IPM

Policy Options for Residential Real Estate

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Acknowledgements

The Boston Public Health Commission, founded in 1799, was the first city health department in the country; Paul Revere was a director of the original board. The Commission's mission is to protect, preserve and promote the health and well-being of residents, particularly those who are most vulnerable. Through community-based health improvement projects in asthma, diabetes, cancer, infant mortality, elder health, cardiovascular health and other areas, the Commission is seeking to restructure and transform health care delivery systems to reduce the burden of disease and eliminate racial disparities in health outcomes.

The Asthma Regional Council of New England (ARC) is a collaboration of public agencies, non-governmental organizations and researchers that bring together the divers organizational perspectives and resources of health, housing, education and environment to focus on the environmental contributors to asthma. Leaders with knowledge, resources and determination have joined forces to swiftly identify and implement solutions to improve the lives of people with asthma. ARC is a program of The Medical Foundation.

IPM Policy Options for Residential Real Estate was researched and written by Jane Malone, Housing Policy Director at The Alliance for Healthy Homes. The Alliance for Healthy Homes is the national nonprofit public interest organization working to prevent and eliminate hazards in homes that can harm the health of children, families, and other residents. The Alliance advocates for policy solutions and builds community capacity to achieve primary prevention by publicizing the importance of fixing housing-related health hazards before they cause poor health and impaired educational outcomes for children.

This paper is a product of the Healthy Pest Free Housing Initiative (HPFHI), a collaborative effort, involving ARC, the BPHC and housing, health, advocacy and academic institutions. HPFHI is designed to reduce pest infestation and pesticide use in public housing in Boston and is funded with support from the W.K. Kellogg Foundation and the U. S. Environmental Protection Agency. The primary focus of HPFHI is to improve the health and quality of life of residents through the implementation of integrated pest management (IPM), a safer and more effective alternative to traditional pest control. IPM relies on residents, managers and pest control companies working together to reduce pest infestation.

HPFHI partners include the Boston Public Health Commission which serves as the lead agency, the Committee for Boston Public Housing, the West Broadway Task Force, the Boston Housing Authority, the Boston University School of Public Health, the Asthma Regional Council, the Massachusetts Public Health Association, and the Boston Urban Asthma Coalition.

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Author: Jane Malone, Alliance for Healthy Homes
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Introduction

Infestations by insects, particularly cockroaches, mice and other rodents in the home affect many residents, and are a major quality of life factor in urban multi-family housing. Exposure to pests can also exacerbate asthma and has been associated with the development of asthma. Many residential property owners and occupants attempt to eliminate this recurring problem by using pesticide products (or having a pest control operator use them) - without realizing the harmful effects of these products' toxic chemicals on human health or recognizing their relative ineffectiveness.

Pest infestations can be eradicated safely, more thoroughly and cost effectively, through the use of integrated pest management (IPM), a set of basic property maintenance and repair practices designed to prevent and eliminate habitat for rodents and insects. Minimizing the use of pesticides, IPM's primary method of pest control, focuses on eliminating food, water, and harborage, and preventing pests from entering the home.

There has been demonstrable progress – although nowhere near universal success - in enacting IPM policies in schools and workplaces, for outdoor recreational areas, and even to reduce occupational exposures. By comparison, IPM requirements for the residential environment, while not completely uncharted territory, are relatively rare. The purpose of this paper is to present existing and promising housing-centered IPM policies.

Background

Pests and Pesticide Use

Pest infestations are not rare. Although only 6% of 50,000 US households participating in a biennial survey reported seeing signs of mice in their homes in the previous three months,[i] a scientific study has found evidence of mice in 82% of a nationally representative sample of US homes checked.[ii] Another scientific study measured allergen levels in bedrooms of more than 400 inner-city homes. Cockroach allergen has been detected in 85.3% of homes,[iii] while dust mites have been found in 49.4% of homes and cat dander in 62.6%.[iv]

Pest infestations are hazardous to respiratory health. Exposure to material left behind by rodents (saliva, urine, droppings or skin) can exacerbate asthma and otherwise create allergic reactions in sensitized persons.. Studies of asthma among inner-city children have found that nearly 20 percent of asthmatic children were sensitized to rats, 15 percent were sensitized to mice,[v] and 69% were sensitized to cockroaches.[vi] Cockroach debris, such as saliva, body parts, droppings and shells that have been shed, are a particularly potent asthma trigger. The most comprehensive study to date looking at the home environment as it relates to children's asthma found those who were both allergic to cockroach allergen and exposed to high levels of cockroach allergen were 3

times more likely to be hospitalized due to asthma exacerbation.[vii] Exposure to cockroach allergen is also associated with the development of asthma.[viii]
Many well-intentioned efforts to reduce exposure to insects and rodents using pesticides create new and more dangerous exposures. Early childhood exposure to pesticides is more harmful because children take in more toxic chemicals and a greater volume of air per unit of body weight than adults while their organs are still developing and less able to detoxify hazardous chemicals.

Various studies have documented that exposure to pesticides is associated with the development of childhood cancer[ix] and asthma. California toddlers exposed to insecticides were over two times more likely to develop asthma.[x] A Lebanese study found similar correlations.[xi] There is also clear evidence that pesticides trigger asthma attacks. Researchers at Johns Hopkins have found that pesticides increase airway hyper-reactivity and actually alter the nerve function controlling the smooth muscle lining of the airway, causing the airway to contract and restrain airflow.[xii]

Pesticide exposure is associated with a wide range of other health problems, including acute and persistent injury to the nervous system, injury to reproductive systems, birth defects, and adult-onset cancer. Fetuses are especially vulnerable to harm from pesticide exposure. Studies have found lower birth weight and length in babies exposed to pesticides in utero,[xiii] and documented developmental lags at age 3.[xiv] Immediate health impacts can include dizziness; vomiting; headaches; sweating; skin and eye irritation; and fatigue.

Advantages of Integrated Pest Management over Pesticide Use

The four basic IPM principles are (1) monitoring pest populations with traps to find out where pests are living and hiding, (2) blocking pest access entryways, and harborage (3) eliminating food and water sources, and (4) applying low-toxicity, low-risk pesticides only as necessary to address problems. IPM focuses on targeted applications of pesticide only where needed, whereas traditional pest management uses a broadcast application of pesticides often in aerosol (spray or bomb) form.

One major difference between IPM and traditional extermination in multifamily housing is that IPM requires a coordinated effort among housing managers, IPM contractors, and residents. While this involves a greater investment of time and resources, managers of housing developments that have implemented IPM are able to get pest problems under control. The more thoroughly and persistently management uses IPM, the better the results.

The adoption of IPM yields improved health and other benefits:

IPM is successful: Pesticides kill some pests in the short run, but do not solve the conditions that allow pests to thrive. IPM practice eliminates the habitats that support pest life: moisture, food, heat, dark places, shelter from the elements. An IPM intervention (including training and intensive cleaning) in a Boston multifamily property occupied by low-income elderly/disabled households reduced the percentage of units with cockroaches from 67% to 0.[xv] The proportion of NYC households checked that had cockroaches dropped from 80% to 40% after IPM was implemented.[xvi] In another study, the interventions from IPM and intensive cleaning improved respiratory health for Virginia children who were asthmatic and presented with allergies to multiple indoor allergens including cockroaches.[xvii]

IPM is sustainable: Pests develop resistance to pesticides; reliance on chemicals alone requires increasing the amount and frequency of applications. IPM practice makes durable changes to the perimeter, exterior, and interior of the building to deny pests entry to the living area.

IPM is cost effective: According to the EPA, preliminary indications from IPM programs in school systems suggest that long-term costs of IPM may be less than a conventional pest control program that relies solely on the use of pesticides. In one study, the cost of an IPM strategy was no more than traditional chemically based pest control.[xviii] In another study, the average monthly per-dwelling cost of IPM ($4.06) proved higher than the traditional baseboard, crack and crevice pesticide application ($1.50), but only IPM actually reduced the cockroach population.[xix]

The Case for IPM Policy for Housing

Policies are important tools to cease practices that can harm public health, as well as to provide a basis for enforcement of protective practices. Both pest infestations and pesticides are health hazards. IPM is more health-protective and effective than broadcast pesticide application in protecting humans from the ill effects of pest exposure. Comprehensive policies governing pest control are important. IPM policies and practices have been successfully implemented in schools and other institutional settings. Since people spend more than 65% of time inside their homes,[xx] policy makers must now advance IPM in housing to address pest infestation problems and prevent pest intrusion.

General Recommendations for Policy

The primary types of policy levers that will effectively advance IPM in all housing are:

1. Housing maintenance and construction codes that prohibit infestations and require IPM [See Appendices for some specific language];
2. State and federal statutes and regulations requiring that pesticide applicators be trained in and use approved[xxi] IPM strategies in occupied buildings and prohibiting or limiting spraying, fogging or other broadcast applications of toxic pesticides;
3. Pesticide registration policies that limit access to toxic pesticides in liquid form; and
4. State and federal guidance on proper training of contractors and the importance of using IPM instead of traditional extermination.

The most immediate opportunity to model the adoption of IPM policies is in residential property that is publicly owned or receives public sector financing for construction or operations. In addition to providing immediate protection to these properties' occupants, public sector adoption of IPM also builds trained capacity and publicizes the benefits of IPM. Such developments can help seed changes in attitude and behavior in the privately owned housing and ultimately policies that govern the private sector.

Regardless of the extent of a jurisdiction's requirements for IPM, public agencies concerned with housing, public health and the environment can build property owners' and occupants' awareness of IPM and equip them to prevent pest problems. Agencies can sponsor training for rental property owners and facilities managers, and disseminate materials explaining occupant responsibilities in multifamily properties.

Existing and Recommended Policies Affecting Pests, Pesticides, and Properties

In considering policies to advance IPM, stakeholders need to grasp and build upon the current policy context. Below are presented common existing policies related to pest control regulation, pest infestation, and IPM, along with recommendations.

1. Municipal and County Policies

Existing Policy

Many localities that regulate privately owned residential buildings through a housing code or property maintenance code have some provision for pest infestation. Some local policies hold the rental property owner responsible for any pest infestation. Other policies hold the occupant of a rental dwelling responsible for a pest infestation, if the unit is a single-family structure, or if it is the only dwelling unit in a multifamily property that is infested. Some localities hold the owner responsible if the infestation is caused by failure to maintain the dwelling, or if it is present in more than one unit or in the shared or public parts of the building. Other policies state that both the owners and tenants shall prevent any condition that can provide harborage for pests.

Traditional code provisions regarding rodent harborage are similar to elements of IPM policy directed at eliminating pests' habitat. These "rat proofing" policies require that openings in a building be covered if they are within four feet of the ground or if they may be reached via pipes, wires, cornices, stairs, roofs, trees, or vines; that there be adequate screens in good repair; that sewers, pipes, drains or conduits and openings around such pipes and conduits be constructed to prevent the ingress or egress of rats to or from a building; and that materials stored outside the building be neatly stacked away from the exterior walls of the structure. However, these rules fail to address smaller pests, such as cockroaches and mice, probably because when these policies were enacted, rats were traditionally known to be the main carriers of acute diseases. Such policies need to be updated to prohibit even the smallest openings and insect-friendly habitat, now that cockroaches and smaller mice are known to promote chronic disease such as asthma.

There is a growing trend for localities to enact IPM for publicly owned buildings. The NYC Pesticide Reduction Law (Intro 329A) requires that City agencies (including the housing authority) and contractors reduce the use of toxic pesticides on property owned or leased by the city. Enacted in 2005, the policy phases out the use of pesticides that are acutely toxic and known or suspected to cause cancer or developmental disorders and it requires City agencies to adopt a pest control strategy that emphasizes safer alternatives throughout city-owned real estate, including 28,000 acres of parkland and even public housing. The NYC policy was modeled on a policy enacted in San Francisco in 1996. Seattle, Olympia, and other Washington localities, Westchester and Suffolk Counties in New York, and Santa Barbara, California are also developing or implementing policies to add IPM to their jurisdictions' property management policies.

Housing authorities, locally controlled entities that operate housing, must meet HUD's Housing Quality Standards (HQS). HUD has sponsored training and conference activities which have helped to build momentum for IPM adoption. However, local initiatives are driving progress in using IPM in public housing:

- Under the New York City law, the housing authority (NYCHA) is beginning to implement IPM throughout the 179,000 dwelling units that it owns. NYCHA has trained its 80 pest

control operators and other staff in IPM techniques. The agency is also promoting maintenance staff's use of HEPA vacuums for allergen, pest and harborage removal, steam machines for removing cockroach waste and eggs, handheld ultraviolet lights for inspections, and exterior oxygen-voiding trash compactors. NYCHA plans to update its pest management protocol to reflect new practices and expand its resident education efforts and is launching an IPM program as part of a comprehensive kitchen upgrade at one development.

- Boston's public housing authority has implemented a voluntary IPM initiative that is having great success in building capacity and resident awareness. Over a three year period, the W.K. Kellogg Foundation is funding a collaboration of public, community, policy and academic partners with the goal of reducing pest infestation and pesticide use in public housing. The initiative includes training and employing community health advocates to mobilize and educate fellow public housing residents, training housing authority managers in IPM and developing model systems. At the end of three years, the initiative will produce a model integrated pest management program that can be replicated in affordable multifamily housing. Preliminary results to date are promising, with reductions in infestations and associated costs.
- Housing authorities in Chicago, Cleveland, and elsewhere have engaged in IPM projects in multifamily developments.

Recommendations

1. Localities should require that rental property owners prevent and eliminate infestations using approved IPM strategies through health and housing codes
2. Local policies should require the use of approved IPM strategies for publicly owned property (including public housing) and adherence to model IPM contract specifications in all pest management contracts
3. Local housing agencies should prioritize IPM in targeting grants and loans from block grants and other discretionary resources.

2. State Policies

Existing Policies

States enact policies governing pesticide use have the authority to limit what pesticides may be used, direct how pest control services may be delivered by certified pesticide applicators, and specify any notification or postings requirements prior to pesticide application.

Some states have enacted relevant safeguards regarding pesticide use, through requirements for advance disclosure of pesticide use to occupants of residential buildings and advance disclosure of garden and other exterior pesticide use to neighbors. Several have also established registries for pesticide-sensitive persons to declare their address and qualify for advance notice of pesticide use on adjacent properties. Some states manage a separate certification classification for pesticide applicators working in residential or child-occupied settings or institutions. Massachusetts has standards for IPM vendors and an approved list (or registry) for IPM service providers to help purchasers of services differentiate among pest control operators claiming knowledge of IPM. One common IPM-specific state requirement is that certified pesticide applicators must receive up-front training and/or continuing education in IPM. New Hampshire uses a portion of pesticide registration fees for grants to promote voluntary IPM practice. Minnesota has mandated the use of IPM in all state-owned property (including higher education and correctional facilities).

Currently, only one state, Maine, has a comprehensive policy requiring consideration of IPM as an alternative to pesticide applications in residential settings. Maine's policy discourages application of pesticides with a higher potential for human exposure in all publicly and privately owned housing. Effective January 2007, the "Indoor Pesticide Applications and Notification for All Occupied Buildings" regulations [xxii] require pesticide applicators to provide advance written notice to residents of plans to use pesticides inside occupied buildings, prohibits application of a pesticide if the tenant objects, and requires IPM and minimization of exposure and human risk in applying pesticides.[xxiii] The pesticide applicator must also identify specific pests, conditions conducive to the development of pest problems, and a written evaluation with specific recommendations for practical non-pesticide control measures.

The experience of the Maine Board of Pesticides Control in adopting these standards is illuminating. The Board decided to enact a policy for occupied buildings after recognizing that its multiple and extensive efforts to require notification for outdoor pesticide use were not protecting persons where they spend most of their time – indoors. The Board soon realized that IPM policies for schools, which allow for applications in vacant buildings after school hours, could not be applied to properties that are occupied around the clock. After several years of stakeholder meetings and hearings, the Board decided it could best ensure IPM by limiting the most dangerous pesticide media: liquid formulations. The resultant policy has the potential to curtail broadcast spraying and fogging by requiring advance notice and tenant consent if these methods are to be used. While stopping short of a complete ban on these methods, setting these limits begins to increase adoption of IPM practices and ultimately reduce pesticide exposure. State Housing Finance Agencies establish criteria for deciding which proposed projects for developing multifamily affordable housing merit an allocation of the state's share of Low-Income Housing Tax Credits (LIHTC). Connecticut is requiring fulfillment of asthma-safe building standards[xxiv] that include IPM for all projects to be funded beginning in 2007.[xxv] Many states are requiring green building and/or Energy Star standards to forestall air leaks and moisture problems, measures that will also prevent pest intrusion and thus facilitate IPM.[xxvi] New Jersey[xxvii] and Maryland[xxviii] award extra points to construction projects that incorporate green building design standards,[xxix] including IPM strategies, into the design; five other states[xxx] are partnering with Green Communities in pilot initiatives that include IPM.

Recommendations

1. States should require that certified pesticide applicators adopt IPM as the standard of care in occupied buildings, and ensure that new and continuing pesticide applicators receive training and continuing education respectively.
2. States should restrict or prohibit the use and sale of toxic pesticides, especially liquid formulations and bombs, foggers and granular formulations. [xxxi]
3. States should require that rental property owners prevent and eliminate infestations using IPM strategies, and enforce these requirements.
4. State housing agencies should require that all housing development projects meet green and asthma-safe building criteria, which address essential elements of IPM, in order to qualify for targeted funding such as tax credits, mortgage bonds, and other programs offering subsidies or favorable financing terms.
5. States should require IPM for all publicly owned property and adherence to model IPM contract specifications in all pest management contracts.
6. State legislatures should fund grants for affordable housing developments to implement IPM.

3. Federal Policy

Existing Policies

The only applicable federal statute that directly affects housing is the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which has required since 1996 that Federal agencies use integrated pest management techniques in carrying out pest management activities, and promote integrated pest management through procurement and regulatory policies, and other activities. Despite this mandate, no federal agency has yet enacted a policy requiring IPM in residential structures.

The US Department of Housing and Urban Development (HUD) has baseline Housing Quality Standards (HQS) for conditions in HUD-subsidized housing (public housing, privately owned units subsidized with vouchers, and properties with project-based subsidies). The HQS include some elements of IPM:

- suitable space and equipment to store, prepare, and serve foods in a sanitary manner;
- adequate facilities and services for the sanitary disposal of food wastes and refuse, including garbage cans;
- no serious interior defects such as large holes in ceilings, walls, and floors;
- no serious exterior defects such as large holes or defects that may result in vermin infestation;
- no serious adverse environmental conditions on the property such as excessive accumulations of trash, or vermin or rodent infestation; and
- no vermin and rodent infestation in the dwelling unit.

HUD provides specific direction for public housing authorities in its IPM Guidance, which states that HUD encourages housing authorities to consider IPM for pest control (but advises that the decision to use IPM rests solely with local housing authority management).[xxxii]
The Environmental Protection Agency (EPA) regulates pesticides and oversees pesticide-labeling requirements, providing important universal national safeguards for consumers, and promotes effective IPM practice in schools and other settings. EPA also delegates to states authority for regulating pesticides and ensuring the qualification of persons and businesses involved in pesticide application.

The US Department of Agriculture (USDA) implements research, demonstration, and education programs to support adoption of Integrated Pest Management. USDA's Cooperative State Research, Education and Extension Service supports the work of cooperative extension offices throughout the US that provide IPM-related technical support and training to schools, farmers, local and state agencies, consumers and others.

Recommendations

1. HUD should more actively promote IPM by publishing standards and guidance for property owners, tenants, and the building and real estate industries.
2. HUD should require that manufactured housing construction standards ensure that homes are designed and built to support IPM.
3. HUD should comply with FIFRA[xxxiii] by mandating IPM in all federally owned and subsidized housing and amending its Housing Quality Standards regulation to specify IPM to control pest infestations in assisted housing.
4. EPA and USDA should promote IPM in the housing sector by providing direction, guidance, tools, and other support to local and state jurisdictions.

5. Congress should direct EPA to expand upon the mandate for registering pesticides to prevent human pesticide exposure by promoting effective IPM, discouraging the use foggers, bombs and sprays, and working with HUD and CDC to advance widespread use of effective IPM.
6. Congress should appropriate funds for Federal agencies to provide incentive grants to state governments and local public housing authorities to off set initial costs of implementing an IPM program.

The Special Role of Health Payers and Public Health

Both public health departments and health insurers should incorporate IPM into the prevention and management of respiratory disease. Health care agencies must recognize infestations and pesticide use as vectors of asthma. Payers must recognize that IPM can prevent recurrence of disease for persons with asthma and other respiratory difficulties. The health care system has an obligation to both protect individual patients in the near term and encourage broad acceptance of the need to prevent pesticide and pest exposure across the entire housing stock and in other occupied buildings. Education and environmental assessment programs in the home for people with respiratory conditions should offer basic pest management supplies as warranted by the research.[xxxiv]

Anti-Discrimination Laws May Require IPM as Reasonable Accommodation

The compelling evidence of causal relationships between pesticides and pest allergen exposures and disease provides a compelling basis for requiring IPM in residential property under federal anti-discrimination laws. Tenants living in private market properties with four or more units who are sensitized to pesticides can request the use of IPM as a reasonable accommodation of their disabilities under the Fair Housing Act; if successful, they may be required to pay the incremental cost of IPM. Occupants of public housing can request IPM under Title II of the Americans with Disabilities Act and Section 504 of the Rehabilitation Act.[xxxv] Unresponsive property owners may be compelled to use IPM depending on a variety of factors.[xxxvi]

Appendix A. Effective Housing Policy Addressing IPM

1. Cross Jurisdictional Standards

Many states and localities that enact property maintenance and construction codes base their decisions on model codes provided and periodically updated by the International Code Council (ICC).[xxxvii] Presently, the ICC Property Maintenance Code requires extermination for any infestation. This requirement should be updated to require IPM, prohibit even the smallest openings and insect-friendly habitat, permit the targeted use of the least toxic pesticides, and restrict the indoor use of pesticides in liquid formulations.

The green building movement seeks to integrate materials and methods that promote environmental quality, economic vitality and social benefits through design, construction, and operation of the built environment. The Green Communities™ program[xxxviii] aligns affordable housing investment strategies with environmentally responsive building practices. The Green Communities guidelines mandate that housing design include two IPM measures: sealing wall, floor and joint penetrations to prevent pest entry, and providing rodent and corrosion proof screens (e.g., copper or stainless steel mesh) for large openings. The guidelines are helping to build IPM awareness and developer capacity; ultimately they should influence building codes. Other green design standards should be amended to promote IPM.

2. Sample Baseline Requirements for Property Owners

- Maintain properties in good physical condition, without pest habitat (holes or other openings or problems that shelter pests)
- Perform visual inspection for infestation and pest habitat upon vacancy and annually thereafter
- Perform visual inspection for infestation and pest habitat after renovation or other activity that disrupts structural elements, floor, wall, or ceiling surface coverings, ducts, pipes, or other building components
- Promptly and safely repair structural deficiencies that provide pest habitat
- Urge occupants to report infestations and pest habitat; clearly explain how to do so
- Notify occupants of infestation, IPM plan, pesticide use, and expectations of occupants

3. Sample Code Agency Accountability Standards for Compliance/Enforcement

- Classify pest infestation and excessive pesticide use as serious code violations
- Establish meaningful, appropriate penalties for unresolved infestation and unwarranted pesticide use
- Require property owners to document IPM in certain situations
- Inspect units proactively, such as on a routine periodic basis
- Collect environmental samples to determine the presence of pest and pesticide hazards
- Set a specific deadline for adoption of IPM
- Conduct follow-up inspection to ensure IPM was performed effectively
- Issue stop-work order to halt improper use of pesticides
- Order property owner to hire independent certified pesticide applicator trained in IPM
- Authorize agency crews to eliminate pest and pesticide hazards (and recover costs by placing a lien on the property)
- Require a renewable rental permit or certificate of occupancy for all rental properties
- Publish information on properties with outstanding code violations and recalcitrant owners

Appendix B. Resources for Pesticide Control Policy addressing IPM

Building Science Corporation's "Read This before You Design Build or Renovate"[xxxix]
Healthy Homes Training Center's Model Contract for IPM Support[xl]

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[i] American Housing Survey 2005, US Census Bureau, Report H-150-05, Table 2-7
[ii] National prevalence and exposure risk for mouse allergen in US households**.** R. Cohn, S. Arbes, Jr., M. Yin, R. Jaramillo, D. Zeldin. *Journal of Allergy and Clinical Immunology*, Volume 113, Issue 6, Pages 1167-1171
[iii] An intervention to reduce residential insecticide exposure during pregnancy among an inner-city cohort. Williams MK, Barr DB, Camann DE, Cruz LA, Carlton EJ, Borjas M, Reyes A, Evans D, Kinney PL, Whitehead RD Jr, Perera FP, Matsoanne S, Whyatt RM. *Environ Health Perspect* 114:1684–1689 (2006)
[iv] The role of cockroach allergy and exposure to cockroach allergen in causing morbidity among inner-city children with asthma. D. L. Rosenstreich, P. Eggleston, M. Kattan, D. Baker, R. G. Slavin, P. Gergen, H. Mitchell, K. McNiff-Mortimer, H. Lynn, D. Ownby, F. Malveaux, and The National Cooperative Inner-City Asthma Study. *NEJM* Volume 336:1382-1384 (1997)
[v] Characteristics of inner-city children with asthma: The National Cooperative Inner-City Asthma Study. Kattan M, Mitchell H, Eggleston P, Gergen P, Crain E, Redline S, Weiss K, Evans R III, Kaslow R, Kercsmar C, et al. *Pediatr Pulmonol* 24:253-262 (1997).
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[vii] D. L. Rosenstreich et al (1997)
[viii] Clearing the Air. *Institute of Medicine* (2000)
[ix] Pesticides and childhood cancer: An update. Nasterlack M. *Int J Hyg Environ Health* (2007) accessed at doi:10.1016/j.ijheh.2007.03.001
[x] Early-life environmental risk factors for asthma: findings from the Children's Health Study. Salam MT, Li YF, Langholz B, Gilliland FD; *Environ Health Perspect.* 2004 May; 112(6): 760–765
[xi] Respiratory diseases and pesticide exposure: a case-control study in Lebanon. Salameh, Pascale, Waked, Mirna, Baldi, Isabelle, Brochard, Patrick, Saleh, Bernadette Abi. J Epidemiol Community Health 2006 60: 256-261
[xii] Asthma: the breathtaking disease. M Field, *Johns Hopkins Public Health Magazine*, Fall 2002.
[xiii] In utero pesticide exposure, maternal paraoxonase activity, and head circumference.Berkowitz GS, Wetmur JG, Birman-Deych E, Obel J, Lapinski RH, Godbold JH, Holzman IR, Wolff MS. Reyes A, Evans D, Kinney PL, Whitehead RD Jr, Perera FP, Matsoanne S, Whyatt RM. *Environ* 112(3):388-91 (2004)
[xiv] Impact of prenatal chlorpyrifos exposure on neurodevelopment in the first 3 years of life among inner-city children. Rauh VA, Robin Garfinkel R, Perera FP, Andrews HF, Hoepner L, Barr DB, Whitehead R, Tang D, Whyatt RW. *Pediatrics* 118: e1845-e1859 (2006).
[xv] Integrated pest management in multi-family housing, Asthma Regional Council of New England, 2006.
[xvi] Integrated pest management in an urban community: a successful partnership for prevention. Brenner BL, Markowtiz S, Rivera M, Romero H, Weeks M, Sanchez E et al. 2003.Environ Health Perspectives 111:1649-1653.
[xvii] A community-based participatory research study of multifaceted in-home environmental interventions for pediatric asthmatics in public housing. Levy et al, *Social Science and Medicine,* 63:2191-2203
[xviii] Integrated pest management in an urban community: a successful partnership for prevention. Brenner BL, Markowtiz S, Rivera M, Romero H, Weeks M, Sanchez E et al. 2003.*Environ Health Perspectives* 111:1649-1653.
[xix] Cost and efficacy comparison of integrated pest management strategies with monthly spray insecticide applications for german cockroach (dictyoptera: blattellidae) control in public housing. D. M. Miller; F. Meek, *Journal of Economic Entomology* 97:2:559-569.
[xx] The national human activity pattern survey (nhaps): a resource for assessing exposure to environmental pollutants. N Klepeis W Nelson, WR Ott, JP Robinson, AM Tsang, P Switzer, JV Behar, SC Hern, WH

Engelmann. *Journal of Exposure Analysis and Environmental Epidemiology* Volume 11, Number 3, Pages 231-252

[xxi] To be defined by federal or state policy or consensus standards

[xxii] http://www.maine.gov/agriculture/pesticides/chapter_26/index.htm

[xxiii] except schools, which are covered by another policy

[xxiv] Building guidance for healthy homes, Asthma Regional Council, 2006

[xxv] http://www.chfa.org/TaxCredits/Low-IncomeHousingTaxCreditApplicationPage.asp

[xxvi] http://www.practitionerresources.org/showdoc.html?id=48151

[xxvii] See page 42 of the Qualified Allocation Plan at http://www.state.nj.us/dca/hmfa/biz/devel/lowinc/ and http://www.state.nj.us/dca/dh/gho/index.shtml

[xxviii] See page 42 at http://www.dhcd.state.md.us/Website/programs/rhf/document/2007GuideFinal110106.pdf

[xxix] See http://www.greencommunitiesonline.org/getstarted-request.asp

[xxx] Florida, Massachusetts, Michigan, Minnesota and Ohio

[xxxi] One barrier to a locality's enactment of a directive to require the use of IPM by private property owners is the fact that most states prohibit units of local government from passing pesticide ordinances that are stricter than state policy. According to Beyond Pesticides, the basic reason for this is that states bowed to pressure from the chemical industry to prevent local governments from restricting the use, sales and distribution of pesticides. The resultant laws, called state preemption laws, have effectively denied local decision makers authority to protect their communities more effectively. Some jurisdictions are working to overturn preemption laws. In 2005 a judge upheld the right of officials in Dane County Wisconsin to enact a local county-wide ban on the use of synthetic lawn fertilizers that contain phosphorus due to its pollution of local lakes. Other municipalities are seeking to limit some pesticides and fertilizers, in some cases to aid in fulfilling environmental mandates.

[xxxii] http://www.hudclips.org/sub_nonhud/cgi/pdfforms/07-12PIH.doc

[xxxiii] "Federal agencies shall use Integrated Pest Management techniques in carrying out pest management activities and shall promote Integrated Pest Management through procurement and regulatory policies, and other activities." 7 USC 136r-1

[xxxiv] See the Asthma Regional Council "Investing in Best Practices for Asthma: A Business Case for Education and Environmental Interventions." (www.asthmaregionalcouncil.org)

[xxxv] People with Asthma: Appropriate Rental Housing Accommodations, California Thoracic Society (2006). Accessed at http://www.thoracic.org/sections/chapters/ca/publications/resources/eoh/AsthmaHousingAdd.pdf

[xxxvi] Fact sheet: allocating the burden of proof in disability cases under the fair housing act. Bazelon Center for Mental Health Law, Washington DC (2004). Accessed at http://www.bazelon.org/issues/housing/infosheets/ReasonableAccommodation.htm

[xxxvii] http://www.iccssafe.org

[xxxviii] www.greencommunitiesonline.org

[xxxix] www.buildingscienceconsulting.com/resources/mold/Read_This_Before_You_Design_Build_or_Renovate.pdf, see page 35

[xl] www.healthyhomestraining.org/ipm/ipm_rfp_full_6-1-07.pdf