, natural enemies are nonetheless providing some help in protecting school landscape plants from pest insects. The IPM program should be designed, when possible, to avoid damaging natural enemies.

(See "Biological Controls" in section 5.3 for more information).

Example: Many spider mite populations on various trees and shrubs are kept under control by naturally occurring predatory mites. In fact, the predators keep them under such good control we may never be aware of their presence until we spray a pesticide intended to kill more obvious pests, such as aphids. For a number of reasons, most pesticides are more harmful to the predatory mites then the pest mites. The pesticide kills almost all of the predators, the spider mites are only slightly affected, and now that they are free from their natural enemies, the pest mites quickly multiply and devastate the plant. By changing the practices for controlling the aphids, a spider mite problem can be avoided.

Use a Multi-Tactic Approach

Every source of pest mortality, no matter how small, is a valuable addition to the program. Biological systems are so complex, rarely will a single practice, such as the application of a pesticide, solve the problem for long. As many non-hazardous practices as needed should be combined to manage the pest problem.

Example: Controlling cockroaches requires direct practices such as applying boric acid dust to cracks, crevices, and wall voids; placing baits in areas inaccessible to students; using an insect-growth regulator and boric acid water washes in areas not in direct contact with food or people; and releasing parasitoids for certain roach species. But long-term cockroach control must also include habitat modification such as caulking or painting closed cracks and crevices; screening vents that may be used by cockroaches to travel between adjacent areas; eliminating water leaks and cracks around plumbing fixtures; and improving the storage of food supplies and organic wastes.

View Each Pest Problem in Its Larger Context

Each pest problem must be considered within the framework of the larger system in which it has arisen. Textbooks and manuals commonly treat pest problems one by one. However, in the real world setting of a school and the grounds around it, pest problems occur several at a time or in a sequence in which the management of one influences the others. In addition, pest problems are influenced by other human activities such as waste disposal and food handling indoors, and mowing, fertilizing, and irrigating outdoors, as well as the attitudes of the many people who work and study within the district. Using IPM means taking a whole system or ecosystem management approach to solving a pest problem.

A successful IPM program considers all of the components of an ecosystem. As biologists and ecologists use the term, an ecosystem is usually thought of as containing non-living (abiotic) and living (biotic) components. For instance, if one considers a school building as an ecosystem, the abiotic components of the building

would be the building itself and the equipment and furnishings within it. The biotic components would be the people, insects, spiders, and other creatures that live or work in the building.

It is essential to consider who is involved in an IPM program—the social/political components. In a school system, this category includes teachers, students, custodians, grounds maintenance staff, food handlers, clerical staff, health personnel, carpenters, plumbers, pest control companies, refuse collectors, and other outside service providers who might be contracted for specific work in or around the school. The school district administration and school board, school neighbors or adjacent landowners, associated public agencies or institutions, professional associations and community groups, and the public must be included. The political and legal constraints of society should also be taken into consideration.

The many components of the school ecosystem can be thought of as a series of systems, each having an impact on the other and all potentially impacted by a pest management program. To design and implement a successful IPM program, it is necessary, at least to some degree, to be aware of and obtain information from each of these components.

This raises the classic problem in systems management: where to draw the boundary of the system. If the boundaries are drawn too narrowly and include only the pest, something important may be missed, like the fact that people are leaving food out at night that feeds the pest. It is better to read, question, and observe as much as possible about the larger system in which the pest problem exists. Otherwise, there is a risk that the solution to the pest problem will be overlooked.

Example: A nuisance fly problem inside the school may prompt use of space sprays or pesticide-impregnated plastic strips. A less hazardous quick fix might be to purchase and install electric insect traps. A broader view could lead to the observation that some window screens need repair and could be improved by the addition of weather-stripping around the frames to exclude flies. A still-larger view might include the observation that the outdoor trash containers on the school grounds are inappropriately placed or not adequately cleaned after being emptied each week, thus attracting flies.

Changing these conditions will involve cooperation from the custodial and maintenance staff. Perhaps the outdoor trash receptacle needs to be moved a greater distance from the door. Perhaps more frequent removal and replacement of the outdoor trash receptacle may be desirable. This will undoubtedly have budgetary consequences and will involve negotiations outside immediate school personnel. Ultimately it may be discovered that the flies are part of a community-wide problem. Complaints from the school system to the local municipal government may help in changing area-wide waste management practices. At first it may seem that there is little that a few individuals can do to influence the process of change in the larger ecosystem; however, the individual schools and the school district can assume a leadership role in educating their community about safer and more lasting methods of pest management. This can be done indirectly by educating the student population, and directly through the participation of school personnel in community forums on pest management-related matters.

Please see section 5, "Selecting Least-Hazardous Pest Control Practices" for more detailed information on the IPM decision-making process.

2.9 IPM Program Evaluation

An IPM-oriented program views the need to regularly apply pesticides as an indication that the program isn't working efficiently, and seeks other solutions in order to reduce pesticide use. One of the most important components of an IPM program is evaluating whether the IPM policy is being implemented and that specific pest problems are being solved. Evaluation is rarely done in conventional pest control. Evaluation should occur after each treatment and may involve monitoring.

For purposes of overall evaluation, it is helpful to view the IPM program as composed of many simultaneously occurring, interacting systems or processes. These can be either technical or administrative in nature.

Technical aspects to consider include:

- Prevention of pest infestations.
- Pest monitoring.
- Recordkeeping.
- Decision-making regarding pest treatment activities.
- Delivery of pest treatments.
- Evaluation of treatments.

Administrative aspects to consider include:

- Collection and cataloging of reference materials on management of the pests.
- Education and training of school personnel in IPM.
- Communication to school personnel regarding IPM program plans and progress.
- Budgetary planning.

Each of these components should have, as part of the development of the initial program plan, some expressed objectives or criteria by which the component is judged successful or not. Nevertheless, in addition, it is important to determine the following:

- Were all the necessary components to the program actually developed?
- Were they integrated successfully?
- Were the right people involved in the integration of the components into a whole program?

2.9.1 Questions to Ask After Treatment Action

At the end of the year, use monitoring data to answer the questions below and make any necessary adjustments in methods for the next season. After two or three seasons of fine-tuning, including modifying the habitat, redesigning parts of the school facility, or changing behavioral practices to discourage pests, it is reasonable to expect problems to have lessened considerably, and in some cases disappear. After reaching this point, periodic monitoring rather than active management may be all that is needed. See also **Appendix L**, *Pest Management Assessment Tool.*

- Was the pest population adequately suppressed below the set injury level?
- Was the pest population suppressed in a timely manner?
- Was the planned procedure used? If not, what was different?

- What damage was produced? What damage was tolerable?
- In the landscape, were natural enemies affected by treatments? How?
- If natural enemies were killed by a pest management treatment, will this cause a problem elsewhere or at a later period?
- Were there any other side effects from the IPM treatments? Were there any unanticipated consequences (good or bad)?
- If ineffective, should the treatments be repeated or should another kind of treatment be evaluated?
- Is the plant or structure worth maintaining? Can the site be changed to eliminate or reduce the problem for the same costs of treatment?
- What were the total costs of the treatment—costs of suppression vs. cost of damage, costs of unexpected consequences, costs of risks from pesticides or benefits from reduction of pesticides.

2.9.2 Assessing Cost-Effectiveness

Cost-effectiveness is crucial to continuation of an IPM program. According to U.S. EPA (U.S. EPA, 1993), "preliminary indications from IPM programs in school systems suggest that long-term costs of IPM may be less than a conventional pest control program." Data from IPM programs in school systems and park districts across the country show that IPM can cost no more than conventional spray programs, and often costs considerably less. A DPR survey conducted in 2002 received responses from more than 400 school districts in California (Geiger and Tootelian, 2002). Some examples of cost-effectiveness are discussed below.

Two schools in Santa Barbara County, Peabody Charter School and Vista de Las Cruces, were demonstration sites in the Pesticides Reduction in Schools Project. The project was funded by U.S. EPA and the Santa Barbara Foundation, and managed by the Community Environmental Council and Organic Consulting Services (Boise and Feeney, 1998). They found that an IPM-based system was more effective in controlling pests, while saving money.

Staff time devoted to controlling ants at Peabody Charter School was reduced from eight hours per week to two and a half hours per week, a reduction of 70 percent. Long-term control of cockroaches required an initial investment of 14 hours to caulk cracks and crevices and to apply boric acid. These treatments for cockroaches did not have to be repeated and pest populations decreased. The cost of these treatments was $705.

Vista de Las Cruces School contracted for their pest control services prior to the IPM program. The monthly perimeter sprays to control indoor pests cost $1,740 per year. The school chose to cancel the contract and assign all pest management duties to the head custodian. The expenditures for pest management were reduced to $270 for a two-year period and the head custodian did not spend any additional time on pest management. Weeds are another pest management challenge at Vista de Las Cruces School. An application of mulch is expected to control weeds for three to five years and to cost $2,170. The previous cost of chemical herbicides was $934 per year, not including labor.

The Ventura Unified School District has reduced its reliance on herbicides by 95 percent while staying within historical spending limits for weed control materials. The money saved on herbicides was used to purchase mulch and a steam weeder with money left over for a contingency fund.

The Ann Arbor School District in Michigan found that hiring a contractor to monitor 35 schools on a regular basis, and treat only if action levels were reached, resulted in only a single treatment (a crack-and-crevice application of boric acid for cockroaches) during the course of a full year. In the first IPM year, this program cost the same as the previous conventional program. Costs were expected to drop the second year when in-house staff were scheduled to assume monitoring responsibilities (Cooper, 1990). In the 1999-2000 school year, 9 percent of the total budget for the Ann Arbor School District was used for operations and maintenance (Ann Arbor Public School District Web site at http://aaps.k12.mi.us.

A conventional pest control program at the Monroe County School District in Indiana, a 19-school district cost $34,000 annually. After an IPM program was implemented, the cost dropped to $28,000 (Forbes, 1991). As of 1998, the district realized a 35 percent reduction in pest management costs ("Cost of IPM in Schools" at http://spcpweb.org/factsheets/schcost.pdf.

Whether an IPM program raises or lowers costs depends in part on the nature of the current housekeeping, maintenance, and pest management operations. The costs of implementing an IPM program can also depend on whether the pest management services are contracted out, performed in-house, or both.

Before 1985, Maryland's Montgomery County Public Schools had a conventional pesticide-based program. More than 5,000 applications of pesticides were made to school district facilities that year. Public concerns about potential hazards to students and school personnel led to development of an IPM program that emphasized prevention through sanitation and habitat modification, and less hazardous baits and dusts in place of conventional sprays. By 1988, annual pesticide applications had dropped to 600, and long-term control of pests had improved. According to William Forbes, pest management supervisor for the district, under conventional pest control in 1985, the district spent $513 per building per year. This covered two salaries, two vehicles, and materials for two employees who serviced 150 sites. Only crawling insects and rodents were managed by in-house staff. The IPM program serviced 200 school buildings (a 33 percent increase in the number of sites) for a cost of $575 per building per year, which covered three salaries, three vehicles and supplies. Contracting services, however at 11 of the sites cost an additional $2,400 per building per year under the conventional program. By 1988, under an IPM program, those same eleven sites were being managed by in-house staff at a cost of only $500 per site per year. In addition, no outside contracting was needed and the program covered virtually every structural pest, from pigeons to termites (Forbes, 1991). In 2002, operations and maintenance costs were $1.7 million out of a total budget of $1.4 billion (Montgomery County Public School District Web site).

During the start-up phase, there are usually costs associated with conversion to IPM. This is particularly true in schools that have not been well-maintained. Examples of these one-time expenses that may produce future budgetary savings include:

- Installing physical barriers such as air curtains over the outside entrances to kitchens to reduce flying insect problems. This is a one-time cost and results in fewer flying insect problems and a savings in years to come.
- Stepping up structural maintenance to correct such situations as leaky pipes. This effort reduces future maintenance problems, prevents pest problems, and saves money and energy in the long term.
- Training and/or certifying staff in IPM. The amount of information necessary to implement IPM is greater than that required for conventional pest control. As a consequence, training or certifying staff in IPM will probably increase costs.
- Re-landscaping the area adjacent to buildings to discourage pests.

Other expenses might include building repair and maintenance, new waste storage containers, screening, traps, and/or a turf aerator. These expenses are usually recouped within the first few years of the program, and benefits continue to accrue for years.

Whether such costs are budgeted as a pest control expense or distributed to the building maintenance budget or the landscaping account depends on the budgetary format of the school system. In the long term, training, repair and maintenance activities, and equipment purchases will reduce overall costs of the pest control operations, as well as other maintenance and operating budgets.

2.9.3 Efficient Procurement

Some non-pesticide products, such as traps, can be stocked to reduce purchases in future years, but few savings can be realized by purchasing pesticides in bulk. It is probably best to keep no more than a 60-day pesticide inventory to assure product freshness and to avoid limiting cash flow. Pest managers should be able to anticipate needs to fit a 60-day buying schedule.

Successful practice of IPM relies on accurate recordkeeping, which leads to procurement that is more efficient. As the IPM program progresses, predictable events and pest control needs will be identified. Close consultation with the pest management specialist is essential for good decisions on purchases within the budget.