

An Integrated Pest Management Tool for Evaluating Schools

Abstract

Having the ability to assess pest problems in schools is essential for a successful integrated pest management (IPM) program. However, such expertise can be costly and is not available to all school districts across the United States. The web-based IPM Calculator was developed to address this problem. By answering questions about the condition of a building and the behaviors of individuals who use it, any pest management professional or building manager can use the IPM Calculator to assess pest risk at a school campus and obtain IPM-based solutions to reduce that pest risk. This new tool is available online at <http://ipmcalculator.com>.

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Introduction

Integrated pest management (IPM) is a science-based decision-making process used to identify and reduce risks to human health and the environment from pests and pest management actions (U.S. Department of Agriculture, 2004). IPM as it applies to structural pest control emphasizes the combination of pest proofing, sanitation, and changes in human behavior as a supplement or alternative to more traditional, pesticide-based pest control programs.

In recent years, the U.S. Environmental Protection Agency and some states have promoted the use of IPM in public schools (Geiger & Tootelian, 2005; U.S. Environmental Protection Agency, 1993, 2002). Anticipated benefits of using IPM in schools to control pests include better pest control and reduced risks from pesticide exposure to children (Alarcon et al., 2005; Hernandez, Parron, & Alarcon, 2011; Kubista-Hovis & Lame, 2004; Williams, Linker, Waldvogel, Leidy, & Schal, 2005).

Adoption of IPM in public schools has been slow, though, often coming only after IPM practices are mandated at a state or local level (Hurley et al., 2014). Expert assessment of pest problems and customized recommendations for improvement have been shown to increase adoption of IPM in schools (Kubista-Hovis & Lame, 2004). However, such expertise is expensive and not universally available to the estimated 12,880 independent school districts across the United States (U.S. Census Bureau, 2012).

For this reason, we developed a web-based IPM Calculator that can be used by any pest management professional or building manager. The calculator is used to assess pest risk at a school campus and offers IPM-based solutions to reduce pest risk. It is available online at <http://ipmcalculator.com>.

Using the IPM Calculator

Users are asked to register before using the IPM Calculator. Registration enables the user to save individual school data, enter evaluation information for more than one school building, and make comparisons among school buildings.

After registering, users are prompted to answer questions regarding current pest activity, customary pest management practices, and the condition of various locations in and around the school building (cracks in walls, door sweep conditions, drainage, etc.). IPM Calculator users also are asked questions regarding sanitary practices in the school (frequency of clutter, cleaning intervals, garbage handling, etc.) as the activities of people in a school has been found to greatly affect the presence of pests (Gillett & Leppla, 2006). Questions are designed to be easy to answer by anyone familiar with the facility, and they focus on the following school sites:

- exterior garbage,
- landscape features,
- building envelope,
- kitchens/cafeterias,
- food storage,
- staff lounges/break rooms,
- office areas,
- classrooms, and
- utility areas.

See the appendix for specific questions asked by the IPM Calculator.

To assess pest risk, the calculator takes into account expected and observed pest pressure for 18 key pests and risks of infestation associated with those pests given the condition of 34 specific building features and maintenance practices.

IPM Calculator Outputs

After data for a school campus are entered and submitted, the calculator provides the user with two

scores: current pest risk and potential pest risk. *Current pest risk* is a risk estimate based on actual pest observations made during the building inspection. *Potential pest risk* is a risk estimate based on the likelihood of pest pressure for a school in the relevant region of the country. The current observed pest risk may be a more valid assessment for a campus when an inspection is done by a trained and experienced evaluator. The potential pest risk may be more realistic when the inspection is done by a less experienced evaluator. The overall current risk score provides a school with a standard academic grade (A to F) that is easily understood by decision makers.

In addition to a risk score, a chart illustrating the top pest risks for the campus is provided. Each pest risk score is based on the presence and importance to overall health and economic cost associated with the pest. For example, German cockroaches, rats, and mice, with their potential for spreading disease, pose a higher risk potential than, say, nonstinging ants.

Building features that contribute the most to overall pest risk also are presented in chart form. For example, for a school with a high actual risk for German cockroaches, kitchen sanitation and pest proofing likely will rank prominently in the list of building features needing attention. Users can use these recommendations to prioritize improvements in building maintenance and sanitation.

Efficacy of the IPM Calculator

To test how well the IPM Calculator performed, 43 individual school buildings in Alabama, California, Florida, Louisiana, Maine, and Texas were evaluated independently with the calculator and by Extension specialists. The results of the independent evaluations were compared, and adjustments were made to the weights for each question as needed. Final results showed that the IPM Calculator results were only 5 percentage points lower than Extension specialist results for the same school.

Summary and Conclusion

The IPM Calculator can be used both as a management tool and as an educational tool to explain IPM concepts. As a management tool, the calculator can provide decision makers with a relatively objective measurement of pest risk. By reinspecting a school and reusing the calculator over time, the calculator can show progress or lack of progress in improving pest control. It also can provide administrators with guidance as to which building feature improvements might have the greatest impact in reducing pest risk. By showing users that modifications to a school environment or changes in staff behavior rather than reliance on pesticides can reduce pest risk, the calculator also serves as an educational tool.

Tighter school budgets and limited numbers of personnel with IPM expertise are significant barriers to widespread adoption of IPM in U.S. public schools. By using the IPM Calculator, schools can perform their own assessments and better prioritize building needs that affect pest problems in schools. The IPM Calculator also can provide Extension agents and specialists with a new tool to assist schools in identifying pest problems and solutions.

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Appendix

School IPM Questions by Area

Exterior Garbage Areas
<ul style="list-style-type: none"> • Rate the general sanitation around your dumpsters for spillage and leaks. • Are dumpsters situated on solid concrete or asphalt pavement? • How well are your dumpster lids sealed against pest entry between uses? • What is the average distance (in feet) between the dumpsters and the buildings?

- How well are outdoor trash cans and receptacles sealed against pest entry between uses?

Landscape Areas

- Approximately what percentage of the building perimeter not easily inspected or is surrounded by landscape beds with shrubbery or vegetation (vines, weeds or other dense plant material) or other equipment or debris that conceals the ground, making inspection for ant nests, rodent burrows and other pest activity difficult?
- Approximately what percentage of the building foundation is hidden or obstructed by vegetation?
- What is the level of general sanitation around the building perimeter (trash placed in trash cans, litter free, grounds free of pallets, lumber or other construction debris or garbage)?
- How many trees are in direct contact with the building?
- Rate your campus for the presence of sites that are prone to hold standing water for more than three days after a rain.

Building Envelope Areas

- Approximately how many doors in your school have bottom gaps greater than ¼ inch?
- Approximately how many doors in your school have horizontal gaps at door bottoms greater than ½ inch?
- Rate the exterior windows for the purpose of keeping ants and other crawling/flying insects out (including condition of caulking and seals around windows and tightness and integrity of screening, where appropriate).
- Rate the exterior walls for their ability to exclude pests (include condition of caulking and sealing of plumbing and electrical service penetrations, as well as general holes and deterioration).
- How many exterior ventilation air intakes are NOT completely screened with at least ¼ inch hardware cloth (metal screen)?
- Rate the site grading as to how well it channels water away from building foundations.
- How many locations show evidence of gutter system failure to properly channel water away from building walls and foundation?
- How many roof locations are there with a known history, or other evidence, of leakage?

- How many locations around the roof edging show evidence of gaps of ½ inch or more?
- How many locations around roof and covered entrances and walkways show evidence of bird nests or nesting?
- How many locations on campus (building or walkways, tree areas) show evidence of roosting or accumulations of bird droppings?
- What percentage of doorways in your school receives direct illumination from outdoor lights at night?
- What percentage of lights in your school is shielded to prevent direct shining of light further than 40 feet from the light fixture?
- What percentage of lights that your school uses to illuminate the campus at night use sodium vapor bulbs (or similar low-UV-output bulbs) to reduce attraction to insects?

Kitchens/Cafeteria Areas

- Rate the condition of walls and doorways for freedom from holes, cracks and unsealed penetrations around plumbing, ventilation ducts, electrical service, etc. (plumbing escutcheon plates in place, holes and/or gaps around service penetrations sealed with concrete, foam, caulk or other appropriate sealants).
- Rate the condition of walls and doorways for dryness, cleanliness and sanitation (free from water leaks, mold, food, grease, and excessive clutter such as un-caulked bulletin boards, old posters, loose paper, etc.).
- Rate the condition of the floors and edging in the kitchen area with respect to drainage, cracking and breakage (free of cracks, broken tiles, standing water).
- Rate the condition of the floors and edging in the kitchen area with respect to cleanliness and sanitation (free from trash and garbage, mopped or swept daily in all areas, including under appliances).
- Rate the number and condition of floor drains in food preparation areas? (adequate number and situation of drains, appropriately screened, free from food and other debris, flushed and cleaned regularly, odor-free).
- Rate kitchen furniture, appliances and food preparation areas with respect to cleanliness and sanitation (clean and free of food and grease deposits).
- Rate kitchen for freedom from clutter, excess cardboard and other pest harborage.
- Rate how well surfaces and used utensils, trays, and dishes are cleaned, dried, and covered by

the end of the day.

- Rate how well cracks and crevices that could harbor pests are sealed in kitchen furniture/appliances (furniture joints and hollow legs sealed tightly).
- Rate how well cracks and crevices are sealed between walls and kitchen appliances/wall hangings and bulletin boards.
- Rate how well plumbing is free from leakage, splashing and condensation (drains and faucets free from leaks, pipes free from condensation, drainage lines empty into floor drains without splashing, easy access for inspection and repair).
- Are air curtains installed on exterior doors?
- Are insect light traps installed?
- Are external doors kept closed between use?
- Rate kitchen and cafeteria ceilings for freedom from broken and damaged tile, signs of pests (tiles complete and in-place, free from signs of moisture damage, free from excessive dirt, dust, rodent droppings and other pest signs).
- Rate garbage receptacle sanitation and handling procedures in kitchen and food service areas (garbage can liners in use, interior and exteriors of containers kept clean and pest free, trash and garbage removed nightly).
- Rate the food service area for cleanliness and sanitation (clean and free of food and grease deposits).
- Rate how well food service areas are kept free from clutter, excess cardboard and other pest harborage.
- Rate how well cracks and crevices that could harbor pests are sealed in food service and indoor eating area furniture/appliances (heating tables, buffet lines and cafeteria furniture with crevices and hollow legs sealed tightly).
- Rate how well vending machines in food service area (cafeteria and surrounding hallways) are kept free of leaks, trash and spillage underneath and food residues.

Food Storage Areas

- Rate the condition of walls and doorways for dryness, cleanliness and sanitation (free from deterioration/holes, water leaks, mildew, food, and spillage).

Rate ceilings for freedom from broken and damaged tile, signs of pests (tiles complete and in-place, free from signs of moisture damage, free from excessive dirt, dust, rodent droppings and other pest signs).

- Rate the appropriateness of design for sanitation and organization (adequate ventilation, adequate storage space, non-solid shelving made of non-porous metal or plastic, 6 inch minimum clearance under shelves, food and utensils covered nightly).
- Rate food storage area for clutter (at least 18 inches clearance between pallets and walls, regular rotation of staples and paper goods, free of excess cardboard).
- Rate the condition of the floors for cleanliness and sanitation (free from trash and garbage, mopped or swept daily in all areas, including under appliances).
- Rate the condition of floor drains in food storage areas (screened, free from food and other debris, flushed and cleaned regularly, odor-free).
- Are procedures in place to ensure that old stock is rotated out? Is no food kept that is older than 12 months?
- Are foods in long-term storage (> 3 days) stored in tightly sealed, pest-resistant containers?
- Are all foods being stored for short term (1-3 days) and all utensils/plates/serving containers tightly covered with foil or plastic nightly?

Staff Lounges/Break Rooms

- Rate the condition of the floors for cleanliness and sanitation (free from trash and garbage; vacuumed, mopped or swept daily in all areas).
- Rate lounge areas for general clutter and cleanliness (trash removed nightly, counters and tables cleaned, etc.).
- Rate the condition of appliances (dishwashers, refrigerators, microwave ovens, etc.) for cleanliness and sanitation.
- Rate how well vending machines are kept free of leaks, spillage and food residue.
- Rate plumbing for leakage and sealing around wall penetrations (escutcheon plates in place and/or gaps around plumbing sealed with concrete, foam, caulk or other appropriate sealants).
- Rate the condition of the floors for cleanliness and sanitation (free from trash and garbage; vacuumed, mopped or swept daily in all areas).

Office Areas

- Rate office area for general clutter and cleanliness (trash removed nightly, counters and tables cleaned, food in desks sealed overnight, etc.).

Classrooms

- Rate the condition of classroom floors for cleanliness and sanitation (free from trash and garbage; vacuumed, mopped or swept daily in all areas).
- Rate all classroom and teacher storage areas for general clutter and cleanliness (trash removed nightly, counters and tables cleaned daily, pet food sealed in pest-proof containers, supplies well organized and stored in sealed containers, etc., access to all corners of rooms and closets).
- Rate plumbing for leakage and sealing around wall penetrations (escutcheon plates in place and/or gaps around plumbing sealed with concrete, foam, caulk or other appropriate sealants).
- Rate the condition of walls and ceilings for holes, missing tiles, moisture damage, excessive dirt, dust, pest signs.

Utility Areas

- Rate the condition of the floors of bathrooms, locker rooms and storage areas for cleanliness and sanitation (free from trash and garbage; vacuumed, mopped or swept daily in all areas).
- Rate areas for organization and freedom from clutter (mops and buckets cleaned and stored off floor daily, free from excess clutter, athletic gear stored neatly, industrial chemicals and supplies stored and secured safely).
- Rate utility areas and bathrooms for general sanitation (tile and surfaces cleaned and free of stains, odors, signs of pests).
- Rate the condition of the floors and tile in bathrooms with respect to cracking and breakage (free of cracks, broken tiles, standing water).
- Rate plumbing for leakage and sealing around wall penetrations (escutcheon plates in place and/or gaps around plumbing sealed with concrete, foam, caulk or other appropriate sealants).
- Rate the number and condition of floor drains (adequate number and situation of drains, free from food and other debris, flushed and cleaned regularly, odor-free).

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