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## Putting 'Pest Prevention by Design' to the Test: San Francisco's Experiment with Public Housing

Chris Geiger, Ph.D.

San Francisco Department of the Environment

*Well done is better than well said.*

--Benjamin Franklin

There's a whole lot of caulking going on in San Francisco.

The San Francisco Mayor's Office of Housing and Community Development (MOHCD), together with the Department of the Environment and a long list of housing developers, has made pest prevention a cornerstone of its current rehabilitation of 3,500 public housing units. The effort is part of the Rental Assistance Demonstration (RAD) project, a nationwide program to preserve and improve housing properties. The rehabilitations have become a proving ground for the *Pest Prevention By Design Guidelines*, a free, peer-reviewed resource on pest-preventive building design elements that was created here three years ago.

"Proving ground" is an understatement; "trial by fire" might be more appropriate. The pest infestations in some San Francisco Public Housing Authority properties had reached jaw-dropping levels. Like many similar agencies nationwide, the Housing Authority here



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has been underfunded for many years, resulting in deferred maintenance and an accumulation of pest-friendly conditions. To make things worse, the original designs of some of the developments often featured poorly placed refuse bins, gaps and holes that invited rodent incursions, and inaccessible void spaces where pests could find refuge. In the words of one RAD architect, "I couldn't have designed it better for pests if I'd tried."

### *Pest Prevention By Design – Some Background*

The San Francisco Dept. of the Environment led development of the *Pest Prevention By Design Guidelines*<sup>1</sup> (PPBD) in 2013 under a Centers for Disease Control grant, with the assistance of a diverse and accomplished national advisory team including pest control professionals, architects, engineers, pest management researchers, green building experts, IPM experts, and public agencies.

The Department initiated the Guidelines because no authoritative resource existed on a topic that is fundamental to integrated pest management practitioners. The need was great: Asthma rates in public housing were soaring<sup>2</sup>, antigens from insects and rodent pests were implicated<sup>3</sup>, and the success of even the best pest management providers was limited by chronic maintenance and sanitation issues. From the outset, however, it was obvious that scientific justification for some pest prevention tactics - at least from peer-reviewed scientific journals - was thin, while anecdotal evidence was abundant<sup>4</sup>.

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Have Questions on IPM in Schools?

Contact EPA's Center of Expertise for School IPM!

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# Featured Member: National Pest Management Association



Integrated Pest Management, or IPM, can be defined in many ways. A quick Internet search on the term “IPM” yields over 20 million results. The structural pest management industry has spent much time and effort defining, fine tuning, and continuing to evaluate IPM practices. The industry provides the tools and resources necessary for pest management professionals to incorporate IPM into any pest management strategy.

The [National Pest Management Association](#) (NPMA) appreciates the acknowledgment that the U.S. Environmental Protection Agency has given to its efforts to advance IPM. These efforts are evident through NPMA’s continued partnership with the Agency on wide ranging issues from best management practices for bed bug to structural fumigation stewardship.

Since 1998, NPMA has actively partnered with EPA through its [Pesticide Environmental Stewardship Program](#). To this partnership, NPMA brings its more than 7,000 members who share its vision that, “People, property, and the environment are safely and effectively protected from the diseases and dangers of pests by trained pest management professionals.”

Most recently, NPMA developed a structure fumigation safety and compliance training program in cooperation with the Agency that was held in San Juan, Puerto Rico and St. Croix, U.S. Virgin Islands with a live, interactive, web-simulcast shared with applicators in St. Thomas. The program attracted more than 75 certified applicators that actively use structural fumigants in the region. The two, half-day workshops provided fumigators with more than 12 hours of refresher training focused on topics that included IPM.

Additionally, NPMA has developed numerous resources to support and further IPM, including the creation of the consumer Website, [What is IPM](#), and the development of an IPM brochure for pest management professionals to educate their customers about the benefits of an integrated pest management program. QualityPro, NPMA’s certification arm, has included IPM requirements in its standards. NPMA has also participated in the advisory committee that provides advice to EPA’s Office of Pesticide Programs on IPM issues.

NPMA is one of several major associations that have been invited to participate in the EPA School IPM Roundtable meeting scheduled for May 2016. NPMA looks forward to bringing the institutional knowledge of its collective membership and expertise in facilitating IPM in structural pest management to support this important initiative.

## EPA Awards School IPM Grants

On March 17, 2016, EPA announced two grants that will help further the adoption of IPM approaches by helping to reduce the unnecessary exposure of students, teachers, and staff to pests and pesticides in our nation’s schools, while saving money, energy and pesticide treatment costs. IPM is a smart, sensible, and sustainable approach that takes advantage of all appropriate pest management strategies, including the judicious use of pesticides.

The National Environmental Health Association (NEHA) was awarded \$241,000 for its project, *NEHA Mentorship Program for Developing School IPM Capabilities*. NEHA is an organization that serves 5,000 members and has a mission to advance the environmental health and protection for the purpose of providing a healthful environment for all. This project will promote effective and environmentally sensitive pest management practices in schools through an intensive mentorship program between local health departments and underserved school districts. The mentorship program, will work in pairing local health departments with school districts, and provide increased access to technical resources, and partnerships. This project is scheduled to begin in late 2016 with a projected completion date of 2017.

Health Resources in Action (HRiA) was awarded \$300,000 for its project, *Keeping the Pests Out: The Economics of Integrated Pest Management in Schools*. HRiA has a vision to see a world where social conditions and equitable resources foster healthy people in healthy communities, with a mission to help people live healthier lives and create healthy communities through prevention and health promotion. Their project will examine the costs and benefits of implementing school IPM activities. Currently, there are few studies assessing the economics of school IPM. Information provided by this project will help school districts understand the costs and benefits associated with establishing and sustaining an IPM program. The results of this two year project will be available in early 2018.

For more information on implementing IPM in your school, visit EPA’s [School IPM website](#). EPA’s website also offers additional information on [current and past School IPM grants](#).



# June is National Healthy Homes Month



June 2016 will mark the inaugural National Healthy Homes Month (NHHM). It will provide a significant opportunity to highlight and reinforce the dangers of residential hazards for people of all ages, but especially children and other vulnerable populations in low income households. It also aims to promote community involvement on a national, state, municipal, and neighborhood scale.

Under one umbrella, NHHM ties together numerous observances related to lead, asthma, radon and others. As part of the observance, HUD's Office of Lead Hazard Control and Healthy Homes (OLHCHH) is making available new outreach products. The overarching NHHM theme, "Everyone Deserves a Safe and Healthy Home," emphasizes the interconnectedness of health and housing. It points out that maintaining a healthy home underlies the overall health and safety of families and communities. It also stresses that health and home safety are attainable for all.

Events at the national and local levels are designed to, more than ever before, facilitate awareness, instill advocacy, and promote adoption of healthy homes policies and standards that protect vulnerable populations. Federal and other partners are being asked to promote NHHM on social media, link to the [NHHM website](#), and host related programs and activities. Other ways of getting involved are to sign local proclamations establishing June as NHHM and to distribute educational materials to residents served by federally funded programs.

To support educational outreach, HUD has released a [National Healthy Homes Month 2016 Toolkit](#). This document contains recommended activities, resources, along with a social media messaging guide. NHHM mobilizes the healthy homes community by, for example, recommending five different health care provider activities. OLHCHH grantees are being asked to partner at the local level. The [Healthy Homes Conference](#), to be held in San Antonio, Texas, in mid-June, will serve as a forum to explore healthy homes concepts and plan for the future. Leading up to the conference, HUD will release a new consumer healthy homes mobile app. The app will contain content provided by several federal agency partners.

## New Healthy Homes App Launches

The U.S. Department of Housing and Urban Development (HUD) Office of Lead Hazard Control and Healthy Homes is excited to announce a new resource for consumers and stakeholders: The Healthy Homes App! The app will be available for download from iTunes and Google Play in May 2016. The app will feature basic healthy homes information for consumers on the "Principals of a Healthy Home" as well as additional details, by topic, for users who are more familiar with healthy homes concepts. Information will be categorized by the home hazard section as well as health impacts. Users will have the opportunity to share the app or connect to more information through links and sign-ups offered through the app. HUD anticipates a broad audience for this outreach and awareness tool and hopes to collaborate with multiple federal agencies and partners to support and promote the app.

The Healthy Homes App will be a highlighted resource showcased during the first annual [National Healthy Homes Month](#) in June 2016. Please check the [Healthy Homes website](#) in May for links to the app.

## Upcoming Events

### [National Conference on Urban Entomology](#)

May 22-25, 2016  
Albuquerque, NM

### [School IPM Webinar - Termite Mitigation in Schools](#)

Presented by the EPA Center of Expertise for School IPM  
Jun. 7, 2016

### [NEHA 2016 AEC and HUD Healthy Homes Conference](#)

June 13-16, 2016  
San Antonio, TX

### [National Environmental Health Association Annual Educational Conference and Exhibition](#)

June 14 -16, 2016  
San Antonio, TX

### [National Association of School Nurses Annual Conference](#)

June 29-July 2, 2016  
Indianapolis, IN

### [International Conference on Pollinator Biology, Health and Policy](#)

July 18-20, 2016  
University Park, PA

### [International Congress of Entomology](#)

September 25-30, 2016  
Orlando, FL

### [National Pest Management Association's PestWorld 2016](#)

October 18-21, 2016  
Seattle, WA

# Putting 'Pest Prevention by Design' to the Test

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The PPBD project opted for an expert review model, assembling the best and brightest from multiple sectors. Team members vetted a long list of pest preventive design elements compiled from scientific and professional literature. At each meeting, the Committee discussed a new batch of pest prevention tactics, reviewing both scientific and anecdotal evidence in support of each tactic's effectiveness. The project also contracted with the International Code Council to review all of the guidelines in detail before publication, and to identify any clear redundancies with accepted building practices and building codes.

The Guidelines identified 110 pest prevention tactics for both new construction and maintenance/retrofit situations, and summarized ten principles of pest prevention:

1. **Understand local pest pressures.** Familiarity with local structural pest species and their biology is essential in order to make the best design choices.
2. **Analyze the physical context for each building situation.** On the larger scale, this means understanding the urban ecology of the site – a concept well described by Dr. Bobby Corrigan in the [Fall 2015 PESPWire](#).
3. **Design for the necessary pest tolerance level.** An occasional trail of ants in the home may be a mere nuisance, but even a single ant in a surgical ward can have grave consequences.
4. **Use durable pest-resistant materials.** Selecting pest-resistant materials can exclude pests from entering a structure, or deny pests harborage once they are there. Some materials provide “resistance to pests” while other materials provide 100 percent exclusion.
5. **Design for easy inspection.** Built-in access to critical areas, such as foundations, false ceilings, or triple wall voids, greatly assists pest control professionals in the early detection of wood-boring insects or rodent infestations.
6. **Minimize moisture.** In addition to promoting building decay, moisture also promotes serious problems with insect pests such as termites, wood-boring beetles, cockroaches, and flies.
7. **Seal off openings.** Effectively sealing off all openings to the building exterior, as well as openings between interior rooms, improves the odds of maintaining a pest-free environment.
8. **Eliminate potential harborage.** Pests prefer hidden spaces where they will not be disturbed. Minimizing inaccessible spaces – “avoiding the void” - can be key to reducing pest pressure.
9. **Engineer slabs and foundations to minimize pest entry.** There is a wide variety of techniques available to minimize cracks in foundations, which otherwise can be critical vulnerabilities for wood-destroying pests.
10. **Design buildings to be unattractive to pests.** Semi-enclosed alcoves are perfect for pigeons. The wrong configuration of exterior lighting can draw insects to windows and doors. Vines up the sides of buildings can be highways for rodents.

## The Transformation of San Francisco's Public Housing

The San Francisco Department of the Environment had pursued a variety of small IPM projects in the City's public housing developments over the past eight years, but their success was spotty in the context of the housing authority's systemic maintenance challenges. In 2012, the U.S. Department of Housing and Urban Development rated the San Francisco Housing Authority as “Troubled,” which is one step away from federal receivership. The following year, funding was cut further due to federal budget sequestration. In his January, 2013 State of the City address, Mayor Edwin Lee called for approaches to reinvent the governance and management of the Housing Authority.

A key recommendation of his task force was shifting to a public-private partnership model, under HUD's RAD program. RAD shifts service provision to a network of affordable housing developers, which enables access to a variety of finance mechanisms previously unavailable to public housing authorities.

With funding finally available, San Francisco's RAD program became an opportunity to install pest prevention features in 3,500 housing units as part of housing rehabilitation projects in 2015 and 2016. The Mayor's Office and MOHCD recognized the critical need for long-term solutions to chronic pest infestations in these developments, and was willing to take a chance in requiring developers to incorporate the pest prevention guidelines into their projects.



## The Nuts and Bolts of Building Out Pests

Implementing pest prevention by design in a large housing rehabilitation program was relatively untrodden territory. The extra costs that would be required were unknown, and the program was already exceedingly complicated, involving eleven housing developers, multiple service providers, construction contractors, architects, financiers and City agencies, as well as the tenants themselves.

With the help of the City's pest control contractor, Pestec, we began by organizing a series of 20 property walkthroughs, each followed by meetings with the project's teams of developers, architects, and contractors. Using a PPBD checklist, Pestec assembled punchlists of structural issues to fuel the discussion. These meetings were critically important to success in that they served as active problem-solving sessions. In a few cases the architects in attendance even began sketching out solutions on the fly: A rat wall to barricade cold joints between buildings, modifications to a refuse enclosure to seal out rodents, and others.

By the end of this series of meetings, some key barriers to implementation became clear:

1. *Division of pest prevention work among trades.* The guidelines called for sealing up cracks and holes that are not typically sealed as part of common construction practices. While the actual sealing process may be simple, the question of who should do it was not. For example, installation of conduit or electrical boxes is the work of electricians – but who will run a bead of sealant along the conduit to remove cockroach harborage?
2. *Communicating non-standard construction practices to subcontractors.* It may be easy for a developer to promise that certain joints around kitchen cabinets will be sealed, for example. But how to make sure the subcontractor in charge of the installation receives the message?

3. *Estimating costs:* Contractors' bidding practices are based on standard time estimates, but the additional time required to fully seal a unit might require change orders and overruns. Preliminary estimates suggest that 4-15 additional person-hours per unit were required.
4. *Modifying cabinetry.* Among the many pest prevention recommendations created, kitchen cabinets stood out as a particular challenge due to the inevitable gap between kick plates and the cabinet proper, which provides an easy entrance for vermin. The solution was relatively simple – scribed pieces to seal the gaps – but required a change in practices.
5. *Switching out baseboards:* Similarly, vinyl cove baseboards are commonly installed in housing units because they are inexpensive, simple to install (glued on), and can adapt to irregular surfaces. However, these baseboards also provide ideal hiding places for cockroaches and bedbugs, and must be removed if bedbug treatments are required.



Informed by this marathon series of meetings, we developed two sets of generic pest prevention specifications, one for [within residential units](#), and one for [elsewhere in the building](#). The city's RAD program coordinators incorporated a version of these specifications into the general project requirements for developers.

To address barriers #1 and #2 above, the groups concluded that some kind of “model unit” inspections were needed early in the construction process. These were simple, one-hour inspections by the pest management provider, with dual goals of quality assurance and training subcontractors.

## Relocating People, Not Bedbugs

One of the most complex aspects of the RAD program has been the relocation of thousands of residents during the construction phase. The plans varied widely from site to site, but the meetings highlighted a key vulnerability: Bedbugs. With so many people being shuffled around, there was a high potential for spreading existing bedbug infestations. With bedbug treatments running over \$2,000 per unit, this can add up quickly.

The most important piece of missing information was the extent of existing bedbug infestations. Working with MOHCD, the developers, the Housing Authority, and Pestec, we scheduled inspections of all 3,450 RAD units. In each unit, a bedbug-sniffing dog was used to identify infestations, with visual confirmation. A cockroach inspection was also conducted, with gel baits applied as appropriate.

These inspections served a dual purpose of targeting bedbug infestations for treatment and also providing a baseline measure of pest infestations, unit by unit, before pest prevention measures were introduced. Another set of inspections is planned for the year following the renovations, allowing us to compare pest infestation levels with pre-RAD levels.

In addition to the unit-by-unit inspections, we also consulted available literature on the subject<sup>567</sup>, and assembled a set of [relocation guidelines](#) for the RAD developers, as well as a set of treatment recommendations, with emphasis on thermal treatments. We hope to follow up on the extent and success of these treatments in the coming year.



In the long term, the success of IPM programs in the rebuilt RAD developments will depend on having educated property managers who are attentive to maintenance issues and equipped to properly oversee pest management contractors. Towards this end, we conducted two half-day property managers trainings for the new RAD managers.

### Lessons Learned

The RAD pest prevention efforts have the potential to improve the lives of thousands of San Francisco's public housing residents. We will not know its real impacts until at least a year or more, since the rehabilitations are still in progress. However, we have gleaned valuable lessons from the activities to date that are worth sharing. Some of these are the barriers to implementation described above, that is, the challenge of clearly assigning pest-proofing tasks across trades, and the need to effectively communicate specifications to contractors and subcontractors. We are cautiously optimistic that our model unit inspections have helped address both of these barriers.

Perhaps a more fundamental lesson has to do with pest prevention checklists in general. Our initial inclination was to rely on checklists as a primary tool. Checklists are easily reproduced, easily used, and lend themselves readily to green building certification programs such as the US Green Building Council's LEED program.

In practice, we found that checklists – no matter how detailed – sometimes missed the mark.

For example, one high-rise development that was plagued with rat problems was situated next door to several restaurants, with a cold joint (a three-inch wide, inaccessible gap between buildings) serving as a rat superhighway between them. In another location, hidden plumbing knockouts in the ground floor slab gave neighborhood rodents easy access to void spaces under bathtubs – and neighborhood rodents were especially abundant due to sanitation issues. In a third case, a concrete slab was poured too thinly in the building's crawl space, and rats from a neighboring construction site had chewed holes through it, turning what should have been a barrier into a warren of hospitable rat tunnels.

Each of these situations was a fundamental source of infestation. Yet none of them are found on the PPBD checklist, and an untrained inspector might not have noticed them at all. All are related to the physical context of each building situation (#2 in the list or pest prevention principles)<sup>8</sup>. What is needed is a trained eye.

Our conclusion, then, is that no checklist can substitute for a highly trained pest management professional conducting a careful inspection of the property. The chief question for anyone wanting to institute an effective pest-proofing operation is therefore: How to gauge the quality of the inspector and the inspection? There are no standards available for pest management inspections, particularly inspections geared to identify structural defects that promote pest problems. Development of such a standard would greatly assist in the wider adoption of pest prevention by design.

### References Cited

<sup>1</sup> Geiger, C, & C. Cox. 2013. [Pest Prevention By Design: Authoritative Guidelines for Designing Pests Out of Structures](#). Report in partial fulfillment of U.S. Centers for Disease Control REACH Core Grant # 1U58DP002990-01, San Francisco Department of the Environment.

<sup>2</sup> Chew, G., Carlton, E., Kass, D., Hernandez, M., Clarke, B., Tiven, J., et al. 2006. Determinants of cockroach and mouse exposure and associations with asthma in families and elderly individuals living in New York City public housing. *Annals of Allergy, Asthma & Immunology* , 502-513.

<sup>3</sup> Crain EF, Walter M, O'Connor GT et al. 2002. Home and allergic characteristics of children with asthma in seven U.S. urban communities and design of an environmental intervention: the Inner-City Asthma Study. *Environmental Health Perspectives*. 110(9): 939-45.

<sup>4</sup> The SCOPE project (Scientific Coalition on Pest Exclusion) was established to address the deficit of scientific research on pest exclusion. See [Dr. Bobby Corrigan's article](#) in the Winter, 2016 edition of PESPWire.

<sup>5</sup> Boston Housing Authority. [BHA relocation procedures](#).

<sup>6</sup> San Francisco Department of Public Health. [Tenant guidelines for unit preparation prior to bed bug treatment](#).

<sup>7</sup> San Francisco Department of Public Health. [Director's Rules and Regulations for Prevention and Control of Bed Bugs](#).

<sup>8</sup> Corrigan, R. 2015. [Urban ecology and pest management](#). PESPWire, Fall, 2015.

