CHAPTER 3

POTENTIAL ACTIONS

OVERVIEW

The following is an outline of potential actions for the five goals identified in Chapter 2.

GOAL 1:

Achieve Major Health Gains and Improve Professional Education

A. Develop a risk assessment methodology, perform research, and conduct assessments.

B. Along with other public health agencies, develop a public health metric (or series of metrics) as a baseline against which to demonstrate health gains.

C. Demonstrate specific health gains from good IEQ practices and marshal evidence to indicate that the gains are due to actions taken.

D. Provide information/education to foster understanding and action.

GOAL 2:

Foster a Revolution in the Design of New and Renovated Buildings

A. Quantify the benefits and costs of integrated design and use this information to provide incentives to build/renovate buildings with integrated building designs.

B. Facilitate competitions or industry consortia to develop integrated building designs.

C. Develop and promote building system performance targets.

D. Develop university and continuing education curricula.

GOAL 3:

Stimulate Nationwide Action to Enhance Health in Existing Structures

A. Identify and fill knowledge gaps for the full range of existing buildings.

B. Develop and promote excellent IEQ standards of care.

C. Develop specific guidance documents for critical junctures in the life cycle of existing buildings.

D. Develop metrics for a performance-based building rating/certification program.

E. Provide information targeted to do-it-yourselfers.

F. Develop homeowner/tenant checklists.

GOAL 4:

Create and Use Innovative Products, Materials, and Technologies

A. Further develop tools to prioritize our efforts to reduce risks from sources and pollutants indoors.

B. Document and evaluate state-of-the-art sensors, test kits, and indoor-related prevention and control technologies.

C. Perform comparative exposure and risk assessments on products and materials.

D. Develop product testing protocols.

E. Work with stakeholders and outside standard-setting organizations to develop voluntary, consensus-based standards and guidelines.

F. Provide market incentives to drive manufacturers to develop both new products and new technologies.

G. Work with interested stakeholders to develop and disseminate product labels, instructional materials, enhanced material safety data sheets, and product specifications.

GOAL 5:

Promote Health-Conscious Individual Behavior and Consumer Awareness

A. Initiate a campaign to educate society's leaders on IEQ.

B. Create a healthy children program.

C. Ensure consumers are well-informed.

D. Provide for healthy home care.

POTENTIAL ACTIONS FOR GOAL 1

GOAL 1

Achieve Major Health Gains and Improve Professional Education

A fundamental requirement for improving human health indoors is a better understanding of the health risks posed by different types of indoor environments. A comprehensive assessment of health risks across the wide variety of indoor environments, and their relationship to ambient pollutants, will require extensive research efforts. Issues needing further research include test methods, basic toxicology for agents and mixtures, and the development of biomarkers and appropriate environmental measurements. A sustained, long-term effort is needed to identify and quantify the most important indoor health risks.

To demonstrate how healthier buildings lead to healthier people, research is also needed to establish public health baselines against which health gains can be measured. Critical to achieving this goal is the quick communication of research findings about indoor health risks, and how they can be avoided, to building and public health professionals, product manufacturers, and the public. Metrics are needed to measure the status and trends of a number of health effects caused by poor indoor environmental quality. This effort will require coordination with other public health agencies interested in indoor environmental issues. Once metrics are established, they can be used to demonstrate health gains from appropriate risk management options.

We can improve the indoor environment most rapidly if all parties involved become more knowledgeable, so that the impetus for change comes from all directions.

A. Develop a risk assessment methodology, perform research, and conduct assessments.

   These assessments will determine how potential risks posed by indoor exposures can be predicted accurately, quickly, and cost-effectively.

1. Address multiple pathways, multiple agents, and non-traditional stressors (e.g., thermal, light, sound).
2. Develop a peer-reviewed, high-level cross-Agency research strategy, with buy-in from other agencies as well as non-federal stakeholders, designed to improve public health. This strategy may be developed at the level of the White House Committee on Environment and Natural Resources and should address:
   - Appropriate test methods to assess the often symptom/complaint-related issues associated with indoor environments.
   - Toxicological testing for agents and mixtures, especially for agents affecting immunotoxicity, neurotoxicity, and human performance.
   - Vulnerable populations, particularly children.
   - Development of biomarkers and appropriate environmental measurements.
   - A testing strategy to help address associated health risks.
   - Measurements and models to determine exposures in various indoor microenvironments.
   - Methods and models to quantify emissions from indoor sources and determine penetration of ambient pollutants indoors.
   - Innovative risk management options to reduce exposures.
3. Manage a coordinated effort (government and non-government) to perform the necessary exposure, effects assessment, and risk management research.
4. Complete the EPA portion of the inter-agency research effort.
5. Establish an indoor environmental risk assessment methodology and databases for ready access.

B. Along with other public health agencies, develop a public health metric (or series of metrics) as a baseline against which to demonstrate health gains.

   Metrics are needed to measure status and trends for asthma and allergens, productivity/human performance, irritancy, neurotoxicity, reproductive toxicity, infectious disease, cancer, and other health impacts.

   1. Identify health conditions that should be included in the public health baseline.
   2. Ensure:
      - Collection of the necessary public health data to assess the public health baseline.
      - Development and acceptance of public health indicators and metrics.
      - A commitment to using the indicators and metrics on a national scale.

C. Demonstrate specific health gains from good IEQ practices and marshal evidence to indicate that the gains are due to actions taken.

   1. Identify specific actions, and ensure that the actions are implemented, documented, and tracked.
   2. Push aggressively to implement those actions likely to produce the largest reduction for each known risk.
   3. Monitor national status and trends of public health by working with other public health agencies.
   4. Demonstrate the link between improved public health and actions taken by assessing changes to the public health baseline.

D. Provide information/education to foster understanding and action.

1. Integrate information about indoor health risks and healthy indoor environments into professional curricula and health professional training, as well as training of building professionals.
   a. Include case studies in the educational curricula of medical professionals, architects, and engineers.
   b. Educate insurance and real estate agents, building sanitation engineers, code enforcement and code writing bodies, mortgage lenders, etc.
2. Develop health issue papers for the public on such known risks as:
   - Radon
   - Environmental tobacco smoke
   - Lead poisoning
   - Asthma/allergies
   - Infectious diseases
   - Reduced productivity from symptom-based conditions
3. Develop additional health issue papers as research identifies further hazards.

POTENTIAL ACTIONS FOR GOAL 2

GOAL 2

Foster a Revolution in the Design of New and Renovated Buildings

Dramatic improvements in the indoor environments of the next century will be achieved with integrated design and good indoor environmental quality planning and construction. The design and construction of new residential and commercial buildings accounts for some $381 billion per year in the U.S. economy, with new homes alone accounting for $182 billion (U.S. DOC 1996, 1997). Extensive building renovations offer similar opportunities for improving indoor environments. Once the poor stepsister of the building industry, non-residential rehabilitation is now a major market. Most of this work requires total building overhaul or major renovations, not just remodeling or repair.

A number of buildings have been constructed around the world over the past few years using an integrated design process. They demonstrate that improvements in energy efficiency can complement indoor environmental upgrades. Often, integrated design actually saves money by downsizing HVAC equipment, reducing material costs, and cutting operating expenses for heating, cooling, and lighting. New and renovated buildings can also be designed for easy maintenance with low-impact, high-efficiency products and procedures.

Several kinds of initiatives are needed to help integrated design move from its present status of "innovative best practice" to standard practice. Research is needed to establish the economic costs and benefits of integrated design and good IEQ construction, as well as the costs of health care, productivity loss, and poor building performance related to inferior ventilation, IEQ design, and construction. Reliable information of this kind will eventually influence costs for insurance, mortgages, and health care coverage, creating strong economic incentives for integrated design.

Needed as well are new tools to provide industry and consumers with the information they require to make sound building and renovation decisions. Professionals in the design and building industries need to agree on the elements of good IEQ design and on appropriate ways to measure and compare the features offered by given designs. Collaboration with professionals and organizations in the design, engineering, construction, building

products, real estate, government, and public health communities is essential to speed change in professional practice, professional curricula, and standards and code setting.

A. Quantify the benefits and costs of integrated design and use this information to provide incentives to build/renovate buildings with integrated building designs.

   Integrated design simultaneously achieves good indoor environmental quality, energy efficiency, high functionality, comfort, and productivity. Building design, construction, and procurement professionals need sound financial arguments to make healthy indoor environment features a priority in new buildings.

   1. Convene a stakeholder process to define good/superior IEQ for various building types.
   2. Collect existing information and perform needed research to quantify initial building and lifetime costs of superior IEQ and the savings from improved health, productivity, and building systems performance. Focus on energy, productivity, absenteeism, cost of law suits and worker's compensation, tenant turnover/retention, sale of homes, rental rates, costs of implementing guidance, and assessment of the market value for a "healthy building."
   3. Use existing data and research results to develop building design simulation packages that demonstrate the consequences of building design and product choice on the health, economics, and productivity of the occupants. Address air quality, air flow, energy consumption, life cycle effects, moisture intrusion, humidity, and health/productivity impacts.
   4. Promote integrated design cost/benefit information for good decision making by:
      a. Widely disseminating cost/benefit information to builders, product manufacturers, commercial realtors, insurance and

mortgage companies, public health professionals, and consumers to improve understanding and encourage integrated designs.

b. Championing insurance industry rate incentives for superior IEQ buildings using cost-benefit arguments. Work with consumer advocacy organizations and insurance companies or their professional organizations to pioneer reduced premium costs for holders of health, home, or commercial property insurance policies who have created high-quality indoor environments.

c. Creating primary and secondary mortgage banking instruments that result in savings for residential remodeling and new construction projects that use integrated design. Use cost-benefit arguments that demonstrate savings from improved systems performance, lowered taxes, and improved insurance rates, and work with consumer groups and mortgage bankers to craft lower debt-to-equity rates for residential lending. This program may be modeled on or integrated with the Energy Efficient Mortgage program.

d. Working with school districts to revise how schools allocate resources, taking into account the cost of new construction, maintenance, and future costs, and revising federal and state formulas to reflect these factors.

e. Educating consumers on the benefits of an integrated design approach.

B. Facilitate competitions or industry consortia to develop integrated building designs.

Options to be considered:

1. Establish a consortia of designers, manufacturers, and other stakeholders to develop the designs and the building materials for high-performance buildings.

2. Promote juried design competitions, undertaken with other stakeholders, that focus the creativity of architects and designers on improved indoor environments.

3. Provide grants to show that integrated designs are feasible.

C. Develop and promote building system performance targets.

1. Through a stakeholder process, develop IEQ performance targets for new or renovated buildings. Work with established voluntary standards-setting organizations to create a unified set of voluntary standards, incorporating key IEQ-related variables (maintainability, air quality, energy efficiency, air flow, ventilation, materials selection, limiting moisture intrusion, controlling humidity, and feedback loops for measurement and evaluation). Develop a voluntary ratings system that predicts performance.

2. Procure a Presidential Executive Order requiring new or renovated federal buildings to comply with the voluntary standards.

3. Establish a green codes program where localities lower permitting fees, cut taxes, or simplify procedures for buildings that adhere to a voluntary IEQ buildings rating system. Work with international code officials and local government organizations responsible for building codes to develop model programs. Where possible, integrate green code efforts with American Institute of Architects (AIA) and other existing green buildings efforts (U.S. Green Buildings Council, Energy Star®, the Office of Policy, Economics, and Innovation (OPEI) Smart Growth Network, and the OPEI/Office of Solid Waste (OSW)/National Association of Home Builders (NAHB) Research Center program) to develop a local green builder program model.

4. Create a recognition program for integrated-design buildings. Highlight buildings built with whole-systems design, including

schools, office buildings, and low– and moderate–income housing. Assist in developing an industry organization or an independent authority to establish and oversee a recognition program that directs potential consumers to the benefits offered by the building's good IEQ. Integrate these efforts with existing green buildings efforts.

D. Develop university and continuing education curricula.

Develop curricula and work with state licensing agencies to incorporate integrated design standards and continuing education requirements for designers, architects, engineers, and health professionals. Begin a certification process for companies and individuals for added marketability and develop a mechanism for recognition and price differentiation in the marketplace. Develop integrated design components for existing professional training programs. Partner with state contractor licensing organizations, builders, remodelers, and other industry groups to promote integrated design standards.

POTENTIAL ACTIONS FOR GOAL 3

GOAL 3

Stimulate Nationwide Action to Enhance Health in Existing Structures

The indoor environments of existing structures must also be considered. Each year, the inventory of existing buildings grows both older and larger. From the point of view of human health, therefore, it is important to improve the indoor environmental quality of existing buildings so that virtually everyone lives and works in healthy surroundings.

Because industrial environments are unique and, for the most part, well-regulated, our efforts focus on non-industrial buildings of all types. These non-industrial buildings range from single-family, owner-occupied structures to large multi-tenanted residential buildings; from small retail establishments to large office buildings; from hospitals to prisons to schools.

Several types of initiatives can combine to improve IEQ in existing buildings. Guidelines can be developed and promoted for improving IEQ in routine remodeling and repairs. Standards of care and livability for healthy building operation and maintenance can be institutionalized. Research can support the development of guidance and make outreach programs more effective. Education and training programs can ensure that those responsible for managing and maintaining buildings have the ability to perform their work. Better measures of building performance and recognition programs can heighten awareness of the issue in general and the status of particular buildings. Enhancements to energy efficiency can be made in tandem and can often pay the bill for IEQ improvements.

A. Identify and fill knowledge gaps for the full range of existing buildings.

   Buildings of interest cover a wide spectrum and can include residences, hospitals, and hotels.

   1. Develop and carry out a data inventory analysis and a research agenda in the following areas:

      - Current IEQ in non-office buildings. (EPA has recently completed the data collection phase of a baseline study of office buildings.)
      - Short–and long–term costs and benefits of good IEQ, including such factors as improved health (and health costs), energy, productivity, absenteeism, cost of law suits and worker's compensation, tenant

turnover/retention, fire susceptibility, equipment life expectancy, sale of homes, rental rates, costs of implementing guidance, and assessment of the market value for a "healthy building."

- IEQ diagnostic protocols and detection technologies.
- Building ventilation control technologies that are most effective from IEQ and energy standpoints.
- Building maintenance protocols and their impact on IEQ, including cleaning and maintenance products.
- Building IEQ remediation protocols.

2. Target a building with stable historical data and identify stakeholders who can study the effectiveness of EPA's guidance in improving IEQ and its effect on health, including quantifying effects through health insurance claims, sick leave, and productivity gains and losses.

B. Develop and promote excellent IEQ standards of care.

1. Work with stakeholders to facilitate the creation of integrated IEQ standards of care for different building types, taking into account the interrelated roles and responsibilities of building owners, managers, occupants, and tenants.
2. Procure a Presidential Executive Order requiring existing federal buildings (both owned and leased) to comply with integrated IEQ standards of care.
3. Encourage the adoption of IEQ standards of care in mortgage and insurance policies and rates, hospital certification, voluntary practice guidelines, and building codes.
4. Develop a voluntary Building Coalition dedicated to promoting the adoption of IEQ standards of care. The Coalition could: develop an outreach mechanism/tool to encourage adoption, including the development of training outlined below; create a building recognition

program; manage the development of the IEQ performance index; and serve as the focal point for future progress on IEQ in existing buildings.

5. With stakeholders, develop training and other tools to educate various audiences on IEQ standards of care. Promote adoption by institutions that educate architects, engineers, home inspectors, and other building professionals, and as continuing education or a prerequisite for certification by professional organizations. Promote education and training programs to ensure that building managers and engineers, maintenance and custodial workers, trash handlers, pest management contractors, recyclers, and others who contribute directly to maintaining indoor environments have the information and capabilities they need for carrying out their work. Ensure that training and other tools reach other IEQ service providers, local health officials, and residential audiences.

C. Develop specific guidance documents for critical junctures in the life cycle of existing buildings.

1. Improve the indoor environment and educate people about the IEQ effects of decisions and activities that may result in increased hazards, including disturbance of asbestos and lead paint. Key events may occur:

   - During remodeling
   - At sale of building/home
   - At building commissioning and decommissioning
   - During annual safety inspection
   - During tenant improvement projects
   - During building recertification
   - After flooding/fire/storms

2. Develop outreach programs to encourage people to take action.

D. Develop metrics for a performance-based building rating/certification program.

1. Facilitate stakeholder development of an IEQ performance metric for different building types that utilizes research done under other action items elsewhere in this plan (e.g., baseline data on IEQ, health effects data, cost/benefit information).

2. Facilitate the establishment of a performance-based rating/certification program that utilizes an IEQ performance metric and baseline data to develop a voluntary performance standard or threshold and a verification protocol. Promote this program to building owners, insurers, occupants, government officials, and consumers using a variety of success stories.

E. Provide information targeted to do-it-yourselfers.

Work in partnership with major hardware retailers, and other organizations that target do-it-yourselfers, to include point-of-purchase displays, print advertising, promotion of products meeting good IEQ standards, and homeowner on-line workshops with IEQ experts. Focus materials and activities on raising homeowner awareness of good renovation design for IEQ.

F. Develop homeowner/tenant checklists.

Develop instruments that allow homeowners/tenants to do their own IEQ self audits which identify issues in the home and stress the importance of proper cleaning and maintenance of home appliances. Develop and implement a strategy to disseminate these checklists widely.

POTENTIAL ACTIONS FOR GOAL 4

GOAL 4

Create and Use Innovative Products, Materials, and Technologies

The products, materials, and technologies that we use inside our buildings are another potential source of indoor environmental problems. A key component for achieving building improvements is the use of building materials, during construction and renovation, which produce low levels of any potentially harmful emissions.

Many strategies are available to accelerate the innovation of products, materials, and technologies. The most fundamental approach is to develop a reliable emissions testing system, to perform comparative risk assessments, and to develop voluntary, consensus-based guidelines and standards to assist in the evaluation of products, materials, and technologies. The results of standardized testing can be used to develop low-toxicity products that are competitively priced with conventional products and can serve as a basis for developing information to assist consumers in making informed choices among products, materials, and technologies used indoors.

Voluntary guidelines and standards for products, materials, and technologies can take many forms. For example, guidelines or standards might ask a manufacturer to provide emission levels from a product for comparative purposes with other similar products, or they may set a level above which a product is regarded as "unsafe." They may also ensure the appropriate use of products (e.g., labeling on the use of adequate ventilation or limiting the use to certified applicators). In addition, certain industry members who perform well in reducing emission levels may be recognized under a program similar to the EPA Green Lights® or Energy Star® programs.

While the first line of defense is to prevent pollution by controlling sources of indoor pollutants, rapid progress is also needed in monitoring and control technologies. Low-cost sensors and test kits, for example, will eventually make it possible for nearly everyone to assess their risks indoors. Improvements are needed in technologies to "clean" air and to increase ventilation efficiency in buildings.

A. Further develop tools to prioritize our efforts to reduce risks from sources and pollutants indoors.

   In consultation with all interested stakeholders, continue developing and using tools to prioritize those products and materials that may present the greatest exposures and risks to human health indoors. This prioritization should address both the health risks and potential benefits of the products and materials. Continually review and update the tools as new information becomes available on product formulations and emissions, exposure data, and toxicity information.

   1. Work with all interested stakeholders to collect and compile additional existing data to assist in this prioritization.

   2. Seek input, through stakeholder workshops, on those priority consumer products and building materials that, based upon the best available data, have the largest relative impact on health in indoor environments based on both chemical and biological contaminant emissions.

   3. In the interest of the public's right to know, make summaries of the publicly available chemical formulations in product categories available through a web page and prepare chemical exposure and toxicity fact sheets for the chemicals and product categories that are accessible through this web page.

B. Document and evaluate state-of-the-art sensors, test kits, and indoor-related prevention and control technologies.

   1. Survey, monitor, document, and assess the status and progress of technologies based on efficacy, health impacts (e.g., enhanced growth of microorganisms, chemical emissions), and cost; identify the trends, technical issues, and needs of future development.

   2. Publish and periodically update this analysis in a database, by technology type; use the database as a source of information on current technologies and as a measurement tool to assess progress in stimulating research and development to improve these devices.

C. Perform comparative exposure and risk assessments on products and materials.

1. Provide leadership in working with outside stakeholders to establish an exposure and health risk assessment methodology for consumer products and building materials used indoors that would address the total health impacts of products, including beneficial impacts (e.g., disinfection).

2. Develop consensus on the general methods to be used to consider relevant information, including:

   - Data on all routes of exposure (nasal, inhalation, dermal, and oral) and their comparative importance.
   - The effects of indoor sinks and interactions of multiple pollutants from multiple sources on indoor exposure levels.
   - Both toxicological and sensory health impacts.
   - Evaluation of dose-response relationships.

D. Develop product testing protocols.

1. Establish a standardized, consensus-based generalized emissions testing system with stakeholders, so that the potential exposure and health risk of most consumer products and building materials can be assessed. Develop and validate low-toxicity products using the testing and assessment system.

2. Assist stakeholders in developing standardized, consensus-based emissions testing and risk assessment systems specific to their products or materials and in promoting the concept of low-toxicity products and materials.

E. Work with stakeholders and outside standard-setting organizations to develop voluntary, consensus-based standards and guidelines.

   1. Develop standards or guidelines for emissions levels of chemicals from products and materials used indoors by convening a dialogue to set consensus-based ground rules that can be used by organizations outside the federal government to develop standards and guidelines.

   2. Develop guidance on safe levels of pollutants in indoor environments to assist in the development of sensor and control technologies.

   3. Develop standards or guidelines to evaluate the efficacy, reliability, and cost-effectiveness of new technologies used to monitor or control pollutants (e.g., sensors, air cleaners).

F. Provide market incentives to drive manufacturers to develop both new products and new technologies.

   The incentives will provide for healthier indoor environments and will not compromise other aspects of environmental performance. EPA will lead other stakeholders in working with a wide range of consumers to direct demand toward healthier indoor products and technologies.

   1. Focus on creative market incentives such as those derived from financing and insurance mechanisms (e.g., discounts in health insurance rates for people who live in homes with healthier indoor environments).

   2. Work with institutional buyers within the federal government and elsewhere (e.g., hospitals, schools and universities, retail sector) to increase demand for cleaner indoor products through individual pilot projects focusing on specific products or materials. Establish bidding procedures for manufacturers to compete on the basis of both price *and* emissions to ensure lower emissions at reasonable prices. Develop a database and communications program to collect

the experience and bid results from participants and to communicate information on technical feasibility and cost to spur new buyer membership and competition by manufacturers.

3. Periodically survey the market to gauge the extent to which demand rises for cleaner products and the extent to which that demand is leading towards improvements in products and technologies.
4. Develop and implement a healthy products award program to recognize companies that develop, market, or purchase cleaner indoor products.
5. Provide programmatic grants to product manufacturers and other parties to develop low-emitting or low-toxicity products that are less problematic from a public health perspective.
6. Promote IEQ-friendly products through the development of planning and sales software for building contractors. Integrate this effort with the Office of Prevention, Pesticides, and Toxic Substances' Environmentally Preferable Products program.
7. Make cost-effective IEQ monitors and control technologies a standard feature.
    a. Identify stakeholders to popularize the standard use of basic detection systems for home and work and help develop a clearinghouse for appropriate sensor and mitigation technologies.
    b. Fund an effort, possibly through programmatic demonstration grants, to integrate reliable indoor sensor technologies with environmental controls (i.e., "smart" building systems) in institutional settings, such as offices, hospitals, schools, and prisons, as a means to create an awareness of indoor pollutants and demand for a healthier indoor environment.

c. Integrate available and reliable indoor sensor technologies with environmental control systems in residential settings to create consumer demand for healthier indoor environments.

d. Initiate a field study to evaluate commercially available indoor pollutant monitors and control devices for both performance and practicality.

e. Assure federal adoption of new systems.

G. Work with interested stakeholders to develop and disseminate product labels, instructional materials, enhanced material safety data sheets, and product specifications that will allow for the incorporation of a broad spectrum of environmental and performance information. These materials can be used by consumers to select the best products, materials, and new technologies for use indoors.

1. Encourage consumers to make informed choices when deciding what products, materials, and technologies to purchase for use indoors, as well as how they should be used.

2. Collect background research and conduct individual interviews and focus group discussions to develop specific recommendations for the type and design of user information to enable consumers to weigh environmental impacts indoors, as well as product performance and beneficial aspects, in purchasing decisions for both products and new technologies.

3. Develop appropriate user information, which focuses on reducing human health risks in the indoor environment and includes information on the beneficial aspects and performance characteristics of the products and materials. Convene all interested stakeholder groups, including industry, institutional purchasers, and organizations experienced in providing user information for priority indoor products, technologies, and services.

POTENTIAL ACTIONS FOR GOAL 5

GOAL 5

Promote Health-Conscious Individual Behavior and Consumer Awareness

More health-conscious individual behavior can create healthier indoor environments. In an ideal situation, nearly everyone sees indoor environmental quality as important for health and most people know how to get information they need. For individuals to engage in health-conscious behavior regarding their indoor environment, they must be informed, have the tools necessary to act, and believe their actions will result in a benefit to their health, lifestyle, or productivity.

Improving indoor environmental quality and reducing the health risks of serious indoor environmental problems will require millions of self-initiated actions by individual home dwellers, building owners and managers, parents, school officials, real estate professionals, and other key target audiences. Effective programs to achieve this mission must emphasize communication and outreach to catalyze and influence actions by the millions of individuals who make decisions affecting indoor environments.

The following list of specific recommended initiatives uses a variety of targeted approaches for encouraging health-conscious individual behaviors to improve the indoor environment. As further research into indoor environmental health risks and mitigation strategies is conducted, new initiatives to encourage health-conscious individual behaviors will be developed.

A. Initiate a campaign to educate society's leaders on IEQ.

   1. Work with private sector leaders and public policy makers at the federal, state, and local levels to demonstrate the significance of the indoor environment and the cost-effective benefits of improved conditions in homes, schools, workplaces, and public buildings.

   2. Develop a highly-targeted campaign aimed at encouraging society's leaders to understand the following key facts about indoor environmental quality:

      - People spend 90 percent of their time indoors.
      - Indoor environmental problems are high risk.
      - There are cost-effective solutions to many IEQ problems.

- Research is needed to improve our understanding of how to prevent IEQ problems.

3. Reach out to scientists, influential medical centers, high-level health officials, state legislators, tribal leaders, private sector executives, influential state and local officials, and other key opinion leaders. Use a variety of targeted channels ranging from scientific journals to the mass media, including articles in popular publications and airline flight magazines, speakers at key conventions, and feature segments in TV programs and Sunday morning talk shows. Conduct these activities in partnership with key stakeholders.

B. Create a healthy children program.

1. Protect children from asthma by reducing the degree to which indoor environmental conditions contribute to the rate and severity of asthma in children. Work in close partnership with other federal agencies to: integrate prevention messages into existing treatment messages; emphasize innovative outreach in homes; use schools to deliver proven asthma prevention and management messages to children of preschool and primary school age; track the effectiveness of these school interventions; leverage the existing health care system to reduce costs by promoting asthma prevention and management education; and employ cutting-edge mass media approaches to raise parent and child awareness and induce health-promoting behavioral changes.

2. Develop an action campaign to improve the indoor environments of children. Form a cross-government team, including EPA representatives from OPPTS, OAR, and the Office of Children's Health Protection (OCHP), to improve the indoor environments of children in homes, day care facilities, and schools. Work with stakeholders to educate parents, day care providers, child health care providers, and school officials on the benefits of reducing children's exposure to lead, secondhand smoke, radon, allergens, pesticides, and other harmful indoor pollutants. Explore partnerships with health maintenance

organizations (HMOs) to encourage participating physicians to include environmental factors in checkups. Explore mechanisms for incorporating environmental factor training into medical school programs for patient background, screening, and diagnosis.

3. Initiate a three- to five-year campaign to reduce minority children's exposure to indoor environmental tobacco smoke using transit and other media appropriate to minority audiences. Expand existing media campaigns to include TV, radio, print, transit, billboard, and other materials targeted specifically to minority populations.

4. Educate children on indoor environmental risks by teaming with stakeholders to develop curricula, science lessons, teaching modules, and other mechanisms for mainstreaming indoor environmental subject matter into the Nation's formal education system. Teaching children about the importance of the indoor environment to human health will help to ensure health-conscious behaviors in two long-term ways: (1) by developing an awareness of how the indoor environment impacts health and productivity so that children will ultimately be better managers of their own indoor environments as adults and (2) when children adopt environmentally conscious behaviors, the adults in their lives often emulate those behaviors (e.g., recycling).

C. Ensure consumers are well-informed.

1. Take a comprehensive approach to the real estate sector, which provides a critical link to achieving measurable risk reduction on radon, carbon monoxide, lead in paint, asbestos, underground storage tanks, and drinking water. Agents, brokers, home inspectors, attorneys, mortgage bankers, and other real estate professionals are uniquely positioned to assist consumers in making informed decisions about correcting environmental problems before they purchase commercial and residential properties. Collaborate within EPA to develop and implement a cross-Agency strategy and workgroup, integrated public information materials, information clearinghouse, web site, one-stop environmental real estate hotline, and outreach partnerships with each of the major seg-

ments of the real estate professions. Engage other federal institutions (e.g., the Department of Housing and Urban Development, the Veteran's Administration (VA), Fannie Mae, Freddie Mac) to coordinate environmental requirements.

2. Publish "50 Things You Can Do to Improve Your Indoor Environment." Develop and promote clear and consistent messages on indoor environmental concerns and questions frequently asked by the public. Prepare and distribute these as concise, easy-to-use materials in multiple formats (web page, consumer advice booklet, magazine article) which clearly explain what people can do now to improve their indoor environments.

3. Encourage more informed consumer product purchasing. Engage the private sector and other concerned federal agencies in designing ways to educate consumers about how to purchase products wisely and use them with appropriate care. Consumers infrequently read product labels before using the contents and often disregard important manufacturer's instructions concerning safe use of the product. Likewise, product labels lack uniformity in the way safety and use instructions are presented. Directions such as "use with adequate ventilation" are subject to broad interpretation.

4. Initiate a consumer campaign to improve indoor workplace environments. With groups like the Occupational Safety and Health Administration (OSHA) and organized labor, develop a comprehensive information campaign to educate the public about the straightforward, cost-effective actions that can be taken to improve indoor air quality in workplaces. Adjuncts to the campaign could include a toll-free hotline number, web site, or other places where building occupants, as well as owners and operators, can receive information and resource materials.

D. Provide for healthy home care.

1. Encourage broad-based public information programs and campaigns on household cleaning and maintenance that combat indoor environmental hazards. For example, expand the Master

Home Environmentalist (MHE) Program nationwide. A small pilot program that has successfully demonstrated a change in behavior, the Master Home Environmentalist Program is a hands-on, tuition-free program that teaches people about the indoor environment in return for their commitment to teach others. Topics include ways to reduce tracking soil containing lead and pesticides into the home; proper vacuuming techniques and how to evaluate the effectiveness of vacuum cleaners; safe methods to dispose of household waste; ways to identify and fix problems related to moisture indoors; and ways to reduce bioaerosols, dust mites, bacteria, and fungi indoors.

2. Make accurate information available to the public on air cleaning and filtration equipment. Working with public and private sector stakeholders, ensure that accurate information is available to the public so consumers can make wise choices when considering air cleaning and filtration equipment. Establish a system to prevent false advertising of indoor air cleaning devices, and design a means of assessing the safety and effectiveness of new devices.

3. Establish an educational mini-grant program on moisture control and the use of microbe-resistant building materials, especially for low-income populations in high-humidity regions. Coordinate with existing educational programs on moisture-related illnesses such as asthma and Legionnaires' disease.