

# **PROVIDING DECISION MAKING ANALYTICAL TOOLS TO IPM MANAGERS THROUGH WEB BASED: ELECTRONIC PEST MONITORING, AND PESTICIDE USE REPORTING SYSTEM**

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**Abstract** Economically and environmentally sustainable pest management requires an integrated approach. Pesticides are one of many tools used in IPM. Majority of non-agriculture and structural pest management focuses on pesticide applications for right of way, turf and landscape, rangelands and indoors. Pesticides are initially distributed in the environment at application, with the intent of maximizing efficacy while minimizing off-site movement and adverse impacts on human and environmental health. A better understanding of initial distribution and redistribution via processes such as airborne loss, run-off and leaching is necessary to characterize both human occupational and non-occupational exposure, and assess risks to biota in surrounding ecosystems. Understanding the initial distribution in the environment at the landscape scale requires information on pesticide use practices. Timely spatial data such as the identity of pesticide, amount, target pest and site GIS can be enormously useful both in the protection of human and environmental health. Accurate information can help provide better risk assessments and illuminate pest management practices that are particularly problematic so they can be targeted for development of alternatives. In situations where more toxic chemicals must be used, the data will help managers to employ training and technologies specifically designed to protect applicators, workers, and the environment. It is also useful in making short and long-term policy and budgeting decisions related to IPM and best management practices. Santa Clara County's web based IPM-Pesticide Use Reporting system and Orkin's PowerTrak<sup>®</sup> discusses framework, user data entry process, provides analytical tools for IPM decision making processes, cost economics, worker safety, environmental data, compliance to signage posting and regulatory reports and public access to data for structural and non-agriculture pest management.

**Key Words** Integrated Pest Management, IPM decision making tools, IPM data

## **INTRODUCTION**

Urban Integrated pest management (UIPM) involves the safe prevention, reduction or elimination of unwanted organisms. It is a process that utilizes regular monitoring to determine if and when a treatment is needed. It employs physical, mechanical, cultural, chemical, biological, and educational programs to keep pest populations low enough to prevent intolerable damage or annoyance. Chemicals should not necessarily be the first choice for solving a pest problem.

Traditionally, pest control in urban environments consisted of the general application of one or more pesticides in and around structures and community. However, there has been a movement away from relying solely on pesticides to solve pest problems in response to public concerns over pesticide use, pesticide resistance, and the possibility that pesticide applications may contaminate the work environment and expose occupants to pesticide residues. It is important to recognize that pesticides (chemicals) regardless of rating as highly toxic or least toxic should not necessarily be the first choice for solving a pest problem.

IPM as used in the urban environment, and as subject to various environmental and sociological pressures, is still evolving. The key elements of UIPM are: 1) A decision to solve pest problem is based on determined need, not an approach of applying chemicals with a prophylactic approach. 2) It calls for multi-disciplinary approach in which all classes of pests and their relationships are jointly considered; and coordination of all available management techniques into a unified program seeking an optimal management policy. 3) It recognizes the need to address economic, ecological and social concerns. 4) It involves the human factor.

Pest control operators and facilities managers or owners face tough challenges in solving pest problems around public facilities, office complexes, hospitals, cafeterias, or other sensitive environments and urban landscapes that can create real or perceived risks. Because of the complexities of the human and structural factors, pest management in urban environments require a systems approach that is capable of collecting critical data and making it available in analytical form to urban IPM practitioners, so that informed decisions can be made, addressing the key elements.

In this non-research article, we have two main objectives. First, to discuss analytical limitations in existing urban pest management monitoring and pesticide use reporting systems; second, case study two (public and private sector) comprehensive IPM data collection and analytical software that has enabled IPM managers in making sound and sustainable pest management decisions in urban environment.

### **Limitations in Existing Urban Pest Management Monitoring and Pesticide Use Reporting Systems**

**Pesticide use data by location.** Urban Pesticide Use Reporting (PUR) systems in which the licensed pesticide applicator is legally bound to report the pesticide use to a governmental organization are established in very few countries. California's pesticide regulatory program is considered by many to be a model program, and its pesticide use reporting program is recognized as the most comprehensive in the world. The data is publicly available and serve a wide range of purpose, used for research, evaluation and observation so trends. There are still some major additional needs, especially for the reporting of non-agricultural uses and location specific use in structural pest management. The amount and type of pesticides used by group of applicators such as residents who apply pesticides to their own homes or landscapes, some maintenance gardeners, pet groomers/kennels, employees applying incidental treatments at commercial businesses and buildings, employees applying incidental treatments at institutional facilities is unreported and unknown. Even those who are legally bound to report pesticide use in structures and urban landscapes only required reporting total quantities of pesticide used per site. The information such as location identity within a site or facility or complex, advisory services on pest habitat manipulation (casually reported by pest control operators in their inspection reports) and what prompted a pest control operator to opt for using pesticide, critical component of decision making in process in urban IPM are not reported.

**Pest habitat manipulation.** This is a critical component of urban IPM programs. Resolving pest issues by pest habitat manipulation, often involves varying elements and complexities in implementation. In most cases, it is the approach which also provides the best long-term pest management. The data if available in analytical form, supported by cost-life cycle benefits, can help IPM Managers making sustainable alternative approaches to pesticides. However, without availability of data at landscape scale, it is very difficult to develop convincing argument on a cost-benefit model.

**Pest management environmental risks.** Risk is multi-dimensional, i.e, risk can be evaluated in terms of numerous end points, and on various scales of time and space. Some of the difficulties urban IPM managers' face are identification and integration of environmental RISK indicators, the bias against future impacts, our ability in measuring and assessing current and tangible impacts, and reality of data limitations, which constraints the development of assessment models for urban pest management. Pesticide environmental risk analysis tool (e.g. WIN-PST) that are available to agricultural pest control practitioners to evaluate the potential for pesticides to move with water and eroded soil/organic matter and affect on non-target organisms; are often not used by urban IPM managers when making recommendations. WIN-PST users can specify pesticides by product name or active ingredient. Long-term human and fish toxicity data and ratings are also included in WIN-PST. These toxicity ratings can be combined with the off-site movement potential ratings to provide an overall rating of the potential risks from pesticide movement below the root zone and past the edge of the field. This important tool has not been integrated or offered in any urban pest monitoring software.

## Approaches to Web Based: Electronic Pest Monitoring and Pesticide Use Reporting System (IPM-PURS)

The following case studies review two IPM-PURS systems, one used by a public agency and other by a private structural pest control service provider, which attempts to integrate various decision making tools in the urban integrated pest management system.

### Case Study: Public Agency

On May In June 2002, the new ordinance (IPM and Pesticide Use — Division B28), directed the Santa Clara County management to establish a pest management and pesticide use reporting system (IPM-PUR) to provide various user departments (managing facilities, landscapes, parks, roads & airports), policy makers, and the public a comprehensive, reliable, cost effective system for collecting and organizing information on structural and non-production agricultural pest management projects on County properties, with a goal of ensuring public health and safety, and protecting the County's water and environment. Constructing a multidisciplinary program requires the efforts of many groups and individuals. The County hired an "IPM Coordinator" to implement and oversee the IPM program. A technical advisory group (TAG) representing a diverse group of individuals, was also formed and required to meet at least four times per year to review the County's IPM program and provide comments to the County Management.

Santa Clara County took IPM adoption approach from an ecosystem management perspective, not just percentage pesticide use reduction. The baseline data on pest management practices prior to the implementation of IPM ordinance indicated a reactive strategy, often relied upon use of pesticide as and when a pest control service is called for. The weed or vegetation control in urban landscapes, roads, airports and parks included calendar based herbicide applications. In order to address pest control through reduced risk strategies, Countywide IPM administrative guidelines and procedures were developed as a working document, which includes: Administrative Guidelines for SCC IPM and Pesticide Use Ordinance; Preparation and Maintenance of Department IPM Plans; Maintenance of IPM Data and Documents; Selection of IPM Product and Service Providers (Contractors); Screening Criteria for Pesticides, Approved List of Pesticides, Pesticide Use Exemption and Approval Process, Review of New Pesticide Products; Pesticide Application Posting and Notification; Pest Management Activity and Pesticide Use Reporting System (IPM-PURS); IPM Training, Demonstration, Public Education and Outreach; Pest Management Field/Site Surveys; Quality Control and IPM Performance Management; Specific Use Guidelines: Protection of Riparian Corridor, Waterways and Buffer Zones, Roads Rights of Ways, Developed Landscapes, Lawns and Turf, Natural/Open Spaces, Pesticide Handling.

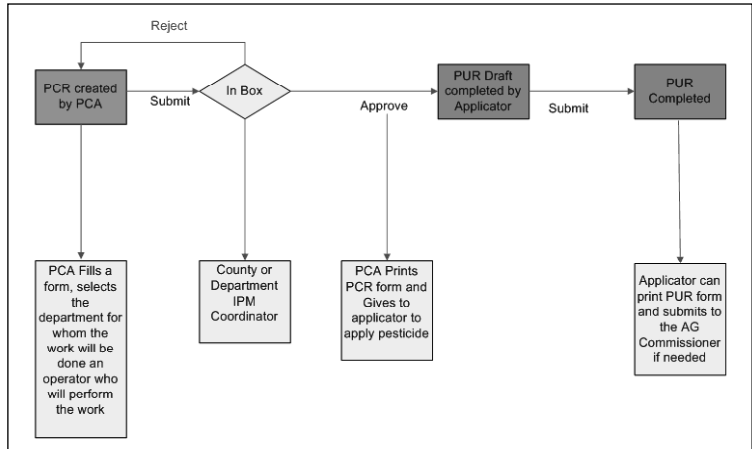
**IPM-PURS.** This is a web-based application accessible via an internet browser. It is a central data bank of pesticide use information for both Non-Production Agriculture and Structural Application categories to facilitate analytical reporting by County departments focusing on pesticide use reduction, as well as meeting all legal and administrative reporting requirements. The application captures information from creating a pest control recommendation until generating a report. It enables the departments to monitor pest control activity and pesticide use by each application, site, location within a site, purpose, associated cost thus allowing analytical and strategic shift from direct chemical intervention to a determined need model.

The system works based on user roles, responsibilities and organization. Role is an action or activity assigned to users to perform certain functions within the IPM-PURS. A single person can have multiple roles such as Pest Control Advisor, Pest Control Operator, Pest Control Applicator, Department IPM Coordinator, Pest Control Supervisor, and County IPM Coordinator. Organization is an entity to which a user role belongs. There are two types of organizations: 1) the department, a County agency who needs pest control work performed; 2) Operator organization, an operator conducts pest control survey, pesticide application if required on behalf of a County agency. The users can access the system through a password-protected secured environment. No one user can access "role" defined for the other user.

The system has a process flow (Fig. 1), enabling decision makers at each role and responsibility within the organization to review pest control activity from creating pest control recommendation (PCR) to Pesticide Use Report (PUR). The system has various checks, approval processes to ensure a pest control activity is an informed

decision involving all concerned, considering reduced risk options as first choice and taking appropriate precautions in case of pesticide application. The system is user friendly, has its own directories (Operator and Applicator, Site addresses, Site Maps, Coordinates, Pests, California Registered Pesticide database, California applicable commodity codes etc.). It has unit conversion calculator allowing users to convert all sizes and quantities (area, volumes) into reportable units. It has one-touch calculator to assist applicator in making area/volume/tank size calculations, should they decide to use pesticides. It is also linked to the external pesticide information database to allow users to review pesticide label/MSDS in real time. It also enables applicator to make calculations on pesticide use, pest control inspections and various other treatment methods.

**Figure 1.** The process flow, enabling decision makers within the organization to review pest control activity, from creating pest control recommendations (PCR) to a Pesticide Use Report (PUR).



The system also prompts pesticide applicator to enter proposed pesticide application time, posting requirements, applicator safety and environmental safety considerations. With few progressions of prompts in a systematic flow of process, it ensures that the pest control work order is complete, reviewed and verifiable prior to any action taken. It does not allow the work order to be printed until all required fields are filled accurately. Upon completion of the pest control activity, the process allows the pest control operator to complete the report. The effort to report (data entry) the pest control activity from point of origin, approval, and work order to completion varies widely; organized operators just need three to five minutes to fill out one record. This a significant saving of time compared to time required in hard copy data entries, creating summary reports and maintenance of documents etc. Moreover the data is retrievable at short commands for analytical purposes by various process owners (role) and organizations across multi-jurisdictional agency.

The system has the capability of generating a variety of reports such as Pest Control Recommendations (PCR), Notice of Intent to Apply Restricted Materials, Pesticide Use Report (PUR), Monthly Summary Pesticide Use Report (known as California State Report), and Business Reports such as pest management activity by category, pest within a category; pesticide applications by pest, by pesticide, by location and by departments; cost analysis by pest, by pesticide. In order to trace back potential data entry errors, the system upgrade is under consideration.

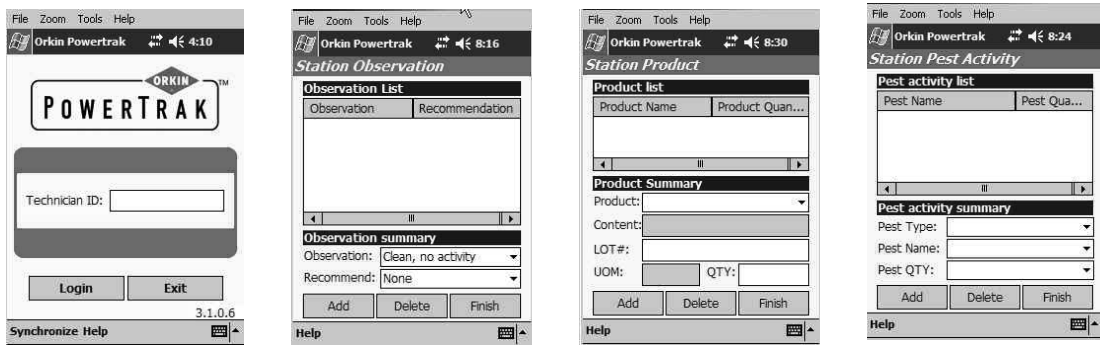
The IPM-PURS was developed in house. Initial cost of development was \$70,000 USD inclusive of installation and training for all user groups. Maintenance cost is approximately \$4000-\$6000 USD per year on as needed basis (at the rate of \$1,200 USD per user group: 6 user groups, representing 39 County departments). Each user group is responsible for making their own data entries using intranet for in-house staff. Contractors make data entries from their business offices using internet.

Implementation of IPM-PURS has enabled Santa Clara County’s IPM management to streamline the pest management reporting process, provided bird eye view of major pest and related issues faced by the county, eased the facilitation process to manage not only pests but also related sanitation, housekeeping and maintenance issues, allowed to focus of budgetary needs and grant facilitation. The system allows critical business analysis to focus on major pest issues, allocate IPM resources to relevant planning, execution and prioritize transitional budgets for short term and long term needs. Gradually, it is turning the pest control from "Reactive" to "Proactive". Large countywide pest problems now can be addressed through a strategic approach whereas small location specific problems can be resolved by removing conducive conditions.

PCO/Client partnership, a most required component of IPM is also improving. It's a learning curve for contractors/pest control operators - who have to make a change in their reporting processes from generic/crude method of reporting on a piece of paper or talking to customers to a documented, more precise and complete progression of IPM prompts from inspection to resolving pest issues.

**Case Study: Private Sector**

The delivery of integrated pest management is a process that utilizes several decision making tools to make a program sustainable. Orkin, Inc. has developed an in-house tool to electronically collect the various information in the IPM process and thus reporting in an almost real time manner the information to the facility or IPM managers responsible for making decisions whether to reduce the use of pesticide or to make necessary habitat modification. Orkin's PowerTrak system (Figure 2) not only has bidirectional capability with company's operating system but collects all relevant pest management data that can be either submitted as data to relevant customers or is used to generate various reports using the company's web reporting portal.



**Figure 2.** Screen images of Orkin's handheld system to collect IPM Data.

The following key information is collected by the Orkin's PowerTrak® system: Type of pest management service: regularly scheduled service, follow up, callback (complaint), or initial start; Pest Activity: type of pests, quantity of pests; Treatment Rendered: non-chemical, chemical; Pesticide usage information: type, amount/Volume; Observations and action plan (conducive conditions and remedial action plans): sanitation issues, housekeeping, and building maintenance issues, related action plan.

A facility is divided into various "Zones" based on customer specific needs. Then in each "Zone" "Stations" are located. The "Stations" include various pest management devices like traps, and bait stations, as well as a station "Area Inspection" in each "Zone" to capture observations/recommendations specific to that area. The flexibility of the system allows it to capture data either on various service intervals (daily, weekly, monthly, or seasonal) including ability to "Create Service" as and when required. Once the handheld devices are synchronized with the server the data is available to both Orkin's internal use and for customer. The customers can obtain their specific data via a secured website as and when desired.



**Figure 3-5.** Orkin's web reporting protocol: Welcome, Select Report, and Pesticide Usage Report screens.

Currently Orkin is using this data capture and reporting system for several customers as follows: Various multi-location food safety customers, including a supermarket chain of 900+ locations. These customers want to be proactive in identifying pest insurgence and or sanitation/building maintenance concerns. Five hundred plus customers representing food processors, pharmaceuticals, and other sensitive locations specifically needing “decision making” information due to the nature of business. Some of the key benefits of using this system are as follows: Collects data and that is made available in real time for being proactive to take appropriate decision in implementing an integrated pest management program. Through various reports, exception and detail, the proper action can be planned to eliminate inconsistency of service include time spent at each facility and inventory of pest control devices. Since this is a proprietary system developed by Orkin, Inc. a few screen images of the handheld unit and web reporting are presented in Figure 3-5. More details will be shared during the oral presentation.

## CONCLUSION

In order to implement a comprehensive IPM program in urban environment, additional information such as pest specific conducive conditions, timely spatial data such as the identity of pesticide, amount, target pest, site GIS and pesticide environmental risk analysis can be enormously useful both in the protection of human and environmental health. Through a detailed full reporting inclusive of pest habitat manipulation data, a large number of different trends can be observed including sanitation, housekeeping and facility maintenance.

Accurate information can help provide better risk assessments and illuminate pest management practices that are particularly problematic so they can be targeted for development of alternatives. In situations where more toxic chemicals must be used, the data will help urban IPM managers to employ training and technologies specifically designed to protect applicators, workers, and the environment. It is also useful in making short and long-term policy and budgeting decisions related to IPM and best management practices.

## REFERENCES

- Purdue University West Lafayette, IN. Integrated Pest Management — An In-Depth Look at IPM and Urban and Industrial Pest Management, Advance Level Urban and Industrial Pest Management Course, Purdue University.
- Pesticide User Reporting Introduction California Department of Pesticide Regulation : <http://www.cdpr.ca.gov/docs/pur/purovrw/purovr1.htm> (Feb, 25, 2008).
- Wilén, C.A., Nila L. Kreidich, Mary Louise Flint, Minghua Zhang. 2005.** Tracking Non-Residential Pesticide Use in Urban Areas of California, June 10, 2005: [http://www.up3project.org/documents/dpr\\_ucipm\\_non-residential\\_pesticide\\_use.pdf](http://www.up3project.org/documents/dpr_ucipm_non-residential_pesticide_use.pdf) (Feb. 25, 2008).
- Windows Pesticide Screening Tools (WIN-PST) — National Resource Conservation Service, United States Department of Agriculture - <http://www.wsi.nrcs.usda.gov/products/W2Q/pest/winpst.html> (Feb. 25, 2008)
- Santa Clara County IPM Program — <http://IPM.sccgov.org> (Feb. 25, 2008)
- Santa Clara County IPM and Pesticide Use Ordinance Division B28 - [http://www.sccgov.org/scc\\_ordinance/TOC074.HTM](http://www.sccgov.org/scc_ordinance/TOC074.HTM) (Feb. 25, 2008)