

National Conversation on Public Health and Chemical Exposures

Action Agenda

Draft

December 20, 2010

NOTE: This report was developed as part of the *National Conversation on Public Health and Chemical Exposures*. This is a voluntary, independent process involving multiple sectors, which was facilitated by RESOLVE, a neutral non-profit consensus building organization. This DRAFT report is a staff version, prepared from deliberations of the Leadership Council for the purpose of gaining additional public comment. This draft does not reflect a consensus of the Leadership Council. *[to be added when consensus is reached: Consensus is defined as each member being able to “live with” the report taken as a whole, rather than as agreement with each recommendation.]* Members of the Leadership Council were asked to participate as individuals, rather than on behalf of their organizations or constituencies. Recommendations for action are directed to a wide range of public and private actors, who have full latitude to consider them through the appropriate decision making procedures for implementing changes within their organization. While federal participants were involved with their agencies’ knowledge and provided important insights into the role of the federal government in addressing chemical exposures, their membership on the Leadership Council or work group does not constitute agency endorsement of the recommendations. The Centers for Disease Control and Prevention’s National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry provided funding for the facilitation, member travel, meetings, Web dialogues, community conversations, and other costs associated with the *National Conversation*. This report does not necessarily reflect the views of the Centers for Disease Control and Prevention, the Agency for Toxic Substances and Disease Registry, RESOLVE, or other organizations involved in the *National Conversation*.

List of U.S. Government Agency Acronyms

AHRQ – Agency for Healthcare Research and Quality
ATSDR – Agency for Toxic Substances and Disease Registry
CDC – Centers for Disease Control and Prevention
CPSC – Consumer Product Safety Commission
EPA – Environmental Protection Agency
DHS – Department of Homeland Security
DOD – Department of Defense
DOE – Department of Energy
FDA – Food and Drug Administration
FEMA – Federal Emergency Management Agency
FOH – Federal Occupational Health
HHS – Department of Health and Human Services
HRSA – Health Resources and Services Administration
HUD – Department of Housing and Urban Development
NCEH – National Center for Environmental Health
NIEHS – National Institutes of Environmental Health Sciences
NIH – National Institutes of Health
NIOSH – National Institute of Occupational Safety and Health
NLM – National Library of Medicine
OSHA – Occupational Safety and Health Administration

Table of Contents¹²

Table of Contents	3
Introduction.....	11
Chapter 1: Improving Public Health through Prevention	14
Featured Recommendations.....	15
Recommendation 1.1: Federal, state, tribal and local government agencies should promote the substitution of hazardous chemicals with less toxic alternatives, through use of policy incentives, investment in research and development, and enhanced efforts to develop effective hazard screening methods.	15
Recommendation 1.2: Reform the Toxic Substances Control Act (TSCA) to facilitate prompt action to eliminate or reduce harmful exposures to toxic chemicals.	17
Recommendation 1.3: All executive and legislative branches of federal, tribal, state, and local governments should improve child health protections by requiring that the unique vulnerabilities, susceptibilities and exposures of children be explicitly considered and that protection of health of vulnerable populations is foremost in all policies and practices. Congress should enact statutory language to make permanent the Federal Interagency Task Force on Children’s Environmental Health, the Children’s Health Protection Advisory Committee (CHPAC), and the Office of Children’s Health Protection (OCHP).	18
Additional Recommendations.....	19
Recommendation 1.4: Federal agencies should work in consultation with the private sector to develop standard, scientific protocols for alternatives assessment to support their use in promoting the development of safer chemicals and products.....	19
Recommendation 1.5: NIOSH and OSHA should improve worker protection from chemical exposures by strengthening health-based exposure recommendations, improving hazard communication, and encouraging adoption of a chemicals management systems approach to purchasing, using, and disposing of chemicals.	20
Recommendation 1.6: Federal agencies should ensure effective compliance and enforcement of industrial and federal facilities and agricultural operations with environmental health regulations, laws and policies.	21

¹ For ease of navigation, you can point your cursor to a portion of the table of contents, press –control + click” at the same time, and it will take you directly to that page.

² Some references in this document may be missing or incomplete.

Recommendation 1.7: Federal agencies should work in consultation with the private sector to develop scientific criteria for the application of the precautionary approach, in order to better protect human health and the environment. 21

Recommendation 1.8: Federal agencies should work in consultation with the private sector to improve and adapt the procedures for conducting quantitative risk assessment so that they are compatible with and integrated within an overarching precautionary paradigm for decision-making, as well as with other decision-making paradigms for regulating toxic substances and protecting public health. 22

Recommendation 1.9: Federal agencies should put increased emphasis on public health principles and establish a coordinated health infrastructure across the federal government. 23

Conclusion 23

Chapter 2: Collecting and Using Information on Chemicals and Population Health to Enable Effective Public Health Protection 24

Featured Recommendations 25

Recommendation 2.1: CDC/ATSDR, the (EPA), and local communities and governments should expand health outcome surveillance to over-sample vulnerable populations and high-priority geographic regions in national data surveys, to include conditions with environmental links as reportable conditions, and by developing nationally compatible health data sets that are accessible through a single portal..... 25

Recommendation 2.2: CDC/ATSDR, EPA, OSHA, state and local governments and academia should expand biomonitoring capacity and use population-based biomonitoring data as a tool to set priority strategies to reduce harmful levels of environmental chemicals identified in people..... 26

Recommendation 2.3: Federal agencies should work with tribal, state and local governments to improve reporting of chemical source, use, and discharge information, to increase the frequency of manufacturing volume reporting and to address Toxics Release Inventory (TRI) shortcomings thereby making monitoring more comprehensive and suitable for assessing risks associated with human chemical exposure. 27

Additional Recommendations 29

Recommendation 2.4: CDC/ATSDR, states and localities should expand environmental public health tracking and state-based occupational health surveillance to include all fifty states and ten metropolitan statistical areas 29

Recommendation 2.5: Federal agencies, tribes, states and localities should standardize and integrate data collection and interpretation 29

Recommendation 2.6: Federal agencies, tribes, states and localities should establish mechanisms for the public and state/local/tribal officials to provide input into data collection efforts in both national data collection efforts and local community study design. 29

Recommendation 2.7: Federal agencies should expand development of diagnostic tools and biomarkers related to chemical exposure..... 30

Recommendation 2.8: The CDC and/or ATSDR should establish a standard process for governmental agencies to assess community and occupational health and potential synergistic, cumulative, and aggregate environmental factors..... 31

Conclusion 32

Chapter 3: Achieve a More Complete Scientific Understanding of Chemicals and Their Health Effects . 33

Featured Recommendations..... 33

Recommendation 3.1: Federal agencies should identify and evaluate hazards of chemicals and their potential alternatives more quickly through encouraging expanded use and further development of modern molecular biology techniques, computational systems biology, and other novel approaches. 33

Recommendation 3.2: Federal agencies should develop a targeted set of toxicological, epidemiologic, clinical, chemical use, chemical transport and exposure data needed to fill data gaps in the scientific knowledge of the health risks of chemicals and prioritize chemicals of concern for further assessment of hazardous exposures and safer alternatives..... 35

Recommendation 3.3: Develop standard protocols and tools to characterize potential human exposures to chemicals across the life cycle of chemical products and processes, and across the human life stages..... 36

Additional Recommendations..... 37

Recommendation 3.4: Federal agencies should lead an effort to improve knowledge of existing databases and increase the accessibility of information across multiple databases. 37

Recommendation 3.5: Improve understanding of individual susceptibility to chemical exposures. 38

Recommendation 3.6: Identify and define gene-environment interactions as they relate to chemical or environmental exposure and social and lifestyle factors. 38

Recommendation 3.7: Identify adverse health effects from indoor air pollutants, including mold and mycotoxins, and improve scientific knowledge of these effects with a focus on the linkage to neurologic, mental health, endocrine and immunologic diseases. 39

Recommendation 3.8: CDC should establish an independent body consisting of scientists, epidemiologists, health care providers, state agency experts, and community and environmental health leaders to 1) review the limitations and effectiveness of ATSDR’s scientific methods of investigating the public health impacts of community-wide exposures to toxic substances and 2) recommend revisions in their procedures for conducting Public Health Assessments, disease cluster investigations, epidemiological studies and exposure investigations with the goal of instilling in the agency a broader public health focus that will allow it to more effectively investigate and address community toxic hazard exposures. 39

Conclusion 40

Chapter 4: Promote Health and Wellness in Communities Affected by Environmental Exposures 41

Featured Recommendations..... 42

Recommendation 4.1: EPA and ATSDR, in cooperation with other relevant federal, tribal, state, and local agencies, should take clear and immediate actions to better protect communities disproportionately affected by chemical exposures. 42

Recommendation 4.2: Congress should strengthen ATSDR’s public health mandate and mission. To this end, CDC should establish an independent body consisting of scientists, epidemiologists, health care providers, state agency experts, and community and environmental health leaders to recommend changes that would broaden the scope of public health actions ATSDR can take to: 1) address environmental health problems in communities and other populations affected by environmental exposures, 2) more effectively build capacity among communities and local health departments to address environmental health problems and effectively engage in public decision making, and 3) establish thresholds that trigger appropriate public health protective actions. Once the review is completed, Congress should amend the agency’s mandate accordingly and ATSDR should implement it..... 43

Additional Recommendations..... 46

Recommendation 4.3: HHS should establish and support an Interagency Working Group on Environmental Public Health to coordinate across government agencies and improve communication with and accountability to communities. 46

Recommendation 4.4: The NIH/NIEHS, CDC/ATSDR, EPA, state and local health departments, tribal nations, and the Indian Health Service should identify and define vulnerability characteristics of communities in terms of both structure and function, as well as their influence on increasing susceptibility to environmental chemical exposures. 46

Recommendation 4.5: CDC/ATSDR, EPA, tribal governments, and relevant federal, state, and local agencies should create agency-tribal partnerships focused on population health monitoring, tribal capacity-building and improved access to state and federal data sources..... 47

Recommendation 4.6: Federal agencies, should establish, facilitate, promote, and expand upon training programs for government employees, community groups/residents, academia, industry, and volunteers to develop and advance their capacity to ensure the success of community-engaged environmental health projects. 47

Conclusion 48

Chapter 5: Strengthen the Public’s Ability to Participate Effectively in Environmental Health Decision-making 49

Featured Recommendations..... 50

Recommendation 5.1: EPA, CDC/ATSDR/NCEH, NIEHS, NIOSH and OSHA should convene a multi-stakeholder group to identify and elaborate the essential elements of an effective multidirectional communication model for government agencies involved in chemicals and public health and develop guidelines and processes to effectively integrate this model into agencies’ standard operating procedures. 50

Recommendation 5.2: Federal agencies should collaborate with state agencies, industry, academia, and NGOs to improve the public availability and clarity of chemical information on all products throughout the supply chain, from initial chemical manufacturer and/or formulator to final article/consumer product..... 51

Recommendation 5.3: The Department of Education, CDC/ATSDR, NIEHS, EPA, academic institutions, and localities should convene a multi-state collaboration to develop 21st century human, environmental and occupational health education to: 1) assure grade-appropriate, general understanding throughout K-16; and 2) integrate mechanistic toxicology and environmental impact science into curriculum requirements for chemistry and chemical engineering degrees at both undergraduate and graduate levels. 52

Additional Recommendations..... 53

Recommendation 5.4: The NLM’s Toxicology and Environmental Health Information Program should develop a comprehensive online portal to provide information to the public on health and chemical exposures. 53

Recommendation 5.5: Increasing public access to data by 1) undertaking a NAS study to resolve the issue of the appropriate balance between confidentiality and data quality; 2) ensuring that respondents have access to data collected on them; and 3) establishing an ATSDR clearinghouse for quality local studies of chemical exposures. 54

Recommendation 5.6: Federal agencies should build public trust in government studies, publications, and communications by 1) developing and enforcing clear guidelines for scientific research involving chemical exposures and 2) creating an ombudsman position with the authority to investigate any allegations of scientific misconduct with regard to government studies. 55

Conclusion 56

Chapter 6: Strengthen the Capacity of the Public Health and Health Provider Work Force to Address the Needs of People Exposed to Harm from Chemicals..... 57

Featured Recommendations..... 57

 Recommendation 6.1: Health professional organizations and relevant federal agencies e.g., CDC/ATSDR, EPA, and HHS) should collaborate to better incorporate environmental and occupational health competencies into formal health professional education. 57

 Recommendation 6.2: Relevant federal, tribal, state, and local agencies, NGOs, and academic institutions should collaborate to educate, mentor, and hire environmental and occupational health professionals committed to and/or coming from under-resourced and historically marginalized communities and their institutions by creating pipeline of experiential learning opportunities for students at all levels. 58

Additional Recommendations..... 59

 Recommendation 6.3: The Public Health Accreditation Board (PHAB) should include strong standards in their national accreditation program to advance the capacity and competence of public health agencies to succeed in environmental public health work and CDC and EPA should endorse and support them. 59

 Recommendation 6.4: The Institute of Medicine should convene experts from primary care and environmental and occupational health specialties to develop specialty-specific clinical practice guidelines for addressing chemical exposures. 60

 Recommendation 6.5: The National Public Health Training Centers Network; HRSA; CDC/ATSDR; the National Environmental Health Association; state and local public health agencies; and other accrediting organizations should maintain and expand opportunities for the professional development of the environmental public health workforce through credentialing and government training and education programs..... 60

 Recommendation 6.6 : CDC, specifically NCEH and ATSDR, and HRSA should encourage and support the incorporation of environmental health services into reimbursable primary and specialty health care services and the creation incentives for change in clinical practice through expert consultation. 61

Conclusion 62

Chapter 7: Reduce harm from chemical emergencies through prevention, planning and coordination 63

Featured Recommendations..... 63

Recommendation 7.1: DHS should work with HHS to provide a single set of federal priorities related to chemical emergency planning and preparedness that 1) supports hands-on, real-time training, including functional drills, to support local interagency emergency response to chemical events; and 2) provides all first responder and first receiver organizations with a core competency curriculum of training on basic chemical emergency response, communication and coordination of the prevention, planning, response and recovery phases to ensure that there is a common foundation on which all further training can be based. 63

Recommendation 7.2: OSHA, EPA, and NIOSH, together with other federal and state response agencies, need to develop clear, easy-to-understand chemical emergency guidance values, which better represent real-life risks incurred by first responders at chemical emergencies. These values should protect responders according to the hierarchy of controls..... 65

Recommendation 7.3: ATSDR, HRSA, the HHS Office of the Assistant Secretary for Preparedness and Response, and other federal government agencies, should develop an ongoing national program to assess and improve the health care response to hazardous chemical releases, and to develop an evidence base for chemical emergency planning 65

Additional Recommendations 67

Recommendation 7.4: A Presidential Executive Order or Homeland Security Presidential Directive should be established that calls for the development of an overarching national vision for chemical emergencies and for each federal agency to develop its own supporting strategy for preventing, preparing for, responding to, recovering from, and mitigating chemical emergencies, and ensuring that preparedness momentum is maintained. 67

Recommendation 7.5: The federal government should establish an office or program whose goal would be to serve as a coordinating unit, unifying and integrating the efforts of federal, state, local, and tribal government agencies with responsibilities related to preventing, preparing for, responding to, recovering from, and mitigating chemical emergencies, and serving as a central coordinating program charged with creating consistency and avoiding redundancy of information on chemical emergencies on the national, state, local, and tribal levels. 68

Recommendation 7.6: DHS should support the NLM and EPA in developing a single, user-friendly, accessible planning tool for toxicological hazard and hazard vulnerability analysis (HVA) for local response to chemical emergencies. 69

Recommendation 7.7: Federal government agencies with responsibilities for providing applied research funding and other funding to tribes and state and local government agencies on chemical emergencies should require that relevant funding announcements include language strongly encouraging the development of partnerships with non-governmental organizations (NGOs), community-based organizations, academia, labor unions, and industry. 69

Recommendation 7.8: The federal government should provide funding and support for the ongoing development of a cadre of trained and experienced Emergency Support Function 8 (ESF 8 health and

medical) planners and responders who will improve emergency operational capabilities and critical decision-making, and also better integrate the tiers of private sector and government responses to public health emergencies during chemical disasters/events. 70

Conclusion 70

DRAFT

Introduction

The National Conversation on Public Health and Chemical Exposures is grounded in the vision that the United States will use and manage chemicals in ways that are safe and healthy for all people. That fact that this effort complements the work of others across the United States underscores the importance of joining in common purpose to further define this vision, recognize the notable accomplishments that have been achieved, express concerns about how far we still are from achieving what is needed, and make a concerted call for action.

Through the National Conversation, public health professionals and others bringing the experience and perspectives of government, communities, business, NGOs, and academic institutions, learned from one another and produced this action agenda.³

NCEH/ATSDR initiated the *National Conversation on Public Health and Chemical Exposures* to identify gaps, emerging priorities, and solutions to strengthen the public health approach to chemical exposures. The *National Conversation's* initial focus was on key public health functions, including, but not limited to, those for which NCEH/ATSDR shares some responsibility. The project began with a kick-off meeting in June 2009 involving over 400 participants from multiple sectors; the project included numerous opportunities for the public and environmental health experts to engage in expert work groups, meetings and listening sessions, web-based discussions, and community-based conversations. NCEH/ATSDR would like to acknowledge the Association of State and Territorial Health Officials (ASTHO), the National Association of County and City Health Officials (NACCHO), and the American Public Health Association (APHA), for their leadership in organizing some of these activities. The approximately 150 individuals who devoted their time to work groups played a particularly

³ This report was developed as part of the *National Conversation on Public Health and Chemical Exposures*. This is a voluntary, independent process involving multiple sectors, which was facilitated by RESOLVE, a neutral non-profit consensus building organization. This DRAFT report is a staff version, prepared from deliberations of the Leadership Council for the purpose of gaining additional public comment. This draft does not reflect a consensus of the Leadership Council. [to be added when consensus is reached: Consensus is defined as each member being able to “live with” the report taken as a whole, rather than as agreement with each recommendation.] Members of the Leadership Council were asked to participate as individuals, rather than on behalf of their organizations or constituencies. Recommendations for action are directed to a wide range of public and private actors, who have full latitude to consider them through the appropriate decision making procedures for implementing changes within their organization. While federal participants were involved with their agencies' knowledge and provided important insights into the role of the federal government in addressing chemical exposures, their membership on the Leadership Council or work group does not constitute agency endorsement of the recommendations. The Centers for Disease Control and Prevention's National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry provided funding for the facilitation, member travel, meetings, Web dialogues, community conversations, and other costs associated with the *National Conversation*. This report does not necessarily reflect the views of the Centers for Disease Control and Prevention, the Agency for Toxic Substances and Disease Registry, RESOLVE, or other organizations involved in the *National Conversation*.

important role in the deliberations that lead to many of the recommendations in this Action Agenda. Their reports can be found at <http://www.resolv.org/nationalconversation/>. The Leadership Council drew on these reports and other public and expert comments through web dialogues, community conversations, and expert meetings for this Action Agenda. A more detailed description of the timeline, process and components of the *National Conversation* will be added in an appendix to a subsequent draft.

Many organizations and individuals in addition to NCEH/ATSDR play important roles in protecting the public's health from harmful chemical exposures. Consequently, the action agenda that emerges from this process includes action each of us must take to strengthen the nation's approach in this area. More specifically, the audience for this action agenda includes the environmental public health community; policy makers and practitioners at the federal, state, and local levels; industry groups and individual businesses; labor organizations; research organizations; community and nongovernmental organizations; and the public at large. All interested stakeholders are encouraged to consider the suggestions for action, using the appropriate decision making procedures for implementing changes within their organization.

The actions recommended to achieve the vision seek to accomplish the following public health outcomes:

1. improving the public's health through prevention,
2. collecting and using information on chemicals and population health to enable effective public health protection
3. achieving a more complete scientific understanding of chemicals and their health effects
4. promoting health and wellness in communities affected by environmental exposures
5. strengthening the public's ability to participate effectively in environmental health decision-making
6. strengthening the capacity of the public health and health provider work force to address the needs of people exposed to harmful
7. reducing harm from chemical emergencies through prevention, planning and coordination

Success will require significant movement in new directions. While real public health achievements have occurred from the efforts of the past, we must learn from what has come before about what else is needed. We have learned that preventing harm is better than responding after it has occurred. Substitution of safer –green” products must be a priority, along with clear criteria and processes for determining that they are indeed safer. We have learned that some people are intrinsically more vulnerable than others to harm from chemical exposures, and that current tools are not yet able to produce sufficient information about variations in susceptibility to respond effectively. Improved information and tools for scientific understanding, such as those highlighted in the National Academy of Science's (NAS) report *Toxicity Testing in the 21st Century*, is a direction that must be accelerated. Some people also experience more exposures than others, which raises concerns about environmental justice. Access to information, empowered citizen engagement, and responsive action by public and

private entities can and does make a difference. These are key, cross-cutting themes in the chapters that follow.

Positive movement in these directions is underway. Bold action is needed to accelerate the achievement of needed results.

DRAFT

Chapter 1: Improving Public Health through Prevention

Preventing and eliminating problems at the source before harm occurs is a fundamental and proactive public health goal. Given that it is impossible to have full scientific certainty regarding public health risks, however, policymakers need decision-making tools that employ scientific rigor and encourage a common-sense, precautionary approach. The most widely-used definition of the precautionary approach comes from the Wingspread Statement on the Precautionary Principle, which states, "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (Wingspread Conference on the Precautionary Principle 1998).

Adequate protection of the public's health is hampered by deficient testing and information collection authority, fragmentation and segregation of critically related public health concerns into separate agency silos, lack of communication between agencies, limited transparency and accountability, inadequate funding, inappropriate placement of the burden to prove harm, and insufficient attention to the concerns of vulnerable communities.

A fundamental shift of emphasis is needed in our nation's approach to chemical exposures toward the development, adoption, and evaluation of safer alternatives. In determining the safety of chemicals, it is important to understand and address the potential impacts of chemical exposures on vulnerable populations. For example,, a threat of harm to human health or the environment may be of concern even if some cause-and-effect relationships are not fully established. While in previous decades toxicology and risk assessment focused on observable clinical and pathological manifestations in laboratory animals and humans, new scientific tools have emerged enabling the identification of more sensitive indicators of toxicity. These suggest new directions to explore for improving the scientific foundation for prevention

A common understanding of what is meant by prevention is needed Applying accepted public health definitions⁴ to chemical exposures, primary prevention focuses on preventing harm by eliminating and/or reducing the production or use of harmful chemicals and by spurring the development and diffusion of safer and healthier alternatives. Secondary prevention focuses on those policies and practices that address harm by reducing and controlling exposures to harmful chemicals, and tertiary prevention involves addressing harm caused by historic and continuing practices, by protecting the health of at-risk populations and contaminated communities. A new approach should prevent communities and individuals from experiencing harm and, if harm does

⁴ **Primary prevention** is generally defined as the elimination or reduction of causative factors for a health problem which can be considered a precautionary, yet practical approach; **secondary prevention** involves early detection and treatment of factors that can lead to harm and implementation of treatment or engineering control methods to minimize the potential for exposure or harm; and **tertiary prevention** entails providing appropriate supportive and rehabilitative services to minimize morbidity and maximize quality of life (CDC 1992).

occur, it should ensure they receive the help they need. Such an approach should also provide sufficient protection for children and other vulnerable populations. Implementation of the policy, science, education and public engagement recommendations in this and subsequent chapters of the Action Agenda would go a long way to shifting the approach in the United States to one of primary prevention.

Featured Recommendations

Recommendation 1.1: Federal, state, tribal and local government agencies should promote the substitution of hazardous chemicals with less toxic alternatives, through use of policy incentives, investment in research and development, and enhanced efforts to develop effective hazard screening methods.

Phase out and replacement of hazardous chemicals and processes with safer alternatives is already occurring. Examples include electroplating process changes to eliminate use of hexavalent chromium; replacing the use of perc in dry cleaning with wet-cleaning or other safer alternative processes; replacing asbestos in fire-retardants, brake linings, and joint compounds; and increasing the efficiency of the polymerization of VC monomer to poly vinyl chloride in order to eliminate the cancer risks of poly VC fabrication. The principles of green chemistry (see box 1 below⁵) allow for the design of chemical products and processes for their production that reduce or eliminate the use or generation of hazardous substances and can prevent the occurrence of unintended future consequences. This, in turn, can reduce harm from chemical emergencies, as well as the burden of environmentally-related chronic diseases.

⁵ P. T. Anastas and J. C. Warner; Green Chemistry: Theory and Practice, Oxford University Press: New York, 1998, p.30.

Box 1. Twelve Principles of Green Chemistry

1. **Prevention**
It is better to prevent waste than to treat or clean up waste after it has been created.
2. **Atom Economy**
Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.
3. **Less Hazardous Chemical Syntheses**
Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. **Designing Safer Chemicals**
Chemical products should be designed to effect their desired function while minimizing their toxicity.
5. **Safer Solvents and Auxiliaries**
The use of auxiliary substances (e.g., solvents, separation agents, etc.) should be made unnecessary wherever possible and innocuous when used.
6. **Design for Energy Efficiency**
Energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. If possible, synthetic methods should be conducted at ambient temperature and pressure.
7. **Use of Renewable Feedstocks**
A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.
8. **Reduce Derivatives**
Unnecessary derivatization (use of blocking groups, protection/ deprotection, temporary modification of physical/chemical processes) should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.
9. **Catalysis**
Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.
10. **Design for Degradation**
Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.
11. **Real-time analysis for Pollution Prevention**
Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.
12. **Inherently Safer Chemistry for Accident Prevention**
Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.

Adoption of a prevention focus entails new and complementary roles for both government and industry, which recognizes both the innovation provided by the private sector and the independent regulatory role of government.

Federal, state and local government agencies responsible for the review of individual chemicals and manufacturing processes (including EPA, FDA, OSHA, and their state and local counterparts) should establish guidelines for and mandate the timely identification and adoption or development of viable safer chemicals and manufacturing processes under existing or (where necessary) new authorities. New policies should require the use of inherently safer technologies for all new installations, modifications, and expansions, as well as the ultimate replacement of

older technologies at existing facilities within appropriate, expeditious timeframes. Policy barriers to substitution must be identified and removed

Furthermore, federal agencies should coordinate in developing a program for the promotion of safer technologies, which would involve fostering relevant expertise in engineering, policy, and alternatives assessment. Specifically, EPA, through its Green Chemistry Program, should expand its funding of research grants to resolve practical problems in the implementation of safer technologies. Security programs should also collaborate with programs that support alternative technologies to 1) identify the priority areas for research into safer alternatives and 2) ensure the security of dangerous chemicals during manufacture, storage, transport, use, recovery/recycling, and disposal.

Shortcomings in existing methods for screening new chemicals for potential hazards impair the identification and adoption of safer alternatives as much as the identification and regulation of existing hazardous chemicals. In order for a comprehensive green chemistry program to assure that new alternatives are truly safer and do not pose significant health risks, the federal government should expand its efforts to develop effective, efficient screening tools for new chemicals, including supporting the development of scientific protocols for alternatives assessment called for in Recommendation 1.4.

Companies should be required to incorporate prevention principles into their decision-making processes. Currently, a wide range of environmental protection and occupational safety regulations require that businesses track chemical uses and releases and evaluate various chemical hazards. This type of management system-based regulation should be expanded to require that on a regular basis, businesses systematically identify, evaluate, and either adopt or develop technologies and approaches that are functionally as good or superior to those they replace, cost effective, and truly safer. Alternatives or technology options analysis is central to facilitating modernization of products and processes. Such regulation is already partly in place in Massachusetts, where the Toxics Use Reduction Act (TURA) of 1990 requires companies that use listed toxic chemicals over threshold amounts to systematically assess both the reasons toxic chemicals are used and the availability and feasibility of safer alternatives.

Recommendation 1.2: Reform the Toxic Substances Control Act (TSCA) to facilitate prompt action to eliminate or reduce harmful exposures to toxic chemicals.

TSCA was intended to protect public health and the environment against the risks posed by chemicals in commerce, but its chemical management provisions have not been updated and strengthened since its enactment in 1976, and the statute does not effectively promote the development or use of safer alternatives. Its limitations leave significant gaps in available data on many widely-used chemicals and result in very few regulatory actions to limit or eliminate chemical exposures. For example, no statutory requirement is in place to test, prioritize, or address all existing chemicals. While new chemicals are subject to a 90-day formal review process before entering production, producers of chemicals already in commerce are not required to provide the data necessary to comprehensively assess potential risks without further specific

action from the EPA. Furthermore, taking action to limit or ban chemicals under TSCA has proven difficult.

Legislation is needed to establish the foundation for an effective preventive approach emphasizing the evaluation, adoption, and development of safer substitutes. This legislation should place the burden on industry to provide essential health and safety information on all chemicals in commerce, including information on the inherent hazards of these chemicals and their mixtures; exposure data; and life cycle information (i.e., production volume, uses, potential environmental fate and transport, and end-of life disposition). Furthermore, the legislation should increase the amount, quality, and accessibility of information available to the public on chemical hazards, particularly with respect to consumer products. Consistent with a commitment to community right-to-know, all of the life cycle information should be made available through an online, accessible clearinghouse. Finally, chemicals characterized by persistence, bioaccumulation, and toxicity (PBT chemicals) under TSCA should be prioritized for phase-out and replaced with proven safer substitutes.

The legislation should take into account the potential impacts of chemical exposures on children and other vulnerable populations, aim to eliminate harmful exposures and design a regulatory regime to be protective of them.

In light of the innovation that often occurs at the state and tribal level, Congress should consider drawing on a primacy model, as in the Clean Water Act, so as to avoid undermining the ability of states to be more protective. In this way, Congress would establish a regulatory floor, but at a high level. Legislation also must recognize the need to provide resources at the federal, state, tribal, and local levels to ensure effective implementation.

In September 2009, EPA Administrator Lisa Jackson released a set of principles for reform of chemical management legislation. The principles include a call for reviewing chemicals against safety standards that reflect risk-based criteria while recognizing the need to assess and manage risk in the face of uncertainty; a requirement for manufacturers to provide data for new and existing chemicals; an acknowledgement of the needs of sensitive subpopulations; a call for prompt action on priority chemicals; the encouragement of green chemistry approaches; and the promotion of transparency and public access to information. These principles provide an important foundation for public health efforts to address chemical exposures.

Recommendation 1.3: All executive and legislative branches of federal, tribal, state, and local governments should improve child health protections by requiring that the unique vulnerabilities, susceptibilities and exposures of children be explicitly considered and that protection of health of vulnerable populations is foremost in all policies and practices. Congress should enact statutory language to make permanent the Federal Interagency Task Force on Children’s Environmental Health, the Children’s Health Protection Advisory Committee (CHPAC), and the Office of Children’s Health Protection (OCHP).

The world in which today's children live has changed tremendously from that of previous generations. Although significant progress has been made in reducing some harmful exposures, such as to lead in the environment, new hazards have emerged. Children, like other special populations, continue to be exposed to environmental hazards when living in communities in proximity to manufacturing plants, when using chemical products, and being exposed during the end-of-life disposal of toxic and hazardous wastes but are uniquely vulnerable to health effects caused by such exposures. Children also have unique environments - the womb, child care centers, schools, and play areas - all of which should be specifically considered, but are often not addressed. For example, children and children's unique environments are not yet routinely included in monitoring and research studies, yet studies consistently show that the hand to mouth behavior of the youngest children add to their exposures to chemicals in the environment. Unlike adult work places, where NIOSH and OSHA play a role, insufficient attention has been given to protecting children in what might be called their "workplace" or from effects to children from their parents' workplace exposures (not only take-home, but also fetal and preconception exposures).

Executive Order 13045, issued in 1997, created to protect children from environmental health and safety risks, resulted in notable successes and promising initiatives, most notably an effective interagency task force on children's environmental health. Over a number of years, however, the Executive Order was weakened. Key components of the Executive Order, such as the interagency task force, the Office of Children's Health Protection (OCHP) and its advisory body, the Children's Health Protection Advisory Committee (CHPAC), should be put into statute. Such legislation must also assure that other agencies with jurisdiction over environments where children spend much of their time -- most notably the Department of Education -- are active and engaged partners. This focus also includes those offices handling child care and related issues. The OCHP and CHPAC have been and should continue to be the conscience for children's health protection in EPA, as well as a spotlight to highlight accomplishments, shortfalls, and opportunities. There should be assurances that a substantial portion of CHPAC appointees be independent experts in pediatric environmental health. Similar panels and offices should be created in other relevant agencies.

Establishment of these entities will encourage coordination and leverage resources to assure that children's unique vulnerabilities, susceptibilities and exposures be explicitly considered, and will also facilitate placing health -- especially protecting the health of our most vulnerable -- foremost in all policies and practices. Healthy children grow into healthy adults. The health of our children is one of the most important investments we can make and should be among our top priorities.

Additional Recommendations

Recommendation 1.4: Federal agencies should work in consultation with the private sector to develop standard, scientific protocols for alternatives assessment to support their use in promoting the development of safer chemicals and products.

Strong scientific principles and strategies to implement the analysis of safer alternatives, and bring new scientific information to bear on environmental decision-making processes, are needed to provide greater protection of public health and the environment from exposures to toxic chemicals. Standard approaches to alternatives analysis and improved risk assessment methods would give decision makers in government, industry and the public an upstream prevention tool, a set of common and clearer expectations, and incentives to produce safer products.

Priority actions include:

- 1) Evaluating existing methodologies and frameworks for conducting alternatives assessment in order to identify key elements and determine the best practices.
- 2) Ranking chemicals that have been fairly well evaluated according to their toxicity, use, and exposure. To do so, it is important to establish an initial list of toxicological properties, uses, and exposures of concern and identify chemicals with those known characteristics. Short-term test methods and chemical properties can indicate if chemicals have the toxicological properties of concern.
- 3) Establishing scientific principles for identifying safer substitutes (i.e., how to know that a substitute would be less toxic), including methods to address the lack of chemical toxicity data.
- 4) Establishing a comprehensive database of chemicals, basic toxicities that are known or suspected, and safer substitutes. Include consideration of designing out the need for a chemical of concern in a product, rather than just substituting another chemical.

Recommendation 1.5: NIOSH and OSHA should improve worker protection from chemical exposures by strengthening health-based exposure recommendations, improving hazard communication, and encouraging adoption of a chemicals management systems approach to purchasing, using, and disposing of chemicals.

Workers typically endure the greatest potential risk of chemical exposure given their proximity to ~~not~~ chemicals in the workplace, often at relatively high concentration levels and over protracted periods. The protection of workers should be improved by requiring employers to assess and control chemical exposures and to implement the hierarchy of controls for all chemical exposures as part of a Health and Safety Program. The hierarchy of controls emphasizes that implementing feasible and effective controls begins with primary prevention and the elimination of exposure and ends with the least effective approach - requiring workers to change behavior (e.g., donning equipment to limit the risk of exposure). Further, hazard communications should provide workers more comprehensive notification about the chemicals to which they are being exposed in the workplace and information that better reflects current data. Full disclosure of a product's chemical composition, without confidentiality exemptions, should be required. To ensure emergency response personnel have complete and consistent access to information on chemical exposures and hazards, MSDSs should be made publicly available in an easily accessible, transparent, understandable, and uniform format such as the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS) safety data

sheet (SDS⁶) format and content requirements for providing information on chemicals. In addition a chemicals management systems approach should be adopted. With a chemicals management systems approach, users of chemicals shift from a traditional purchaser-supplier relationship to a strategic alliance with a chemical service provider in which the user assists with purchasing, managing, and tracking chemicals. This shift to chemical services directly aligns the incentives of the service provider and chemical user to reduce chemical use, exposures, and costs.

Recommendation 1.6: Federal agencies should ensure effective compliance and enforcement of industrial and federal facilities and agricultural operations with environmental health regulations, laws and policies.

Vulnerable communities suffer from the health and environmental consequences of a lack of enforcement of and compliance with existing environmental health regulations, laws, and policies. Federal regulatory agencies must ensure effective compliance of industrial and federal facilities - in particular the facilities of DOE and DOD - and agricultural operations by implementing strong enforcement and prevention measures, including: 1) bans on the production of harmful industrial or pesticidal formulations; 2) revocation of discharge/emission permits; 3) denial of new – or revocation of existing – pesticide registrations; 4) assessment of significant fines for non-compliance; 5) independent monitoring; 6) increased oversight of state enforcement agencies (e.g., state environmental and agricultural departments); 7) improvement of pesticide use and toxic emissions reporting requirements; and 8) civil and criminal penalties. EPA and OSHA, in collaboration with ATSDR and FOH⁷, should develop and implement an effective inspection program that requires frequent, unannounced inspections at industrial, DOE and DOD facilities and agricultural operations. Also, EPA and OSHA should sign memoranda of understanding (MOUs) with ATSDR and establish collaborations with exposed communities to ensure their effective participation in inspections to assess health hazards.

Recommendation 1.7: Federal agencies should work in consultation with the private sector to develop scientific criteria for the application of the precautionary approach, in order to better protect human health and the environment.

Successful implementation of a precautionary approach as defined in the introduction, with resulting improvements to public health protection, requires establishment of a strong scientific basis for determining when to use this approach and with what data, analytical methods, and criteria. Establishing standard, science-based criteria is expected to result in the consideration of a broader spectrum of scientific data in environmental and public health decision-making, greater protection of public health and the environment from exposures to toxic chemicals, and the promotion of a public that is an informed partner in decision-making. The EPA, FDA, ATSDR, the NIEHS, state and local health and environmental protection agencies, and

⁶ Safety Data Sheets (SDS) is the international designation, as well as the terminology used in the GHS field, for what is often referred to as Material Safety Data Sheets (MSDS) in the U.S.

⁷ FOH is a non-appropriated agency within the HHS that provides occupational health and wellness services exclusively to federal employees.

representatives from environmental and health non-governmental organizations should consider contributing to this effort.

Priority actions to advance the scientific basis for applying a precautionary approach include

- 1) conducting research to establish criteria for using the precautionary approach to chemicals and support a range of precautionary options;
- 2) identifying the scientific evidence to incorporate into the precautionary approach;
- 3) identifying the most important and useful data to include in alternatives assessments that will serve to implement precautionary decisions;
- 4) identifying the additional scientific data that can be obtained readily and can influence a precautionary approach to decision-making; and
- 5) refining the analytical methods for integrating the information collected, comparing alternatives, involving the public, and monitoring the consequences of decisions.

Recommendation 1.8: Federal agencies should work in consultation with the private sector to improve and adapt the procedures for conducting quantitative risk assessment so that they are compatible with and integrated within an overarching precautionary paradigm for decision-making, as well as with other decision-making paradigms for regulating toxic substances and protecting public health.

Acknowledging recent challenges to the current risk assessment paradigm, in 2009 the National Research Council (NRC) issued *Science and Decisions: Advancing Risk Assessment*. The report made a number of recommendations on improving the methodology of risk assessments and their utility for decision-making. The improvements recommended by the NRC report should be implemented by the EPA and other agencies responsible for risk assessment.⁸ Adoption of these recommendations should improve risk assessment as a tool for the systematization of the relevant scientific knowledge concerning the hazards, contamination levels and population exposures, dose-response relationships, and cumulative risks⁹ of the environmental problem at hand, as well as for evaluating a wide range of alternative options. These reform efforts should involve:

- An open, multi-stakeholder dialogue that addresses public and private sector methods for making decisions using information on risks, including, but not limited to, how the elements of a precautionary approach can be taken into account
- Timely revision of guidance documents on risk assessment
- Training of risk assessment staff as needed in order to implement the revised methodologies, including guidance on working effectively and compassionately with exposed communities

⁸ EPA has stated its commitment to implement the framework presented in the NRC Report *Toxicity-Pathway-Based Risk Assessment: Preparing for Paradigm Change. A Symposium Summary* (2010). EPA and other regulatory agencies at the federal, tribal, state, and local levels; NIEHS; National Toxicology Program; and representatives of community and national groups, the regulated community, and the scientific community, especially the scientists who contributed the relevant NRC reports all are encouraged to contribute to this effort.

⁹ Exposures from multiple pathways, complex mixtures, multiple stressors, and factors affecting vulnerability (e.g., children, the aged, and the health-compromised).

- Increased stakeholder involvement, especially of members of exposed communities (at the “ground floor” and throughout the risk assessment process)
- Research focusing on improving existing scientific tools and/or developing new scientific tools that are necessary to complement risk assessments in addressing the anticipated enormous quantities of data and testing expected to result from the European Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) program and the anticipated revision of TSCA

Recommendation 1.9: Federal agencies should put increased emphasis on public health principles and establish a coordinated health infrastructure across the federal government.

A renewed emphasis on the part of all federal agencies would call for the development and implementation of prevention-driven policies across agencies. It should entail efforts to achieve a more cohesive and coordinated health infrastructure across the federal government and between the federal, state, local and tribal governments. For example, it could call for the establishment of a public health position in all relevant agencies or the development of a multi-departmental and multi-agency standing commission to promote prevention-driven decision-making. One option for creating this new direction is through an executive order, or a legally-binding order issued by the president, acting as the head of the executive branch, to federal administrative agencies.

Conclusion

There are significant opportunities to more effectively align federal, state, tribal and local policy to reduce harm from chemical exposures, revitalize federal agency efforts, and modernize regulatory approaches. Taking a proactive approach, with prevention of harmful exposures as the first priority, is essential. Additional opportunities lie in the promotion of alternatives assessment and green chemistry, which are important precursors for healthier communities, as well as innovation, greater efficiency, and financial benefits in the marketplace. Finally, it is important to develop and improve mechanisms for science-based decision-making, such as creating protocols for alternatives assessment, establishing scientific criteria for applying the precautionary principle and correcting flaws in the risk assessment process.

Chapter 2: Collecting and Using Information on Chemicals and Population Health to Enable Effective Public Health Protection

Many federal, state and local entities have compiled, analyzed, and interpreted data on the uses and presence of chemicals in the United States to address specific regulatory or health concerns. As technology has advanced, the data collection and storage techniques have evolved over time. Many of these datasets have been used to help to identify people's potential exposure to chemicals, and the potential impact they have on human health, resulting in improved health and safety. Further ongoing surveillance provides an opportunity to evaluate the effectiveness of regulations and intervention strategies.

However, the current status of the nation's knowledge of chemical use, environmental concentrations, levels within humans and other species, and consequent health effects can best be characterized as partial, uneven and minimally integrated. Steps should be taken toward a comprehensive collection of information covering all important chemicals for all relevant populations, including data on chemical source (inclusive of imports), chemical uses, environmental and biological concentrations, and toxicity. These data should be collected in a manner that facilitates analysis, data integration, interpretation and most importantly, protective actions.

Although federal, state and other organizations in the U.S. collect *chemical use and release data* for a wide range of purposes, further improvements are necessary to protect public health. First, information is dispersed among a number of different systems created by different statutes. Developing a single system or portal to track all potentially harmful chemical substances would greatly assist in identifying and addressing the presence of harmful chemicals. Second, chemical use/release data is insufficient to understand potential exposures to the extent necessary to protect the public. Third, much of the information requested on chemical use is unavailable to the public and often to the government itself because chemical producers either cannot obtain the desired information or invoke the need to protect their confidential business information (CBI). Thus, current chemical use and release monitoring data in the United states is severely limited because monitoring of environmental media and the collection of necessary supplementary information are incomplete, fragmented and too infrequently collected to allow for a comprehensive interpretation.

*Biomonitoring*¹⁰ is a useful tool for measuring an individual's exposure to a specific chemical or set of related chemicals from all sources, and can help identify groups of people who may be more or less exposed to a given chemical, potentially reducing the uncertainty associated with other methods of assessing exposure. Still, there are a number of technical and practical

¹⁰ *Biomonitoring* provides a precise measure of the concentration of a chemical in a specific body fluid or in exhaled air.

limitations to biomonitoring. Not all chemicals can be biomonitored; laboratory methods for many chemicals have not yet been developed or they may only be able to detect chemicals at higher concentrations than are relevant for human exposures. In addition, some biomonitoring surveys may be too expensive to implement at the necessary scale. Finally, for most biomonitored chemicals, the interpretation of test results is a major challenge because the measurement of an environmental chemical in a person's blood or urine does not by itself mean that the chemical causes disease; separate studies of varying exposure levels and health effects are needed to determine whether blood or urine levels result in disease.

Ongoing surveillance of *health status, health outcomes, and health conditions* associated with chemical exposures in the United States occurs at the federal, state and local levels. Systems for conducting surveillance of health outcomes in the context of chemical exposures can be broadly divided into two categories: (1) state and local systems for identifying and investigating disease cases and outbreaks in order to identify potential environmental causes; and (2) ongoing state and national health data collection systems, which collect data on general health indicators that may or may not be related in part to chemical exposures. As most data sets are collected for other purposes, there are many limitations to the use and interpretation of existing health datasets for environmental health assessment.

Featured Recommendations

Recommendation 2.1: CDC/ATSDR, the (EPA), and local communities and governments should expand health outcome surveillance to over-sample vulnerable populations and high-priority geographic regions in national data surveys, to include conditions with environmental links as reportable conditions, and by developing nationally compatible health data sets that are accessible through a single portal.

(a) Expand national data surveys to over-sample vulnerable populations and high-priority geographic regions.

Expanding national data surveys and other data collections will allow for a better understanding of the variation in health outcomes potentially linked to chemical exposures across the United States. Designing these collections to over-sample specific subgroups will enable better identification of vulnerable populations, as defined by demographic and socioeconomic indicators. Larger annual sample sizes will provide better information on current status and trends. High-priority geographic regions could be considered as a domain in the sampling design. This would require statistical research to establish feasibility, implications, and cost considerations. An indicator of the success of this recommendation will be whether the resulting data is more broadly used to provide timely data on geographic and population subgroups.

(b) Expand reportable conditions to other conditions with environmental links

State, local and tribal health departments and CDC have established a process for recommending that health conditions be placed under surveillance at the state and national level under the

auspices of the Council of State and Territorial Epidemiologists (CSTE). CSTE, an organization of member states and territories representing public health epidemiologists, has the responsibility for defining and recommending which diseases and conditions are reportable within states and which will be voluntarily reported to CDC. Such recommendations are made through the development of position statements that include guidance on how surveillance should be conducted for a specific condition (e.g., case definition, reportable data elements).

A work group led by CSTE and including CDC/ATSDR epidemiologists should collaborate to review currently reportable conditions of interest to surveillance of chemical exposures to identify gaps (i.e., conditions that are absent from the current list or those that are on the CSTE list but reportable in very few states). The work group should develop plans to address constraints on interpretation imposed by the limitations of available chemical exposure data and the understanding of factors affecting chemical exposure. The work group should develop recommendations for ways to fill the identified gaps, obtain consensus from the larger group of CSTE environmental epidemiologists, and then develop position statements for their recommendations.

Recommendation 2.2: CDC/ATSDR, EPA, OSHA, state and local governments and academia should expand biomonitoring capacity and use population-based biomonitoring data as a tool to set priority strategies to reduce harmful levels of environmental chemicals identified in people

Biomonitoring data confirm human exposures to chemicals (via ingestion, inhalation, and absorption) and can be used to validate the need for and evaluate the impact of public health policies. For example, population biomonitoring data showing high blood lead concentrations resulted in EPA's regulatory reduction of lead in gasoline, and subsequent biomonitoring data demonstrated the positive impact of this regulatory action

Biomonitoring efforts should be expanded. State and federal public health and regulatory agencies must collaborate on generating, analyzing, and interpreting the data as a tool to set priority strategies to reduce the harmful levels of environmental chemicals identified in people and in food source animals. While the potential value of biomonitoring data is recognized, regulatory and scientific challenges surrounding their reliability and use for regulatory purposes must be overcome. Necessary changes include improving the ability to design biomonitoring studies; developing new laboratory methods and expanding capacity to measure locally the more than 3,000 chemicals used in high volume in the U.S.¹¹; incorporating biomonitoring studies of food source animals; interpreting what biomonitoring data mean for public health; addressing the utility of the data; and communicating results to study participants, policymakers, and the public. A trusted source, which can interpret and communicate the health implications of the biomonitoring data to the public and policymakers, should be identified. An interagency task force should be established to coordinate federal biomonitoring efforts and an expert advisory panel should be convened to inform the process.

¹¹ EPA classifies High Production Volume (HPV) as those chemicals produced or imported in the United States in quantities of 1 million pounds or more per year. See <http://www.epa.gov/chemrtk/pubs/general/basicinfo.htm>.
Draft Action Agenda V12_clean

Furthermore, the U.S. needs a state-based, national biomonitoring network of laboratories and public health agencies. Although the CDC's *National Report on Human Exposure to Environmental Chemicals* provides national estimates of chemical exposures, its current design was never intended to allow state or local agencies to calculate exposure estimates for their jurisdictions. In order to produce such data, states need the capability and capacity to conduct biomonitoring assessments statewide or in communities or groups where chemical exposure is a concern.

The Association of Public Health Laboratories (APHL) is working with CSTE and ASTHO to develop a laboratory network called the National Biomonitoring System to create guidelines for state and local participation within a period of five years.¹² This network should help localities connect with each other to leverage existing capacity. The ultimate goal would be to have, at a minimum, the capacity to measure each chemical of concern somewhere in the nation. Systemization will allow standardization of biomonitoring study design, sample collection and analysis, data analysis and comparability, as well as interpretation. Concurrently, legal and financial recommendations will be needed to allow different jurisdictional authorities to take advantage of the network.

Finally, one important action that can be taken relatively quickly (within 1-2 years) is to build carefully-designed and well-managed human sample banks (blood, milk, tissues such as placenta) and environmental sample banks (fish, tree barks, etc.). These banks will be very helpful in (1) establishing chronology of pollution, (2) identifying new pollutants, (3) tracing back to sources, (4) archiving samples for future analysis with better technology than we have today, (5) exploring regional differences, and (6) carrying out longitudinal studies.

Recommendation 2.3: Federal agencies should work with tribal, state and local governments to improve reporting of chemical source, use, and discharge information, to increase the frequency of manufacturing volume reporting and to address Toxics Release Inventory (TRI) shortcomings thereby making monitoring more comprehensive and suitable for assessing risks associated with human chemical exposure.

The following improvements to TSCA should be considered in the broader context of the reforms outlined under recommendation 1.1:

(a) Increase the frequency of manufacturing volume reporting required under the Toxic Substances Control Act Inventory Update Rule and require more extensive information on downstream uses.

TSCA's Inventory Update Rule (IUR) should be improved by 1) increasing the frequency of reporting from every five to every one or two years; 2) requiring greater substantiation of claims

¹² More information on APHL's National Biomonitoring Plan is available at <http://www.aphl.org/aphlprograms/eh/Pages/nationalbioplan.aspx>.

that information is "not readily obtainable"; and 3) providing clear guidance as to those circumstances under which a claim of "not readily obtainable"¹³ would be accepted.

(b) Address Toxics Release Inventory (TRI) shortcomings; provide more information on short-term releases.

Instead of relying on nominations for additions to the TRI list, the TRI should undergo a process of regular scientific review and revision. Potential sources for candidate chemicals and industries include scientific peer-reviewed literature, weight-of-evidence evaluations such as the International Agency for Research on Cancer (IARC) and National Toxicology Program (NTP) lists of carcinogens, and state or international identification of high-risk chemicals as subjects of new restrictions. TRI reporting should be tied to information on hazards, uses, and exposures that would result from improved manufacture and use information.

(c) Develop a cross-agency, systematic approach to the collection of monitoring information that will make “chemical use and release” or “environmental” monitoring more comprehensive and suitable for assessing risks associated with human chemical exposure.

Federal agencies, such as CDC/ATSDR, CPSC, HUD, DOE, EPA, and NIH, state environmental departments, and local government should develop a cross-agency systematic approach to the design and implementation of routine environmental monitoring and expansion of the data collected. To accomplish this, the appropriate agencies should identify an existing inter-agency work group or form a new work group to coordinate environmental monitoring across agencies. Such monitoring should address (1) all major microenvironments that people occupy; (2) the broad spectrum of persistent and non-persistent chemicals in current use in materials and consumer products; and (3) the multiple media to which people are exposed, including diet. Environmental monitoring should collect data of sufficient temporal resolution to address short- and long-term exposures to chemicals and to address temporal variability of chemical concentrations in the environment. To make environmental monitoring more comprehensive and suitable for assessing and predicting human exposures, new, innovative, low cost, and low burden monitoring methods need to be developed. In addition to collecting data on chemical concentrations in environmental media, ancillary information (e.g., activity, product use) should be collected in order to make the monitoring data more useful for characterizing people’s exposure to chemicals for different life stages (children, adults, elderly) and for susceptible or vulnerable groups. Environmental monitoring should be conducted on a routine and regularly scheduled basis (every 5 to 10 years) to track trends and identify potential exposure issues.

¹³ EPA proposed an IUR Modifications Rule on August 13, 2010. This rule calls for increased frequency of reporting from every five years to every four years; required reporting of production volumes meeting or exceeding the threshold for a chemical substance in any calendar year since the last principal reporting year; required reporting of additional manufacturing and use data; and upfront substantiation of CBI claims, among other changes. See http://www.epa.gov/iur/pubs/Fact%20Sheet_IUR%20ModificationNPRM_08-05-10.pdf for EPA’s fact sheet on this proposed rule and <http://www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480b2ff32> for the docket.

Additional Recommendations

Recommendation 2.4: CDC/ATSDR, states and localities should expand environmental public health tracking and state-based occupational health surveillance to include all fifty states and ten metropolitan statistical areas

The concepts and tools of environmental public health tracking (EPHT), and the development of the integrated state and federal network, represent a significant step to developing a more comprehensive environmental public health surveillance system, but EPHT has been implemented in only about half of the states because of funding limitations. Additional funding would need to be secured in order to achieve this recommendation. Organizations representing public health, including ASTHO, CSTE, NACCHO, APHL, APHA, and others have been strong supporters of this initiative. State-based occupational health surveillance data systems are needed in all fifty states because 1) chemicals in the workplace are often the origin of chemical exposures and 2) a sick worker is frequently the first indication that a chemical could have adverse health effects in the community. Currently only twenty-three states are funded by CDC for this activity, and additional funding is needed for the remaining states to participate.

Recommendation 2.5: Federal agencies, tribes, states and localities should standardize and integrate data collection and interpretation

Agencies conducting ongoing health surveillance and environmental monitoring programs (e.g., EPA, CDC, FDA and others) should evaluate the feasibility of developing a clearinghouse of standardized methods for data collection and interpretation. Adopting and implementing standards for content, format, collection, transport, and interpretation of data will strengthen the ability of governmental agencies to exchange information needed for assessing environmental threats and designing effective interventions, as well as render the data accessible to and usable by other interested parties. CDC should also evaluate the possibility of providing a “Community of Practice” (CoP) forum for this community. One suggestion is to build upon the existing Public Health Information Network (PHIN), to enhance cooperation, standardization, and integration of environmental sampling and analytical methods, biomonitoring approaches, and other methods associated with exposure monitoring. Suggested methods to implement a CoP include electronic collaboration tools, such as message boards, listservs, chat rooms, webinars, and shared electronic workspaces.

Recommendation 2.6: Federal agencies, tribes, states and localities should establish mechanisms for the public and state/local/tribal officials to provide input into data collection efforts in both national data collection efforts and local community study design.

(a) Ensure that effective mechanisms exist for the public and state/local/tribal officials to provide input into decisions about *national data collection efforts*.

All national data collection mechanisms should be open to public comment through a robust process prior to their initiation and periodically as preliminary or interim data are collected. Proposed data collection mechanisms and any updates to them should be published on www.regulations.gov, and public input should be posted in a docket available through the site. The responsible agency should also solicit public comment through listening sessions or public administrative hearings held in each federal region affected by the data collection strategy. During the 120-day public comment period, the responsible agency should provide opportunity for the public to give input on specific issues it has identified, allow for open-ended comment, and encourage the public to suggest reformulated questions if they find the agency's questions insufficient. For the hearings, agencies should provide at least 30 days' public notice and transcribe and post all comments in the docket. In addition to publishing a Federal Register notice, agencies should conduct aggressive outreach to national, regional, statewide and local organizations as well as individuals in order to engage stakeholders in the comment process – an effort that should ensure translators and materials are available in the languages of affected communities. After the public input is received, the agency should again publish its decision(s) in the Federal Register and seek public input to the docket to enable any final adjustments.

In addition, national data collection efforts should provide the opportunity for state and tribal governments to pay for enlarged sample sizes that meet their local data needs.

(b) Ensure that effective mechanisms exist for the public and state/local/tribal officials to provide input at the local level into public health monitoring and investigations of potential chemical exposures.

A local community public health investigation should involve the members of the subject community. This, too, should be a process that seeks to ensure broad input from the public with ample opportunity to participate through written and oral comments and a methodology and outreach strategy similar to those for national data collection efforts as described above or community-based participatory action research methods. A truly participatory process should seek to engage a cross-section of the community. Since most participatory processes are self-selective, it is critical that the outreach and inclusion methodology eliminate the barriers to participation and ensure participants an opportunity to establish the framework and definitions of the problem(s) and the data necessary to capture it. To that end, the agency should hold workshops to solicit the community perspective on the study design.

Recommendation 2.7: Federal agencies should expand development of diagnostic tools and biomarkers related to chemical exposure

Healthcare providers need better and more extensive diagnostic tools, such as validated biomarkers of exposure and effect of environmental chemicals, to improve diagnosis and treatment if an exposure is known or suspected. Better data is needed on body burdens of chemicals in order to target interventions. Further, to advance the development and validation of population-based biomarkers for other chemicals, EPA, NIEHS, and CDC should request that the NTP undertake an effort to identify chemicals for which population-based biomarkers could

be developed and subsequently validated for use, if appropriate, in clinical practice settings (with adequate confidentiality protections¹⁴). In addition, CDC's biomonitoring program should continue to develop new methods each year for selected chemicals or their metabolites based on scientific data that suggest exposure in the U.S. population; the seriousness of health effects known or thought to result from some levels of exposure; and other factors. With its existing authority under the Federal Insecticide Fungicide and Rodenticide Act of 1972 (FIFRA), EPA should require pesticide registrants to develop population-based biomarkers of exposure and, if possible, valid clinical diagnostic tools.

Recommendation 2.8: The CDC and/or ATSDR should establish a standard process for governmental agencies to assess community and occupational health and potential synergistic, cumulative, and aggregate environmental factors.

There are a number of issues with existing national disease registries – they are far from complete; there is insufficient uniformity in the information collected; and access to the information is difficult. Standardization of outcomes, definitions and indicators is needed, as is improved compatibility with electronic medical records. Expansion of vital statistics data to include diseases with accepted linkages to chemical exposures should be considered. Current efforts to harmonize the meta data in existing national disease registries are worthwhile and need to go much further in response to suggestions from both the Pew Environmental Health Commission (2000) as well as CDC (n.d.) and ATSDR on the value of having the ability to perform nationwide public health tracking (Pew Environmental Health Commission, 2000). Creating a standardized national set of health and hazard indicators with higher geographic resolution than state and county would help localities and federal agencies identify those communities with disproportionately lower environmental health status in order to empower communities to implement targeted interventions.

As a first step, CDC, in coordination with EPA, FDA, state and tribal public health agencies and academic centers should establish a National Health Outcomes portal that improves and coordinates access to national health outcomes data. Over the longer term, these entities should explore the design and implementation of a system that achieves results similar to the FDA's Sentinel System,¹⁵ where the population can be surveyed by the CDC and state health departments for toxic exposures in real-time, effectively monitoring those at risk for long term-health effects, as well as maintaining targeted surveillance to their offspring and successive generations. Development of a system of real-time monitoring of health outcomes will require collaboration with efforts currently underway for development of electronic medical records, which, to be most useful, would need to include core occupational and environmental risk factor

¹⁴ Privacy and confidentiality issues often emerge in the context of biomonitoring, especially in occupational settings. It is because biomonitoring results can and have been used to discriminate against workers that OSHA included medical removal protection for workers participating in workplace monitoring and surveillance programs for lead. Clearly, results of workplace and community-based surveillance and biomonitoring efforts must be available to employers and health authorities in order to identify problems and take corrective action. In making this recommendation, the Leadership Council cautions that information generated by the use of biomarkers in individual patients in the clinical practice setting be appropriately protected by the physician-patient relationship.

¹⁵ See <http://www.fda.gov/Safety/FDAsSentinelInitiative/default.htm>

information and require careful consideration of privacy and confidentiality. Such a system also should integrate information from vital records, geographically-based environmental exposure monitoring (e.g., National Health and Nutrition Examination Survey biomonitoring data), environmental hazard data (e.g., TRI, hazardous and solid waste facilities, groundwater/surface water contamination, air pollution sources), and should retain the flexibility to incorporate additional community-specific information as well as community-based knowledge, where appropriate.

Conclusion

In order to improve monitoring of chemical exposures and their effects on public health, the Leadership Council recommends expanding both health outcomes surveillance and biomonitoring capacity. The Council suggests methods for improving the quality and robustness of the data available by expanding environmental public health tracking to all fifty states; improving the reporting of chemical source, use and discharge information under TSCA; and making environmental monitoring more comprehensive and suitable for assessing risks associated with human chemical exposure. Developing standards for collecting and integrating data will facilitate the interpretation of results and make them more accessible to users. Data collection efforts can be further improved by integrating public and stakeholder input into the process. Finally, additional diagnostic tools and biomarkers should be developed to expand healthcare providers' capacity to diagnose and treat harmful chemical exposures and the public health community's ability to target interventions where human exposures have been confirmed.

Chapter 3: Achieve a More Complete Scientific Understanding of Chemicals and Their Health Effects

Protecting the public from harmful chemical exposures is predicated on sufficient knowledge and understanding of chemical toxicity, modes of action, sources of exposures, and potential adverse health impacts. Integral to this understanding are multiple sources of knowledge, including academic, governmental, private sector, and community-based research. It is also important to conduct research into ways to minimize the consequences of chemical exposures, as well as to better utilize and manage existing data on chemicals and their health effects.

Current research needs include: understanding the connection between chemical exposures and multiple health outcomes (including neurobehavioral, developmental and reproductive endpoints); investigating the impacts of low-dose, multiple, and cumulative exposures to chemicals; and understanding the role non-chemical stressors play in combination with chemical exposures. Research is also needed to better understand emerging concerns, such as the health effects that may occur from exposure to engineered nanoparticles. Attention should be focused on the interplay between genes and the environment, individual susceptibility, and disproportionate community risks. All of these research areas will draw upon recent technological advances in both the traditional sciences (e.g., biology, chemistry, epidemiology, and toxicology) and new cross-cutting technologies (e.g., computational toxicology, genomics, proteomics and other “-omics,” and bioinformatics). Achieving a more complete understanding of chemicals and their health effects is necessarily a long-term effort. Thus, it is essential to engage in focused, energetic action now. Important results can be achieved soon by expanding upon and accelerating current initiatives to create novel analytical tools, fill data gaps, increase the accessibility of existing information, improve understanding of variations in individual susceptibility to harm from chemical exposures, and develop better scientific methods of investigating the public health impacts of community-wide exposures to toxic substances.

Featured Recommendations

Recommendation 3.1: Federal agencies should identify and evaluate hazards of chemicals and their potential alternatives more quickly through encouraging expanded use and further development of modern molecular biology techniques, computational systems biology, and other novel approaches.

Data on the potential adverse health effects are limited for many chemicals in the environment and in commerce. In addition, existing conventional methods for hazard evaluation are time consuming, expensive and resource-intensive. These deficiencies, which impede existing risk assessment and management efforts, also are obstacles to implementing a primary prevention approach focused on hazard evaluation. Two recent NAS reports have made recommendations to address many of these deficiencies. The 2007 report *Toxicity Testing in the 21st Century: A Vision and a Strategy* outlines a transformational change in hazard and risk assessment methodologies. Reliance on high-dose animal testing as the gold standard would be replaced by

modern molecular biology techniques, computational systems biology, and other novel approaches. The report describes “a not-so-distant future in which virtually all routine testing would be conducted in human cells or cell lines *in vitro* by evaluating cellular responses in a suite of toxicity pathway assays using high-throughput tests, that could be implemented with robotic assistance. Risk assessment based on results of these types of tests would shift towards avoidance of significant perturbations of these pathways in exposed populations.” (Andersen and Krewski, 2009). This new approach would also address many of the current challenges in risk assessment as outlined in the 2009 NAS report *Science and Decisions: Advancing Risk Assessment*. In particular, hazard assessments would be conducted across a much greater range of doses in systems more relevant to human biology; thus reducing uncertainty, enhancing the ability to evaluate mixtures and cumulative exposures and significantly streamlining the risk assessment process.

Currently there are many on-going programs to implement some of the concepts outlined in the NAS reports. For example, the EPA, other agencies and industry make some use of computer-based models to evaluate potential hazards associated with chemicals, as well as a variety of models to predict environmental fate and transport. However, these models are somewhat limited in scope and application. Further, there is a need to advance the models that predict important cancer and non-cancer effects such as endocrine disruption, developmental and reproductive toxicity, immunotoxicity, and neurotoxicity, and are better at addressing areas of uncertainty. The EPA National Center for Computational Toxicology is currently evaluating hundreds of chemicals in their HTP program TOXCAST. However, important questions remain about the underlying biological processes being tested, the predictive validity of the *in vitro* cell based systems to whole animal (*in vivo*) toxicity, and ultimately the relevance of these findings to human health.

Realization of the vision articulated in the NAS report is projected to take 10-20 years. In the near term, working groups of national and international scientific experts should be convened to reevaluate and refine approaches for toxicity evaluation to develop targeted testing approaches in the whole organism (*in vivo*), to determine the validity of cell culture (*in vitro*) and alternative model systems to predict *in vivo* toxicity, and to generate a series of guidance documents for *in vitro* toxicity screening within the framework of predictive validity for *in vivo* toxicity. Over the medium to long term, efforts should be undertaken to foster collaborations between basic biomedical researchers and toxicologists to identify biological processes associated with toxicity, develop methods of greater sensitivity for evaluating target organ specific toxicities, develop approaches to examine interrelationships between biological systems in toxicity (e.g., immune and nervous, respiratory, or reproductive systems), and understand underlying mechanisms of toxicity to advance the identification of biomarkers of effect. Eventually, assays and pathways relevant to toxicity in specific organ systems need to be identified. Proof of concept and/or some type of validation for all methods must provide an assurance that false negatives and false positives will be minimized. Important products of this initiative would be the identification of test systems with predictive validity for adverse human health effects resulting in significantly more relevant and efficient risk assessment and regulatory processes

Recommendation 3.2: Federal agencies should develop a targeted set of toxicological, epidemiologic, clinical, chemical use, chemical transport and exposure data needed to fill data gaps in the scientific knowledge of the health risks of chemicals and prioritize chemicals of concern for further assessment of hazardous exposures and safer alternatives.

In the near term, the EPA should define a targeted set of toxicologic and exposure data, along with all available information necessary for a robust assessment of chemical hazard and risk. This effort should build upon previous efforts, such as the Screening Information Data Set for high production volume chemicals developed by the Organisation for Economic Co-operation and Development (OECD, n.d.) and include assessment of the safety and risk of new and existing chemicals. The targeted data set must be adequate to allow determinations that new and existing chemicals in commerce pose an acceptable level of risk and do not endanger the public or the environment. The targeted data set should be reviewed periodically and adjusted by EPA and other regulatory agencies to incorporate new scientific understanding of data necessary to assess critical health endpoints.

In the medium term, EPA should develop a prioritization method focused on chemical safety and health, with special emphasis on sensitive subpopulations, e.g., children, the aged, and the health compromised. Based on the prioritization method, EPA should identify those chemicals posing the greatest potential hazards and risks, as well as those contaminants requiring more toxicological information (including naturally occurring contaminants, such as mycotoxins). Results of the prioritization method should trigger additional appropriate analysis for chemicals posing a substantial hazard or risk, such as alternatives assessments; research to determine effective exposure-reduction strategies, including the adoption of inherently safer technology and “green chemistry;” and additional testing. EPA should reassess a chemical’s prioritization when there is a change that may affect public health risk, such as increased production volume, new uses, or new information on potential hazards or exposures.

Outcomes of efforts to fill data gaps in the scientific understanding of health effects from chemicals used in commerce should be evaluated on an ongoing basis and reported annually, by EPA and other federal agencies. Evaluation reports should be publicly available online and presented to Congress. An online public database should be created and maintained that identifies each chemical used in commerce, identifies the chemical manufacturer(s), and indicates whether each element of the required targeted toxicological and exposure data set has been adequately provided by the manufacturer(s). EPA should disclose all data provided by manufacturers on chemical toxicity, storage and manufacture, use, transport, disposal, exposure, as well as the chemicals incorporated into products, as soon as possible after receipt of information from chemical manufacturers, taking steps to protect information that can legitimately be claimed to be confidential business information. In addition to review by EPA and other federal agencies, public comment opportunities should be created to allow citizens, researchers, and other stakeholders to provide input on the adequacy and quality of scientific data provided by chemical manufacturers.

Recommendation 3.3: Develop standard protocols and tools to characterize potential human exposures to chemicals across the life cycle of chemical products and processes, and across the human life stages.

Accurate exposure information is critical for a variety of decisions. Protocols and tools to characterize exposure sources and the pathways of chemicals to unanticipated places are required to provide information not only for direct assessment of human exposure but also to facilitate green chemical and product design, the safe use of chemicals, and prevention of adverse health consequences to people and to the environment. These protocols and assessment tools should address chemical exposures across the lifecycle of chemical products and processes, as well as interactions with other chemicals and substances, transformation, transportation, fate in the environment, potential for human exposures across multiple exposure pathways, especially in sensitive subpopulations, e.g., children, the elderly, and people with underlying chronic diseases.

Two recent activities have been undertaken by the NAS to address the need for better tools and approaches for measuring, understanding and predicting exposures. In 2009, the NAS initiated a project to develop a long-range vision for exposure science and a strategy to develop an integrated approach to assess risk over the next twenty years. The same year, a workshop was convened, titled “The Exposome:¹⁶ A Powerful Approach for Evaluating Environmental Exposures and their Influences on Human Disease.”¹⁷

Initially, this effort will require the collection and evaluation of detailed exposure measurement data on existing chemicals and the use of these data to develop metrics that can be used to predict use and behavior of proposed and emerging chemicals. Chemicals show up in unexpected places long before their impact on health and the environment is understood or evaluated. Strategic exposure monitoring programs should be established to provide an early indication of a chemical's behavior in our homes, communities, and environment. For example, small-scale biosensors should be developed to detect specific sets of environmental agents in air, water, and food, and even in our bodies. This kind of surveillance can inform interventions to prevent or eliminate unexpected sources of exposure prior to the identification of potential health consequences and to help individuals make educated personal decisions. Exposure information and tools also are needed to screen chemicals for potential risks so that time and resources can be devoted to the chemicals of greatest concern. (Anastas, Teichman, Cohen-Hubal, 2010) Combined with green chemistry and an array of computational approaches, exposure research also offers an opportunity to maximize chemical benefits—by design—while minimizing chemical risks. Interest also lies in developing improved tools to more accurately measure exposures. EPA recently implemented its ExpoCast program, which aims to develop novel approaches and metrics to efficiently screen and evaluate chemicals on the basis of biologically relevant human exposures. (i.e., exposures that can be directly linked to key events, adding to toxic response) (Cohen Hubal, 2009). ExpoCast, combined with information from ToxCast—a battery of rapid screens being studied to determine whether they can predict toxicity (Dix et al.,

¹⁶ The term "exposome" has been defined to represent the long-held concept that effects on health encompass the integration of all environmental exposures from conception onwards, including exposures from chemicals, diet, lifestyle, and endogenous sources (Wild, 2005)

¹⁷ See <http://dels.nas.edu/envirohealth/exposome.shtml>

2007)—can be used in the screening phase of integrated evaluation strategies. The critical component here is the aspect of biological relevance with regards to exposure and to the underlying mechanisms of the toxic response. This integrated link is essential for determining successful approaches for assessing exposures that lead to adverse human health effects.

Additional Recommendations

Recommendation 3.4: Federal agencies should lead an effort to improve knowledge of existing databases and increase the accessibility of information across multiple databases. ¹⁸

Data and database management has the potential to significantly enhance our knowledge of contaminant risks and improve the quality and timeliness of risk assessments. A significant amount of information is available in various databases maintained by the EPA, the CDC/ATSDR, the Organisation for Economic Co-operation and Development, the NLM, and many other federal and state agencies. There is a need to understand the information that currently exists in these various databases and to determine how much of this data is unique and how much is duplicated from another source. This effort should expand beyond the borders of the United States to include the European Union, Canada, and Asia-Pacific sources.

To meet this need, the federal government should charter a National Data Management Advisory Committee or turn to an existing body comprised of representatives from major government agencies, industry, academia, non-governmental organizations, and the general public to facilitate the collection of information and a plan for a National Registry of significant databases. Such a registry might be designed as a portal or data system to improve knowledge about and access to existing data bases, rather than as creating a new data base on its own. Such a data system would address issues of confidential or non-public information, working closely with the managers of the databases. The Committee would also identify relationships between independent databases and opportunities for synthesis. To ensure performance and accountability, the Committee would need to have access to the managers of all relevant sources of data within various agencies and organizations, establish targets and publicly report its progress.

The federal government then should create such a National Registry of significant databases on chemicals and other contaminants and develop a knowledge-based search engine to access data across multiple agencies' and organizations' databases. This search engine should build on the efforts already taken by several of the agencies to expand their capabilities. The intent would be to develop a knowledge-based system, rather than an information-based one, capable of fielding detailed questions that would allow a user to find relevant data and sources. This effort will require a focus on identifying interrelationships of data between chemical toxicity, exposure, and human health fields.

¹⁸ See also recommendation 5.3.

Recommendation 3.5: Improve understanding of individual susceptibility to chemical exposures.

Since certain groups exhibit unique susceptibility to chemical exposures, including children, the elderly, and people with underlying chronic diseases, a better understanding of variations in individual susceptibility may yield targets for prevention and treatment. Some of this variability in susceptibility is related to genetic variation and acquired epigenetic changes. Epigenetic changes may themselves result from chemical exposures during critical windows of development. Research funding agencies should continue to support research into mechanisms of variation in individual susceptibility and the role of such variations in the observed burden of environmentally-related disease. Additional insights may also be obtained from studies of variation in susceptibility as manifested by chemical sensitivity. An interdisciplinary group comprised of scientists from federal agencies, industry and academic institutions and practitioners experienced in the practice of “exposure medicine” should be convened to develop a research agenda on chemical sensitivity.

Recommendation 3.6: Identify and define gene-environment interactions as they relate to chemical or environmental exposure and social and lifestyle factors.

Most common human diseases likely arise from a combination of genetic and environmental risk factors. The understanding of these interactions is critical to defining risk and focusing preventative measures at the individual level. The familial nature of many complex diseases suggests an underlying genetic susceptibility. At the same time, factors outside the genome, such as environmental exposures and epigenetic influences, can also be important. The current scientific view is that virtually all health conditions will reveal evidence of interactions between genes and the environment (GxE) if studied in adequate detail. However, these data are often not available for adequate numbers of individuals for most diseases. A Gene-Environment Interaction Steering Committee should be established to foster national and international collaborations and to develop a Prospective Cohort Study of Genes and the Environment, which will allow for the definition of gene-environment interactions in many common diseases. Specifically, its charge should include integrating existing and newly developed clinical databases, registries, specimen repositories and other resources to allow for the study of large numbers of people with well characterized phenotypes, with known exposures to environmental risk factors and known genetic risk factors, to assess gene-environment interactions for more conditions. This Committee would also make specific recommendations on adding genetic studies to DNA repositories of subjects in investigations of environmental risk factors for disease (e.g., the Sister Study¹⁹) and add environmental studies to genetic investigations.²⁰ The activities of the Gene-Environment Interaction Steering Committee would expand on the NIH Genes, Environment and Health Initiative (GEI)²¹ to include studies of international groups, those in military and civilian populations with unusually high toxic environmental exposures, rare

¹⁹ See <http://www.sisterstudy.org>

²⁰ For example, see <http://www.genome.gov/gwastudies>

²¹ See <http://www.genome.gov/19518663>

diseases, and studies to understand genetic risk factors for adverse events to drugs and biologic agents.

Recommendation 3.7: Identify adverse health effects from indoor air pollutants, including mold and mycotoxins, and improve scientific knowledge of these effects with a focus on the linkage to neurologic, mental health, endocrine and immunologic diseases.

Given growing concern over prenatal exposures and exposures to children, the physically compromised, and the elderly, and the fact that Americans spend 90% of their day indoors, an evaluation of the impact of indoor air quality and its various components during development should be conducted by an authoritative group (e.g., NTP Center for the Evaluation of Risks to Human Reproduction, NAS). The objective would be to improve the scientific understanding of the effects of indoor air pollutants and their impact on identifying individual susceptibilities. It should produce a database of indoor air pollutants categorized to interface with health data, define the impacts of individual components of indoor air on human health and assess the influence of exposure to indoor air pollutants (including mold and mycotoxins) on the susceptibility of individuals to other chemicals.

Recommendation 3.8: CDC should establish an independent body consisting of scientists, epidemiologists, health care providers, state agency experts, and community and environmental health leaders to 1) review the limitations and effectiveness of ATSDR's scientific methods of investigating the public health impacts of community-wide exposures to toxic substances and 2) recommend revisions in their procedures for conducting Public Health Assessments, disease cluster investigations, epidemiological studies and exposure investigations with the goal of instilling in the agency a broader public health focus that will allow it to more effectively investigate and address community toxic hazard exposures.

In recent years there has been increasing public concern about the role ATSDR plays in protecting public health and conducting environmental health assessments in identified communities. Community groups across the country have criticized the limitations of some investigations and studies conducted by ATSDR, NCEH, state health agencies and others in addressing community concerns.²² The major scientific issue with these investigations is the limited capacity of the methods used to evaluate the public health impacts of community-wide exposures to toxic substances.²³ Research is needed to identify new methods to address exposure

²² ATSDR, NCEH, state health agencies and others conduct a variety of studies, including Public Health Assessments (PHAs), Health Consultations (HCs), exposure investigations (EIs), disease cluster investigations and other studies in response to requests from the public and from state and tribal agencies. The objectives of the PHAs and HCs are primarily (1) to determine whether people have been, and/or are currently exposed to toxic substances and (2) to assess the likelihood of current and/or future adverse health effects from these exposures. PHAs and HCs may recommend further work, such as EIs or epidemiological studies to assess exposures and adverse health effects. In addition, ATSDR and other public health agencies are often asked to conduct disease cluster investigations because of community concerns about high rates of health problems, such as childhood or adult cancers and birth defects.

²³ Two recent reports, *The ATSDR: Problems in the Past, Potential for the Future?* (U.S. House of Representatives 2009) and *ATSDR: Policies and Procedures for Public Health Product Preparation Should be Strengthened* (Draft Action Agenda V12_clean

and health concerns of communities as well as to improve existing methods for conducting these investigations. In the near term (within 6 months), CDC should establish an independent body comprised of scientists; epidemiologists; state agency and independent public health and environmental experts; residents from affected communities, and representatives from environmental and public health non-governmental organizations to conduct a two-pronged review of the methods used by ATSDR and other public health agencies to investigate the public health impacts of community-wide exposures to toxic substances. Within another 12 to 18 months, this body should identify and report on case studies of effective best practices for assessing exposures and health effects in community-wide settings and for conducting epidemiological studies and disease cluster investigations. In the long term, as better procedures are identified, these best practices should be piloted and incorporated into the Public Health Assessment Guidance Manual. This should include establishment of a formal peer-review process for all products developed or funded by ATSDR. A new protocol for disease cluster investigations should also be developed, which could take another 12 months. Finally, ATSDR staff and cooperative agreement partners in state health departments should receive training and support in implementing these best practices. Congress should allocate funds to ATSDR to establish this body and ensure the agency and the investigative body should have the capacity and resources to effectively implement this recommendation.

Conclusion

People are exposed to myriad chemicals every day, and it is important to understand the impacts of these chemicals throughout their lifecycles and at different stages in human lives. However, government agencies still lack critical information to protect the public's health. Targeted action through research and improvements in tools for conducting research is needed to achieve a more complete understanding of chemicals and their health effects, including information about individual susceptibility, community vulnerability, and the impacts of low-dose, multiple, and cumulative chemical exposures. Finally, we must develop the scientific knowledge needed for decision making to improve public health protection.

Chapter 4: Promote Health and Wellness in Communities Affected by Environmental Exposures

Although having a safe and healthy environment is a fundamental expectation, many people across the country live, work, and play in circumstances that are neither safe nor healthy. Concerns about equity and justice are part of the fabric of the national conversation about the changes needed.

In addition to the everyday exposures faced in every community, low-income communities, communities-of-color, and indigenous communities experience disproportionate impacts. For example, people of color make up the majority of those living in neighborhoods that host hazardous waste facilities (Bullard, Mohai, Saha, & Wright, 2007) and, thus, have more exposure to legacy chemicals than others. Non-Hispanic black children have a greater risk of elevated blood lead levels than white children (the disparity is greater for black children whose families live below the poverty line) (Environmental Protection Agency, 2010), and children of American Indian or Alaska Native descent have asthma prevalence rates 25% higher, and black children 60% higher, than white children (Akinbami, 2006).

Moreover, disparities exist in the enforcement of environmental and public health laws (Lavelle & Coyle, 1992; Lynch, Stretesky, & Burns, 2004) and in the quality of healthcare received in communities disproportionately affected by environmental exposures (Smedley, Stith, & Nelson, 2003).²⁴ These communities enjoy fewer environmental benefits (*e.g.*, clean air, water, and land) and suffer more environmental threats (*e.g.*, hazardous chemicals and environmental illness). Employment opportunities are often limited to jobs with low pay, limited or no health benefits, and, at times, severe workplace dangers involving enhanced chemical exposure. Children, those previously harmed by chemical exposures, and people who are immune-compromised are special populations with particular vulnerabilities to chemical exposures.

Many communities do not trust industry to protect them from harm due to chemical exposures. Moreover, they do not have faith that public health and regulatory government agencies will adequately execute public health authorities and enforce environmental regulations. This

²⁴ Akinbami, L. J. (2006, December 12). *The state of childhood asthma, United States, 1980-2005*. 381. Centers for Disease Control and Prevention. Retrieved from <http://www.cdc.gov/nchs/data/ad/ad381.pdf>

Bullard, R.D, Mohai, P, Saha, R & Wright, B. (2007, March). *Toxic wastes and race at twenty: 1987-2007*. Retrieved from <http://www.ejrc.cau.edu/TWART-light.pdf>

[EPA] U.S. EPA. (2010, August 28). *Concentrations of lead in blood*. Retrieved August 28, 2010 from http://yosemite.epa.gov/ochp/ochpweb.nsf/content/blood_lead_levels.htm

Lavelle, M., & Coyle, M. (1992). Unequal protection: The racial divide in environmental law. *National Law Journal*, S1-12.

Lynch, M., Stretesky, P., & Burns, R. (2004). Determinants of environmental law violation fines against petroleum refineries: Race, ethnicity, income, and aggregation effects. *Society and Natural Resources*, 17 (4), 343-357.

Smedley, B. D., Stith, A. Y., & Nelson, A. R. (2003). *Unequal treatment: Confronting racial and ethnic disparities in health care*. Institute of Medicine. Washington, DC: The National Academies Press.

mistrust stems from a long history of unequal treatment, a lack of responsiveness to communities' concerns, and the lack of community involvement in decisions, among other reasons. Furthermore, environmentally-affected and contaminated communities often do not have the resources they need to be effective self-advocates.

Further, little is known about the particular characteristics that may increase the risks posed by toxic chemicals for certain communities. In the absence of this knowledge, government health and risk assessments use standardized exposure scenarios in lieu of community-specific information. Risk assessment models need to better account for communities' socio-cultural differences and potential vulnerabilities. Finally, risk management decisions are sometimes made without consulting affected communities, which can result in an inadequate characterization of risk and remedial options, leaving these populations at greater risk.

Featured Recommendations

Recommendation 4.1: EPA and ATSDR, in cooperation with other relevant federal, tribal, state, and local agencies, should take clear and immediate actions to better protect communities disproportionately affected by chemical exposures.

In 2004, the National Environmental Justice Advisory Council (NEJAC), a diverse group of stakeholders created to advise EPA's Office of Environmental Justice, provided a report to the EPA entitled *Ensuring Risk Reduction in Communities with Multiple Stressors: Environmental Justice and Cumulative Risks/Impacts*. The report described eight overarching themes meant to provide a long-term vision for addressing environmental justice issues and recommended twelve specific actions that EPA could immediately take to lay the groundwork for larger changes. This report and its recommended actions should be revisited as guidance for the development and implementation of actions to protect communities.

Three key policy changes are needed to advance environmental justice and substantially reduce the disproportionate burden of chemical exposure placed on special populations:

1. Immediate action must be taken to prevent exposure to the worst chemicals through adoption of safer alternatives. All chemicals and their alternatives should be evaluated against a health standard that protects all people and the environment, especially the most vulnerable subpopulations, including children, workers, and pregnant women.
2. There needs to be improved communication and coordination between and among multiple levels of government and among federal agencies to enable an integrated and immediate response to community concerns.²⁵
3. Action plans must be created and implemented to relieve the burden from communities highly affected by disproportionate chemical exposures. Strategies to support and finance local cleanup, including direct funding, incentives, private-sector investment, and innovative public financing, must be developed and implemented. The leadership of

²⁵ See Recommendation 5.1 for a discussion of a multi-directional communications model based on respecting all players as both sources for and recipients of information..

federal, state, local, and tribal agencies must take a publicly visible role in supporting interagency cooperation and coordination on these reforms.

Further recommended actions include:

- initiating community-based, collaborative, multi-media, risk reduction pilot projects;
- developing a toolkit of implementable risk reduction actions;
- providing resources for community-based organizations;
- developing tools for targeting and prioritization of communities needing urgent intervention;
- creating incentives for business and industry;
- convening scientific and stakeholder dialogues in ways that enhance scientific understanding and collaborative problem-solving ability;
- establishing the scientific basis for incorporating vulnerability into EPA assessment tools, strategic plans, and research agendas;
- offering guidance on greater use of statutory authorities;
- elevating the importance of community-based approaches;
- establishing an agency-wide framework for holistic risk-based environmental decision-making and incorporation of Tribal Traditional Lifeways in Indian Country;
- strengthening EPA's social science capacity and community expertise; and
- integrating the concepts of the NEJAC's Cumulative Risks/Impacts Report into EPA's strategic and budget planning processes.

Recommendation 4.2: Congress should strengthen ATSDR's public health mandate and mission. To this end, CDC should establish an independent body consisting of scientists, epidemiologists, health care providers, state agency experts, and community and environmental health leaders to recommend changes that would broaden the scope of public health actions ATSDR can take to: 1) address environmental health problems in communities and other populations affected by environmental exposures, 2) more effectively build capacity among communities and local health departments to address environmental health problems and effectively engage in public decision making, and 3) establish thresholds that trigger appropriate public health protective actions. Once the review is completed, Congress should amend the agency's mandate accordingly and ATSDR should implement it.

In recent years there has been increasing public concern about the role ATSDR plays in protecting public health and conducting environmental health assessments in identified communities. A major policy issue with these investigations is the lack of community involvement at the "ground-floor," including the planning, design, problem-formulation, scoping and conduct of the investigation or study. This lack of community involvement severely limits the focus and relevance of these activities. In addition, at the federal, state and local level, regulatory and non-regulatory agencies are too often limited by bureaucracy, overburdened with

crisis management, complaints and responding to partisan political and economic interests. Also, jurisdictional boundaries and rules isolate agency functions and limit their activities without the benefits of cross-communication and integrated expertise, resulting in public safety gaps. Data collected are not routinely shared nor coordinated among agencies, limiting comprehensive approaches to chemical exposure.

While agencies need to improve their processes to reach out and better involve communities, on their side communities do not always know how the community/public participation process works, how decisions are made by policy leaders, how they can influence the decision-making process, how to apply for funding and technical resource support, or how to develop partnerships with government, academia, and public health officials to address their environmental health concerns. In addition, communities do not always get the necessary guidance from government officials, which can lead to frustration.

Communities have much to offer in terms of playing an increased role in public health protection – for example, they can often identify problems and trends before government agencies have prioritized those concerns. However, communities lack the funding and technical resources to conduct the independent research necessary to document local problems. Communities are well-positioned to document emerging issues, and providing communities with support can help increase ownership and trust and enrich the research. Communities play a major role in defining and prioritizing the issues and setting the priorities for research about their health and safety concerns especially when they receive resources, access to environmental and health information, advice on appropriate technical resources, and support in the development and implementation of community-based participatory research.

The independent body should develop and implement a process to engage community groups and stakeholders across the U.S. to contribute to the review and re-envisioning of ATSDR's mission and mandate. The goal of the review is twofold – 1) to identify the best methods for the government to respond to community concerns related to environmental exposures and 2) to enable communities to better interact with agencies on environmental health issues. The review should consider how best to achieve the following, as well as other outcomes:

- Collecting primary data and analyzing it at environmental justice-designated sites when data received is incomplete, insufficient, or not available from other agencies/entities²⁶
- Coordinating community dialogues with other agencies/organizations as part of an community engagement mandate to address health issues and health care gaps beyond ATSDR's environmental health mission
- Establishing policies and procedures to ensure community advisory groups (or similar structures) are used in disproportionately-affected communities (including communities of color, Indigenous communities, and low-income communities)

²⁶ Collection of data and scientific analysis will not delay interim changes necessary to protect the health of affected communities. These changes can include erecting temporary barriers or buffers to protect communities from migration of toxins into residential and/or public spaces while waiting for studies and analysis to be completed.

- Reviewing, updating, distributing, and making available in plain language ToxFAQs and site-specific fact sheets as science changes, new information is acquired, and new hazardous chemicals/substances are identified
- Providing communities with funding, technical assistance and resources to build capacity to address environmental health problems.
- Identifying best practices, providing training and/or increasing consultation for local public health improvement, broaden the scope of monitoring environmental contamination and establish a threshold that triggers appropriate public health protective actions.
- Integrating and training state and local public health teams to use the ASTDR/CDC technical competencies to meet the increasing demand for conducting community and neighborhood-based health impact assessments in contaminated communities
- Establishing accountability performance measures to strengthen agency activities, such as periodic systematic reviews of their application of health recommendations and guidelines, regular reporting on effectiveness, and quality of service and communication debriefing. Long-term, comprehensive and strategic environmental health planning is needed, together with regulatory reform, to address tertiary prevention. Adopting a system of open, transparent case review to learn about deficiencies and improve response would benefit all the agencies' performance accountability.

As part of this review process, ATSDR should collaborate with appropriate federal agencies with environmental responsibilities²⁷, foundations, practice-based research networks (PBRNs), and academic institutions to consider developing and expanding programs to provide support and funding for a) intermediary environmental justice and other non-profit organizations to provide technical assistance and funding support to smaller environmental justice groups and communities; b) a shared clearinghouse for communities to access information on best practices and resources offered by state and federal agencies, and to connect communities to additional resources; c) training on how to negotiate government systems, engage with political and regulatory decision makers, work with government agencies to get health information, and develop partnerships with government, academia, and public health officials; d) training and other resources to become effective advocates; e) information and resource support in applying for funding to address public health concerns; and f) expanded programs to support and fund community-based participatory research.

Congress should allocate funds to ATSDR to establish the review process and ensure the agency has the capacity and resources to effectively implement this recommendation. At the conclusion of the process, Congress should amend the agency's mandate accordingly.

Finally, ATSDR staff and cooperative agreement partners in state health departments should receive training and support in implementing these new mechanisms for community involvement, including sensitivity training.

²⁷ For example, the EPA/EPA, AHRQ, and the Departments of Health and Human Services, Agriculture, Defense, Energy, Interior, Transportation and Justice.

Additional Recommendations

Recommendation 4.3: HHS should establish and support an Interagency Working Group on Environmental Public Health to coordinate across government agencies and improve communication with and accountability to communities.

HHS should re-establish and support an interagency working group on environmental public health comprised of the federal agencies with a shared commitment to environmental public health.²⁸ This Federal Interagency Working Group on Environmental Public Health should be constituted with a broad mandate, but begin with a priority focus on health effects from chemical exposures. It would have a mandate to coordinate research, communication, training efforts, and funding announcements across the federal agencies, as well as establish a centralized resource for community groups with a focus on human health. The working group would be charged with fostering multi-directional communication between government and communities. To ensure that federal agencies better assist community residents seeking information, the working group should create a mechanism to help residents find services within the participating federal agencies. The working group should also establish a Public Ombudsman to ensure that communities have access to complete and comprehensive information as well as assistance in communicating with government agencies at all levels. Furthermore, the working group could review and implement Open Government Plans that address government transparency and engage existing community advocacy groups in a manner similar to the NIH Director's Council of Public Representatives (COPR). These efforts could be expanded to increase government accountability, streamline government operations and ensure communities' involvement in the process.

Recommendation 4.4: The NIH/NIEHS, CDC/ATSDR, EPA, state and local health departments, tribal nations, and the Indian Health Service should identify and define vulnerability characteristics of communities in terms of both structure and function, as well as their influence on increasing susceptibility to environmental chemical exposures.

Research is needed to identify and define the “vulnerability characteristics” of communities. Those assessing risks in communities need to understand how community characteristics in terms of both structure (e.g., age, socio-economic factors, proximity to pollution sources, cultural and religious practices) and function (e.g., social organization, capacity to address impacts, language barriers) serve as both risk and protective factors for chemical exposures. To adequately assess and understand cumulative risks in communities, questions about community-specific situations and vulnerabilities should be incorporated into exposure assessments, risk assessments, and existing surveys.²⁹ In doing so, it is important to involve the communities themselves in describing their specific situations and vulnerabilities. Such changes would lead to developing a more holistic risk management approach that identifies and measures cultural impacts and integrates them with human health and ecological effects. Pilot research projects

²⁸ CDC/ATSDR, the EPA, NIH, the Health Resources Services Administration and the Departments of Health and Human Services, Defense, Energy, and Justice, etc.

²⁹ E.g., National Health and Nutrition Examination Survey, ATSDR, census-derived follow-ups, and activities supported by the U.S. EPA's Community Action for a Renewed Environment grants program.

should be undertaken to identify and define vulnerability characteristics in appropriate communities. Based on what is learned in the pilot projects, guidance for including these questions should be developed for all relevant programs. Finally, as additional vulnerabilities are identified, toxic site remediation actions and local emergency response planning efforts (e.g., floods, man-made disasters) should be tailored to the specific, empirically-derived, vulnerability characteristics of a community.

Recommendation 4.5: CDC/ATSDR, EPA, tribal governments, and relevant federal, state, and local agencies should create agency-tribal partnerships focused on population health monitoring, tribal capacity-building and improved access to state and federal data sources.

Tribal communities are vulnerable to toxic and chemical exposures due to the location of reservation lands in proximity to chemical waste disposal sites; contamination of the fish and wildlife that sustain the Native American diet; and pervasive poor health conditions. While an investigation may assess chemical damage and recommend remediation actions, there are limited funds and resources within tribal health programs and tribal governments to adequately address remediation. In an example of a successful program, FEMA provides grant funding for tribes to develop Pre-Disaster Mitigation Plans (PDMP), which in turn makes the tribes eligible for 75% of damages on tribal lands. In addition to preparedness, this initiative promotes tribal intra-departmental coordination and recognition of tribal sovereignty.

Recommendation 4.6: Federal agencies, should establish, facilitate, promote, and expand upon training programs³⁰ for government employees, community groups/residents, academia, industry, and volunteers to develop and advance their capacity to ensure the success of community-engaged environmental health projects.

In order for partners to work effectively with communities, it is vital to build the skills and capacity of those partners (Ahmed and Palermo 2010). Too often, skill-building is focused solely on community organizations and residents and not on other partners, especially government employees who oversee and administer federal programs that promote and foster community partnerships. All partners – government employees, academia, industry, and community health volunteers – need to develop and advance their skills to ensure the success of community-engaged projects. Following are specific recommendations to meet the needs of each partner:

- **Government employees:** Training programs should build the capacity of government employees to work in partnership more effectively with community groups and residents and should include topics such as environmental justice competencies and principles of community engagement.
- **Academia:** Grant-making institutions should promote, and academic institutions should offer, programs to build the skills of current and future researchers with a commitment to

³⁰ Examples of existing programs include the HHS Office of Minority Health's offering of cultural competencies for clinicians and others; the National Institute of Minority Health and Health Disparities' (NIH) loan repayment and training program for young investigators; the NIEHS's (NIH) fellowship program for investigators wishing to do work in environmental public health; and CDC's Collegiate Leaders in Environmental Health and Public Health Apprentice Program..

community-engaged research. Such activities could include fellowships, training, and loan repayment programs.

- **Volunteers:** A new Community Environmental Public Health Corps Program should be created to bring in young graduates committed to working with community groups focused on environmental public health and environmental justice concerns. This program would provide critical training to the program members and also ensure grant dollars and volunteers for community-based organizations, especially in communities of color and low-income communities.
- **Industry/Business Partners:** Training programs should be created to develop the skills of business partners to work more effectively with community organizations/residents as they address environmental health and justice issues of concern to the affected community. The training programs should include topics such as cultural competencies, communication, trust-building, and collaborative problem-solving.

Conclusion

Significant changes to current policies and procedures are needed to promote health and wellness in environmentally-burdened communities. This includes strong chemicals policy reform that will address issues of environmental justice and better protect vulnerable communities.

ATSDR's current scientific methods, as well as its overall mission and mandate, should be reviewed not only to better account for the public health impacts of toxic exposures and the special health vulnerabilities of communities, but also to create mechanisms for increased community engagement in scientific research and government decision-making. In order to account for the vulnerabilities of communities, it is important to gain a better understanding of the specific factors that increase the vulnerability of certain communities to chemical exposures. Fostering improved, multidirectional communication between communities and governments will be a step toward building trust between the two and ensuring that communities' needs are met. Finally, to effectively address communities' environmental health problems and allow them to advocate on their own behalf, it is important to provide resources for strengthening the capacity of tribes, communities, and those who work in partnership with them – government employees, academics, volunteers, and industry representatives.

Chapter 5: Strengthen the Public’s Ability to Participate Effectively in Environmental Health Decision-making

Despite extensive communication efforts and increasing attention to public health and chemical exposure issues in the media, the public is often unaware of actual or potential health issues related to chemical exposures until an event occurs in their lives, such as the discovery of a community contamination or the illness of a family member suspected of being related to chemicals. In these situations, the public looks to the government and other actors for information. The public deserves accurate, timely, and transparent answers to their questions, which means ensuring the public has an active role in the information exchange (communication) process.

Governmental and other efforts to communicate and engage effectively with the public about chemical exposures and health face serious challenges, including public distrust of information coming from the government and the private sector; differing views of risk; the inaccessibility of relevant information; the need to use appropriate modes of communication; and the ability of target audiences to manage the scientific complexity, volume and pace of information, as well as to distinguish its quality. Cooperative efforts to promote education and communication between the government and the public and workforce must incorporate and honor multiple sources of knowledge and experience, styles of learning, diverse cultural values and resources, and varying levels of education and access to information. For those seeking information on chemicals and chemical exposures, many existing databases and information sources are often isolated, hard to find, difficult to use, or outdated. Hazard information is subject to diverse and sometimes conflicting domestic and international requirements, which can create confusion. Finally, recent efforts to protect the confidentiality of data have often resulted in less than the desired amount or quality of datasets on chemical exposures.

Even the best multidirectional *communication* in the face of specific problems, exposures, assessments, or studies does not provide the level of environmental health literacy needed to understand and participate in problem-solving and decision-making about the increasingly complex chemical exposure and health challenges that will continue to arise. *Education* about chemical exposures and public health is a longer-term and more sustained effort.

Although environmental *awareness* has increased in recent years, a deeper knowledge of environmental principles, understanding of causes and solutions, and ability to apply this knowledge in real world settings is needed. While simple awareness of environmental issues may contribute to public support for strong environmental policy, it is insufficient for informed decision-making and engagement in the policy process. True environmental health literacy begins with sustained and focused efforts around environmental and health education – starting with youth – and continues through efforts of life-long learning.

Despite these challenges, there are enormous opportunities for enhancing education and communication regarding chemical exposures and health. In a successful participatory system, the public would be more knowledgeable about environmental health, and key audiences would have the knowledge, skills, and ability to engage actively and effectively in discussion, deliberation, community-based research, and decision-making about health and the environment. In such a system, government agencies at all levels would embrace a multi-directional approach to communication and education, based on trust, mutual respect, and a commitment to civic empowerment and capacity-building.

Featured Recommendations

Recommendation 5.1: EPA, CDC/ATSDR/NCEH, NIEHS, NIOSH and OSHA should convene a multi-stakeholder group to identify and elaborate the essential elements of an effective multidirectional communication model for government agencies involved in chemicals and public health and develop guidelines and processes to effectively integrate this model into agencies' standard operating procedures.

The public is often unaware of actual or potential health issues related to chemical exposures until an exposure, contamination, or disease cluster occurs in their community or the illness of a family member, friend, or acquaintance is suspected of being chemically-related. In these emergent situations, the public looks to the government for help and information. For example, they want to know if and to what chemicals they have been exposed; what is known and not known about the health effects; who is responsible for the problem and what will be done to abate it and prevent it from happening again; and how their own knowledge, experiences, questions, and needs will inform the government's response, research, and potential policy development.

Too often, government agencies have responded to chemical exposure events and public concerns by simply disseminating findings and conclusions of investigations conducted or supported by the government. This unidirectional, non-participatory approach to communication fails to provide the necessary context for the information provided, and it limits the public's participation to that of a passive target. Indeed, the public is an important source as well as target of critical information. A model for multidirectional communication is essential for communicating, understanding, and ultimately preventing and resolving issues of chemical exposures and public health. The key principles of this multidirectional learning process should be the cultivation of mutual trust and respect and a commitment to civic empowerment, participation, and capacity building.

Although many government agencies have made progress on public participation and stakeholder involvement over the years, the mechanisms are often pro-forma and inaccessible to a large segment of the public. Agencies have not fully embraced, integrated, and institutionalized an effective multidirectional model of communication with the public. To do so, government agencies will need to devote specific and adequate resources to train staff, develop guidelines, and create infrastructure that

will enable the public and affected communities to participate in the development of knowledge, and the creation of effective health-protective recommendations.

The EPA, CDC, NIEHS, and OSHA should convene a multi-stakeholder working group to 1) identify and elaborate the critical elements of an effective multidirectional model for federal, state, and tribal government agencies involved in chemicals and public health and 2) develop guidelines and processes for integrating this model into standard operating procedures of government agencies. Possible mechanisms include:

- creating specific agency staff positions devoted to building capacity of traditionally disempowered communities and to cultivating and routinely partnering with grassroots community organizations and leaders in communication efforts;
- establishing a mutually supportive network of federal, state and local governments staff members dedicated to fostering and enhancing multidirectional education and communication.
- allocating financial resources to support public participation and multidirectional education and communication efforts for projects that prevent, assess, or remedy chemical contamination events and public exposure to environmental pollutants.

Recommendation 5.2: Federal agencies should collaborate with state agencies, industry, academia, and NGOs to improve the public availability and clarity of chemical information on all products throughout the supply chain, from initial chemical manufacturer and/or formulator to final article/ consumer product.

Information regarding chemicals, their risks, and their uses in products is limited, fragmented, and difficult to access and understand. Current product labeling requirements often lack chemical-specific information, and labels are often incomplete, misleading, or unnecessarily complex. For many products, there is no requirement to make any chemical ingredient information available. Consumers have difficulty accessing credible, reliable, and useful information on chemical hazards. Many valuable existing sources of information are not linked in a way that facilitates access to and use of the information they contain.

Federal and state agencies should collaborate with stakeholders from academia, nongovernmental organizations, and industry to 1) develop, enhance, and integrate existing databases on chemicals in products and articles; and 2) create and improve tools to facilitate interpretation of chemical hazards and provide the public with a greater understanding of chemical use and exposure. California is currently developing a Toxics Information Clearinghouse; Michigan is creating a Green Chemistry Clearinghouse, and EPA's Design for the Environmental Program and the Chemical Specialty Products Association also have an initiative. These could serve as models for a national effort. Moreover, the federal government should demonstrate leadership by developing a publicly available Chemical Information Initiative (CII). This "national network" would provide the electronic means to link and coordinate information on chemicals from the range of existing and planned data, information systems, and networks, enabling stakeholders to quickly and easily to access information on chemical production, hazards, use, and presence in products and the environment.

Another important aspect of this approach is requiring that all consumer products and articles list the chemicals that remain in the product in sufficient quantities on the label. This change could fit within the framework of the Fair Packaging and Labeling Act, which states: “Packages and their labels should enable consumers to obtain accurate information as to the quantity of the contents and should facilitate value comparisons.” The CPSC is responsible for regulating consumer products, and children’s products in particular, under the Consumer Products Safety Act (CPSA). While the CPSC is tasked with evaluating the safety of products and setting limits, it does not currently require labels to list the primary components of products. Efforts should be undertaken to amend consumer protection legislation to require dissemination of information to consumers on the chemicals that could present potential hazards in consumer products.

Recommendation 5.3: The Department of Education, CDC/ATSDR, NIEHS, EPA, academic institutions, and localities should convene a multi-state collaboration to develop 21st century human, environmental and occupational health education to: 1) assure grade-appropriate, general understanding throughout K-16; and 2) integrate mechanistic toxicology and environmental impact science into curriculum requirements for chemistry and chemical engineering degrees at both undergraduate and graduate levels.

It is critically important to expose students to environmental health issues from the earliest educational stages and throughout their formal education. A 21st-century environmental and occupational health education model for K-16+ is needed to build environmental health literacy, numeracy, and foundations for careers in order to create the next generation of informed citizens and practitioners. Interdisciplinary curricula should be standards-aligned, place-based, and student-centered, all aimed at developing a new cadre of environmental health guardians of the future.

- *Standards-aligned:* States, in collaboration with federal education and health departments, should develop interdisciplinary K-12 educational standards, including (but not limited to) the subjects of science, civics, social studies, reading, and math, that require teaching the scientific and social bases of environmental health. These K-12 standards should ensure that students will be eligible for college and post-college programs that prepare environmental health professionals. Experts should review curricula to ensure they cover chemical pollutants and their effects on environmental health; identify gaps; and help teachers better integrate this topic into their courses.
- *Place-based:* Curricula should take issues of local geographic and community relevance into account in order to relate to diverse communities. There should be a particular emphasis on environmental justice and vulnerable populations.
- *Student-centered:* The U.S. Department of Education, the CDC/ATSDR, and the NIEHS should train teachers in a student-centered approach to teaching environmental health. Student-centered teaching increases student enthusiasm for the content matter, allows for experiential knowledge and application of concepts, and reinforces and operationalizes a multidirectional learning approach. Models include the CDC’s Science Ambassador

Program,³¹ which targets teachers, and the NIEHS's Summers of Discovery Program, which works with students directly in lab settings.

For undergraduate and graduate education, institutions of higher education, certifying professional associations, and government health and environmental agencies should develop professional competencies (including ethics); assess student proficiency in these competencies through certification and licensure exams; and assess institutional proficiency in these competencies through the accreditation process. Partnerships with colleges and universities serving students traditionally underrepresented in environmental health should be a priority (e.g., tribal colleges and universities and historically black colleges and universities). As recommended by the Consensus Conference on Undergraduate Public Health Education, public health could provide an effective interdisciplinary framework for fulfilling general education requirements found in many undergraduate institutions. Non-biomedical disciplines should also be encouraged to teach concepts of environmental health literacy to help create a broad base of professionals committed to increasing public knowledge about public health and chemical exposures.

The Department of Education, CDC/ATSDR, NIEHS, and EPA should convene a multi-state collaboration to develop environmental health education standards to be adopted and implemented at the state level as well as incorporated into the Common Core³² standards. Curricula that fulfill these standards should be made publicly available in a centralized, online repository co-hosted by the Department of Education and the CDC to facilitate collaboration between teachers. Additionally, these agencies should train teachers in new approaches, technologies, and methods to effectively achieve these standards, with the goal of encouraging and ensuring population-wide environmental health literacy and numeracy.

Additional Recommendations

Recommendation 5.4: The NLM's Toxicology and Environmental Health Information Program should develop a comprehensive online portal to provide information to the public on health and chemical exposures.

To ensure that the public has adequate opportunity to obtain needed information on health and chemical exposures, there should be a comprehensive information portal that functions as a single point of entry for chemical risk and exposure information sources held by academic institutions, government, industry, labor unions, and non-governmental organizations. The NLM's Toxicology and Environmental Health Information Program³³ (TEHIP) already provides a website (<http://sis.nlm.nih.gov/enviro.html>) and manages the Toxicology Data Network

³¹ For more about CDC's Science Ambassador Program, see <http://www.cdc.gov/excite/ScienceAmbassador/ScienceAmbassador.htm>.

³² The Common Core State Standards define the knowledge and skills students should have within their K-12 education careers so that they will graduate high school able to succeed in entry-level, credit-bearing academic college courses and in workforce training programs. See <http://www.corestandards.org/about-the-standards>.

³³ A TEHIP fact sheet is available at <http://www.nlm.nih.gov/pubs/factsheets/tehipfs.html>.

(TOXNET), which provides access to numerous toxicology and environmental health databases. The TEHIP resources should be expanded to (1) provide easy access to sources of information pertinent to each chemical, such as regulatory status, safety standards, exposure limits, and health effects; (2) acknowledge sources and limitations of research for each resource³⁴; (3) cite any incomplete, ongoing studies that the program is aware of; and (4) provide the best information and education available, even if the issues are not well addressed by government agencies, or point interested parties to other resources. Given that the portal links to various sources of information, guidance should be developed to ensure federal agency websites (1) are regularly updated; (2) present information in lay-audience and user-friendly formats; and (3) include a method to allow public and transparent input on the relevance, accuracy, and completeness of posted documents. Consistent with the multidirectional model, the portal needs to allow for feedback loops in communication that enable information to flow both to and from the public. Finally, all government agencies should develop guidance to ensure communities that cannot access the online portal can still receive information.

Recommendation 5.5: Increasing public access to data by 1) undertaking a NAS study to resolve the issue of the appropriate balance between confidentiality and data quality; 2) ensuring that respondents have access to data collected on them; and 3) establishing an ATSDR clearinghouse for quality local studies of chemical exposures.

The results of workplace and community-based surveillance and biomonitoring efforts must be available to employers and health authorities in order to identify problems and take corrective action. It is important, however, that information generated by the use of biomarkers in individual patients in the clinical practice setting be appropriately protected by the physician-patient relationship. To date, the federal government's efforts to protect the confidentiality of individual study respondents' data³⁵ have had the unfortunate consequence of either preventing the release of local datasets on chemical exposures or reducing the quality of the data and thus their utility. Several steps can be taken to balance the need for quality data with the need to protect confidentiality:

- a) **A NAS study should be sponsored to resolve the issue of the appropriate balance between confidentiality and data quality, especially for local analyses.** The NAS should assess 1) the impact of data masking and how these methods can be modified to assist analyses of chemical issues, particularly at the local level; and 2) the similar trade-

³⁴ The portal should provide a brief description of the utility of each information source, cross-referencing and linking (1) government and non-government Web sites; (2) peer-reviewed papers; (3) non-government "grey literature," such as relevant policy documents and credible unpublished reports; and (4) tools and methodologies developed by various professional subgroups to educate the public and healthcare providers about health and chemical exposures. Agencies that develop information on chemical risks should tabulate and make accessible the health outcomes studies they use, and include information about the population(s) studied, the adequacy and strength of the studies, and what is known and unknown about the chemical under consideration. As chemical exposures often occur first and worst in occupational settings, OSHA and NIOSH should develop easily accessible information on workplace assessment tools, best practice controls, occupational exposure limits, and safer substitute materials and processes.

³⁵ For example, the Health Insurance Portability and Accountability Act (HIPAA) and the Confidential Information Protection and Statistical Efficiency Act (CIPSEA).

off between protecting confidential business information and releasing data on possible chemical exposures. This study should be initiated within three years.

- b) **Respondents should have access to data collected on them.** Study respondents should be offered the option to receive the results of personal biomonitoring and physical samples collected from their property. These data should be accompanied by an explanation in layperson's terms that provides context for the exposure measurements. Respondents must be assured of the confidentiality of their personal information.
- c) **ATSDR or another governmental agency should establish a clearinghouse for quality local studies of chemical exposure.** The clearinghouse should provide standardized information that would allow users to judge the applicability of the data.³⁶

Recommendation 5.6: Federal agencies should build public trust in government studies, publications, and communications by 1) developing and enforcing clear guidelines for scientific research involving chemical exposures and 2) creating an ombudsman position with the authority to investigate any allegations of scientific misconduct with regard to government studies.

Trust is a critical element in efforts to educate, communicate with, and otherwise engage the public about chemical exposures and health. Public mistrust of the data sources, study methods and results, or interests and intentions of the researchers or communicators, can undermine education and communication efforts about chemical exposures and public health and render these efforts futile. The scientific community is guided by a set of principles, traditions, norms, and standards that embody the values of honesty, integrity, objectivity, openness, and collegiality.³⁷ Because these standards have not always been upheld³⁸, government should take steps to strengthen the trust in and credibility of its science and its capacity to improve the public's health. Therefore, agencies that address public health and chemicals should

³⁶ Examples of documentation that should be required for inclusion of a local study in the clearinghouse include statistical sample design; sample size; list of chemicals tested for; physical analytic methods; basic findings; links to publications or a summary of findings; and contact person information.

³⁷ National Academy of Sciences, National Academy of Engineering, Institute of Medicine, Committee on Science, Engineering, and Public Policy, Panel on Scientific Responsibility and the Conduct of Research. *Responsible Science – Ensuring the Integrity of the Research Process*. Vol. 1. Washington, DC: National Academy Press, 1992;

³⁸ See the following for examples of past problems with government science: *A Public Health Tragedy: How Flawed CDC Data and Faulty Assumptions Endangered Children's Health in the Nation's Capital* (May 2010): http://democrats.science.house.gov/Media/file/Commdocs/hearings/2010/Oversight/20may/Staff%20Report_DC%20Lead_5.20.10.pdf; *Agency for Toxic Substances and Disease Registry: Policies and Procedures for Public Health Product Preparation Should Be Strengthened* (April 2010): https://atlanta.securemail.hhs.gov/exchweb/bin/redir.asp?URL=http://democrats.science.house.gov/Media/file/Commdocs/hearings/2010/Oversight/20may/GAO_Report_ATSDR_5.20.10.pdf; *The Agency for Toxic Substances and Disease Registry (ATSDR): Problems in the Past, Potential for the Future?* (March 2009): <https://atlanta.securemail.hhs.gov/exchweb/bin/redir.asp?URL=http://democrats.science.house.gov/Media/file/Investigations/ATSDR%2520Staff%2520Report%252003%252010%252009.pdf>; *EPA Science: New Assessment Process Further Limits the Credibility and Timeliness of EPA's Assessments of Toxic Chemicals*. (September 18, 2008) Government Accountability Office, Testimony before the Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives; *U.S. Fish and Wildlife Service: Endangered Species Act Decision-Making*. (May 21, 2008). Government Accountability Office. Testimony before the Committee on Natural Resources, House of Representatives.

create an ombudsman position with the authority to investigate allegations of scientific misconduct for any study authored by the government (or published in a government journal).³⁹ In addition, agencies should develop and enforce clear guidelines for scientific research involving chemical exposures in a specific community or region that require:

- Public participation early in the investigative process (i.e., when the problem to be studied is defined and the research questions are identified), giving voice to affected and vulnerable groups, independent scientists and public health experts;
- Full and fully verified federal government responsibility for the data used in government studies and its accuracy, even if that data originated in local, regional, or state offices;
- Full disclosure of authors' financial and non-financial conflicts of interest, as well as uncertainties and limitations of their research;
- Peer-review for all government studies that includes reviewers selected by the affected community/communities;
- Full transparency of data sets, analyses, notes, and draft reports, to be subject to Freedom of Information Act (FOIA) requests with no exceptions; and
- A clear retraction policy requiring government studies with falsified, fabricated, or missing data, as well as erroneous or misleading analyses and/or conclusions to be removed fully and in a timely and transparent manner.

Conclusion

Empowering the public to make choices that protect their health depends on improved information, enhanced models of communication, effective means to participate in environmental health decision-making; and the availability of healthy choices. The Leadership Council suggests standardizing, consolidating, and improving the quality of information available on chemicals and chemical exposures, as well as rendering it more easily accessible the public. It also is critically important to build environmental health literacy among the public and to foster a commitment to life-long learning of environmental health issues. These efforts also will help ensure a “pipeline” of future public health and health professionals, to be discussed in greater detail in the next chapter.

³⁹ CDC's NCEH/ATSDR had this position at one time.
Draft Action Agenda V12_clean

Chapter 6: Strengthen the Capacity of the Public Health and Health Provider Work Force to Address the Needs of People Exposed to Harm from Chemicals

Health professionals, including public health practitioners, clinicians, and nurses, are often unprepared to prevent, diagnose, and treat health conditions related to chemical exposures. In addition to clinicians, the nation relies on a large corps of health professionals to help protect and promote the health of humans, animals, and the environment. These professionals work in public health and environmental departments and other government agencies, healthcare institutions, non-governmental organizations, industry, and academic institutions. They may have had little or no formal training in environmental health in general or chemical exposures and health in particular.

To help protect and promote the health of humans, animals, and the environment, environmental health education needs to be better integrated into medical and nursing education. The nation needs to establish a model for career-long learning for healthcare providers and to build a pipeline of future public health professionals who have formal training in environmental health through early investment in their training. Furthermore, the United States needs well-trained environmental public health professionals who represent the under-resourced and historically marginalized communities that bear a disproportionate burden of environmental health risks and to increase the resources available to public health agencies.

People in the nation's most at-risk communities are often served by community and public health centers, which have the potential to offer a wide array of preventative and environmental health services. Although individualized assessment of environmental exposures, along with associated risk communication, health education, and anticipatory guidance efforts, could contribute to disease prevention and early detection, potentially eliminating the need for expensive health care services, these environmental health services are virtually absent from primary care settings.

Ideally, the United States would have a diverse cadre of health care providers and public health professionals who are well trained in environmental health, see prevention as primary, and are committed to and prepared to meet the needs of affected individuals, vulnerable populations, and marginalized communities who are geographically remote or who bear a disproportionate burden of environmental health risks.

Featured Recommendations

Recommendation 6.1: Health professional organizations and relevant federal agencies e.g., CDCATSDR, EPA, and HHS) should collaborate to better incorporate environmental and occupational health competencies into formal health professional education.

Exposure to chemicals can have serious adverse health effects, especially for children, people with chemical sensitivities, and other vulnerable populations. Yet most healthcare providers are

not prepared to recognize and refer or help prevent chemical exposure-related illness in their patients. All healthcare providers should have basic competency in environmental health. Leading health institutions and professional organizations have emphasized the need to enhance the knowledge and skills of healthcare providers in environmental health. Over the years, expert bodies have made recommendations and developed resources to integrate environmental health curricula into medical and nursing education. To date, most of our medical and nursing schools and training programs have not adequately met this need or used these resources.

Recommended strategies for incorporating environmental and occupational health into health professional education include the following:

- 1) Health professionals, their professional organizations, and their decision-making bodies (i.e., curriculum committees, accrediting institutions, etc.) should collaborate to develop national guidelines that recommend competencies specific to the prevention, recognition, and management of environmental exposures for both undergraduate and graduate training in medicine and nursing.
- 2) National professional organizations should endorse these guidelines and ensure that these competencies are addressed in licensure and certification exams.
- 3) Health professional organizations and their decision-making bodies should create board exams and set curriculum requirements to include competencies in environmental health.
- 4) The relevant federal agencies (e.g., CDC/ATSDR, EPA, and HHS) should work together to create and launch an Environmental Health Leadership Program that would fund 146 faculty champions (one faculty champion in each of the 126 academic health centers in the U.S., plus an additional twenty faculty champions in twenty other higher education institutions) and create a vibrant network of educators committed to ensuring a pipeline of healthcare professionals competent in environmental health.⁴⁰ This component is designed to ensure the development of a nationwide cadre of faculty champions who will lend expertise and support for this effort in their institutions and surrounding communities. The Leadership Program should be evaluated after five years and be considered a success if the schools and training programs specifically include and address environmental health competencies in their required curriculum.

Recommendation 6.2: Relevant federal, tribal, state, and local agencies, NGOs, and academic institutions should collaborate to educate, mentor, and hire environmental and occupational health professionals committed to and/or coming from under-resourced and historically marginalized communities and their institutions by creating pipeline of experiential learning opportunities for students at all levels.

The United States currently has a dearth of well-trained environmental health professionals who come from the under-resourced and historically marginalized communities that bear a disproportionate burden of environmental health risks. The nation can begin to develop an

⁴⁰ A faculty champion, for purposes of this initiative, is defined as a faculty member who takes a leadership role in integrating environmental health into his/her institution in a sustainable fashion (Rogers, McCurdy, Slavin, Grubb and Roberts 2009).

extensive, diverse pipeline of environmental health professionals by providing opportunities for both students and scientists.

To provide motivation for and strengthen environmental health literacy, CDC/ATSDR, NIEHS, state agencies, and institutions of higher education should collaboratively create a bold, exciting, new transdisciplinary approach for students by developing a meaningful dialogue and experiential learning opportunities with those representing the social and scientific fields related to public health and chemical exposures - medical professionals, science administrators, epidemiologists, environmental scientists, behavioral researchers, social workers, and policy representatives .

All agencies that hire environmental health professionals (i.e., CDC/ATSDR, NIEHS, EPA, state, local, and tribal health and environmental departments, NGOs, etc.) should create and participate in organized approaches to identifying potential environmental health professionals early and providing them with prestigious, well-paid opportunities that allow them to continue to develop as professionals over the course of their career through formal program coursework, fellowships, and practical experience. These programs should (1) emphasize identifying under-represented professionals and their institutions and encouraging their participation; and (2) prioritize serving under-resourced and historically marginalized communities.

Such programs could (1) establish comprehensive fellowships and experiential opportunities for environmental health students and individuals who have graduate degrees that emphasize community outreach and research; (2) permit flexible scheduling that adapts training schedules to a variety of educational and career-development pathways; and (3) conduct proactive, equal-opportunity recruitment that ensures representation of a wide variety of cultures and races. In addition, government and academic centers should offer internships that engage students at all academic levels in environmental health as well as identify and mentor those showing significant promise as environmental health professionals.

Additional Recommendations

Recommendation 6.3: The Public Health Accreditation Board (PHAB) should include strong standards in their national accreditation program to advance the capacity and competence of public health agencies to succeed in environmental public health work and CDC and EPA should endorse and support them.

To encourage improvements in environmental health services, the public health field should take advantage of existing accreditation efforts. In particular, the Public Health Accreditation Board's (PHAB) national accreditation program for state, local, territorial, and tribal health departments should include strong standards related to departments' competence to address the chemical exposure issues most relevant to their community.⁴¹ While PHAB accreditation is voluntary, CDC and EPA should endorse the program and institute accreditation as a

⁴¹ The PHAB accreditation program is currently under beta testing in thirty health departments across the nation and will be launched officially in 2011.

requirement for federal funding. CDC should further support the program by (1) assisting with outreach to ensure that the program is marketed broadly and (2) encouraging and supporting the use of the existing Environmental Public Health Performance Standards,⁴² which will help prepare public health programs for the accreditation process. Specifically, CDC should enumerate and increase (1) the environmental public health programs that use the Environmental Public Health Performance Standards and (2) the users of standards that report addressing identified gaps and program improvement measures.

Recommendation 6.4: The Institute of Medicine should convene experts from primary care and environmental and occupational health specialties to develop specialty-specific clinical practice guidelines for addressing chemical exposures.

The Institute of Medicine should convene an expert committee to review any existing guidelines for occupational and environmental exposures, identify gaps, and develop national environmental health practice guidelines for practicing clinicians that recommend practice skills for each primary care specialty. These clinical practice guidelines should address occupational and environmental history-taking, clinical assessment, prevention and treatment of chemical exposures, referral indicators and resources, and access to other relevant resources. The focus should be on practice in medicine and nursing (including physician assistants, nurse practitioners and nurse midwives). The committee should develop an integrated set of occupational and environmental practice guidelines within three years, to be disseminated to relevant audiences and included in the National Guideline Clearing House of AHRQ. The committee should recommend a strategy for evaluating the use and effectiveness of the guidelines. Relevant specialties include family medicine, internal medicine, emergency medicine, pediatrics, obstetrics and gynecology, clinical toxicology, and occupational health. The guidelines should then be endorsed by leading professional associations.

Recommendation 6.5: The National Public Health Training Centers Network; HRSA; CDC/ATSDR; the National Environmental Health Association; state and local public health agencies; and other accrediting organizations should maintain and expand opportunities for the professional development of the environmental public health workforce through credentialing and government training and education programs.

While it is important to promote standardized competencies for addressing the harm from chemical exposures and establish curriculum requirements for schools of public health and accredited environmental health education programs, it must be acknowledged that many environmental public health professionals enter the workforce without having completed public health or environmental health degree programs. Thus, environmental public health professionals require on-the-job training and education to maximize their effectiveness. The following measures can be undertaken to support ongoing education:

⁴² The Environmental Public Health Performance Standards are based on the 10 essential services of environmental public health and were developed to drive continuous improvement in the delivery of environmental public health services. See <http://www.cdc.gov/nceh/ehs/envphps>.

- The National Public Health Training Centers Network, which links public health practitioners with schools of public health and other academic institutions, should provide educational opportunities in the prevention and control of chemical exposures; HRSA should require the inclusion of such training at each training center as a condition for funding.
- The National Environmental Health Association (NEHA) should continue to expand and market its credentialing program for state, tribal, and local environmental health employees (e.g., registered environmental health professional exams, certified professional – food safety, certificates of public health, etc.).
- Credentialing programs, the training products that help people prepare for the exams, and the exams themselves may be issued or conducted by state and local public health agencies, national organizations such as NEHA, or other accrediting organizations.
- Continuing education requirements for these credentials need to be supported in both concept and practice.
- CDC/ATSDR should continue to offer leadership training and resources for state, local, and tribal environmental public health professionals.⁴³

Recommendation 6.6 : CDC, specifically NCEH and ATSDR, and HRSA should encourage and support the incorporation of environmental health services into reimbursable primary and specialty health care services and the creation incentives for change in clinical practice through expert consultation.

Primary health care providers (physicians, nurses, and others) receive limited training in environmental health in their basic education and therefore do not necessarily have the knowledge and skills to integrate environmental assessments/interventions into their clinical practices. In this context, practical and achievable interventions would be to increase primary provider knowledge and skills to allow them to better determine when an environmental contributor may be present and to expand the reservoir of experts in environmental health so that consultation and management services become more readily accessible. This can be achieved by 1) creating an environmental health assessment tool; 2) developing interventional and referral guidelines for environmental issues; and 3) requiring that environmental health data be incorporated into electronic health records. Furthermore, specialty care reimbursement should be facilitated by creating specialty codes appropriate to medical toxicology and to environmental medicine and by establishing billing codes and reimbursement schemes for environmental health assessments, risk communication, health education, and other associated interventions. CDC, specifically NCEH and ATSDR, and HRSA should collaborate to convene and fund the activity of an expert committee representing primary care disciplines and relevant environmental specialists to identify key environmental issues, develop realistic incentives for incorporating

⁴³ For example, CDC should continue to dedicate funds to its Environmental Public Health Leadership Institute (EPHLI), a one-year developmental program for practicing environmental health professionals, and should use participant feedback to ensure it continues to be relevant to the workforce. CDC can further expand EPHLI's benefit to the nation's environmental public health workforce by providing all health professionals access to the growing network of EPHLI graduates. Within two years, CDC should establish a process by which state, local, and tribal health professionals can consult with former EPHLI fellows on issues of mutual interest.

environmental and occupational health considerations in clinical practice, and create a plan for implementing, demonstrating and evaluating them.

Conclusion

In order to strengthen the capacity of the public health and health provider work force to address the needs of those exposed to harm from chemicals, environmental health needs to be incorporated into the formal education of the health professional field and develop standardized competencies in environmental public health. More information needs to be collected on lessons learned, best practices, and guidelines that can be used to train the first responders and first receivers who will be in the front lines of chemical emergency response, and a core competency curriculum should be developed for the responder community. Finally, with an eye towards assuring a pipeline of future environmental health professionals, opportunities need to be created for career-long professional development in environmental health, particularly for those from under-resourced and historically marginalized communities.

Chapter 7: Reduce harm from chemical emergencies through prevention, planning and coordination

The capacity of the existing chemical emergency response system, which is comprised of a diverse group of actors on the federal, tribal, state and local levels, to respond to incidents is currently hampered by limited funding, inadequate coordination, deficient laws, insufficient communication, and the unavailability of necessary data. A successful system would prioritize the prevention of chemical emergencies. Such a system would feature the use of safer technologies, including green technology; strategic outreach and communication; enhanced training and coordination during all phases of emergency management among government agencies, tribes, community residents, academia, industry, nongovernmental organizations (NGOs), and voluntary organizations active in disaster (VOADs); and adequate resources for all phases of implementation.

The planning process creates a framework for risk-based decision-making to reduce harm to lives, property, and the economy from future chemical emergencies. All communities, including rural and tribal communities, should have adequate resources and legal authority to complete thorough vulnerability analyses, promote chemical emergency hazard reduction, create effective plans, and take immediate steps to mitigate any hazardous effects of a chemical emergency.

In the context both of federalism and ever-increasing global inter-connectivity, effective coordination is more crucial than ever. Response efforts may require coordination across multiple levels and various silos of local, state, tribal, and federal governments, and even international organizations. Lessons learned from the 2010 Gulf oil spill underscore how critical coordination is to successful chemical emergency preparedness and response. For example, all state and federal health and safety agencies need access to all oil response areas on water and land in order to assure the safety of response workers.

In the case of a chemical emergency, those responding first at the scene may not have the proper training or resources to recognize and mitigate the presence of hazardous chemicals. First responders need to be aware that a potential exposure hazard exists before becoming into contact with potentially hazardous chemicals. To foster an adequately trained emergency response service, it is necessary to address the shortcomings in the current system, including a) uneven access to training; b) inconsistency in the types and levels of training; and c) the lack of coherent local, state, tribal, and federal competency standards for chemical emergency response.

Featured Recommendations

Recommendation 7.1: DHS should work with HHS to provide a single set of federal priorities related to chemical emergency planning and preparedness that 1) supports hands-on, real-time training, including functional drills, to support local interagency emergency response to chemical events; and 2) provides all first responder and first

receiver organizations with a core competency curriculum of training on basic chemical emergency response, communication and coordination of the prevention, planning, response and recovery phases to ensure that there is a common foundation on which all further training can be based.

One of the common concerns and barriers to competency identified by members of the responder and receiver communities is the lack of opportunity participate in real-time and real-life training scenarios. While hands-on, full-scale drills are becoming more accepted and widely used in the responder and receiver communities, they often focus on scenarios built around a large-scale, mass casualty event such as a bus or plane crash or pandemic viral outbreak. DHS and HHS, in establishing a single set of federal priorities on chemical emergency planning and preparedness, should include the provision of both the financial and logistical support to enable communities and the responders and receivers who serve them to plan and execute training drills directly related to chemical emergencies in their local areas. The scenarios drilled should be relevant to specific chemical-related hazards present in the community, such as a leak at a local manufacturing plant or a train derailment. This process must involve not only responders and receivers, but also members of industry and the business community. Tribes, communities, and the public and their needs related to notification, evacuation and awareness education should be considered and taken into account when planning and performing a drill.

All first responders, including, but not limited to, fire service (both career and volunteer), law enforcement and emergency medical services personnel, local health departments, and first receiver organizations should possess a basic core knowledge and level of competency in responding to chemical emergencies. In order to strengthen capacity related to chemical emergency event planning, response and cleanup, the country needs a series of successive and interrelated trainings, delivered through existing training providers and funded by federal agencies, including DHS and HHS. Training should include HAZMAT response, terminology, communication and incident command structure to optimize both response capability and responder/receiver safety. DHS and HHS are best suited for this effort as both agencies already provide multiple trainings, either directly or through third parties to the target receiver and responder populations. Trainings on the Incident Command System (ICS) and the National Incident Management System (NIMS) could serve as useful models. Implementation of this program should occur within one year.

To avoid complacency, it is important to provide first responders and receivers with continuing and refresher training. DHS and HHS should look for ways to collaborate with state and local resources to ensure the highest possible participation from all members of the responder and receiver communities. Trainings should be held at accessible locations during hours that first responders can be available, particularly in rural areas where many of the intended trainees are volunteers and hold regular full-time employment elsewhere. It is therefore necessary to hold night and weekend trainings to allow these participants to attend.

The success of this program should be measured by tracking the total number of personnel trained, as well as their performance during drills, exercises, and responses to events.

Recommendation 7.2: OSHA, EPA, and NIOSH, together with other federal and state response agencies, need to develop clear, easy-to-understand chemical emergency guidance values, which better represent real-life risks incurred by first responders at chemical emergencies. These values should protect responders according to the hierarchy of controls.

There is a discrepancy between the recognized legal exposure values provided by OSHA and the exposure values provided by other entities such as NIOSH and the ACGIH.⁴⁴ These values were developed for specific populations and circumstances, and none were developed for guiding response and limiting exposures during an emergency situation. As a result of this shortcoming, the question of which exposure value is applicable in an emergency is an issue of great concern and debate. Further work is needed to develop protective guidance values that are tied directly to the current state of knowledge and research regarding community exposure levels.

Chemical emergency exposure guidance values should require protection of responders according to the hierarchy of controls – a list of steps that employers must take to prevent or reduce exposure to a hazard, ranked from most to least effective. At the top of the hierarchy is the substitution of a safer material, machine, or process; followed by the use of engineering controls like mechanization, enclosure, and ventilation; then by the institution of administrative controls such as housekeeping, hygiene facilities, medical surveillance, air monitoring, and limiting exposure time and proximity; and finally, the use of personal protective equipment like hearing protection, respirators, gloves, goggles, and clothing forms the last rung of the hierarchy.

Congress should 1) streamline or remove the impediments that make it difficult for OSHA to accomplish this goal; 2) authorize and appropriate sufficient funds for the agencies to carry out the recommendation; and 3) examine and modify, and where appropriate, remove legislative, legal, or other impediments to the fulfillment of the recommendation. Success of this program could be measured by the reduced exposure of responders, tribal communities, and the public, as reported to various state and federal agencies (including the military). Implementation may take one to three years. OSHA should regularly evaluate the standards established by this program to ensure proper protection of responders and the public and adjust them as the need arises.

Recommendation 7.3: ATSDR, HRSA, the HHS Office of the Assistant Secretary for Preparedness and Response, and other federal government agencies, should develop an ongoing national program to assess and improve the health care response to hazardous chemical releases, and to develop an evidence base for chemical emergency planning.

One of ATSDR's missions is to prevent exposure and adverse health effects from unplanned releases of hazardous substances. In order to achieve this mission, ATSDR educates physicians

⁴⁴ Current resources used to determine the potential risk of chemical specific exposures include, but are not limited to, OSHA Permissible Exposure Limit (PEL) standards, NIOSH Recommended Exposure Limit (REL) and Short Term Exposure Limit (STEL) guidance values; current American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) guidance; EPA Acute Exposure Guideline Limits (AEGLE); American Industrial Hygiene Association Emergency Response Planning Guidelines (ERPG); and DOE Temporary Emergency Exposure Limits (TEEL).

and other health care providers and provides technical support and advice to other federal agencies, states, and local and tribal governments that respond to hazardous chemical releases. The passage of SARA Title III and the Nunn-Lugar Anti-Terrorism Act reflect increasing concern in recent decades about the country's preparedness to manage adverse health effects due to hazardous chemical incidents. Unfortunately, there is a lack of empirical studies that would allow for the evaluation of the country's current levels of preparedness or guide the establishment of effective preparedness programs. Limited data suggest that the level of preparedness is not adequate. Since planning is only as good as the assumptions on which it is based, it is important that planning assumptions are correct.

To address this deficiency, ATSDR should work with its partners to 1) develop an ongoing national program that includes the following elements and 2) provide the necessary funding to make it sustainable⁴⁵:

- 1) Establishment of a regularly updated national collection of published and unpublished documents, reports, and research papers on the responses to chemical emergencies and releases and the lessons learned from them that would be made available to planners, policymakers, practitioners, and the public.
- 2) Establishment of a standing national rapid-response field chemical emergency research team that would mobilize quickly to gather data on the operational lessons learned and best practices from responses to chemical emergencies. This can occur in conjunction with the ATSDR Assessment of Chemical Exposures (ACE) program teams that collect data on chemical emergency exposures and both short- and long-term outcomes. It is important to collect information from multiple events to identify common trends and patterns and to generate a large enough sampling for analysis. In addition, after-action reviews should be held with first responders and receivers, as well as with affected community members through community post-incident advisory panels.
- 3) Utilization of the data from points #1 and #2 above to establish evidence-based criteria for effective chemical emergency preparedness.
- 4) Regular, national randomized surveys of chemical response organizations and institutions to assess their levels of preparedness using the criteria from point #3. (One might consider this a national preparedness surveillance system.)
- 5) Funding to establish additional National Toxic Substance Incidents Program (NTSIP) states and promote the sharing of existing chemical emergency incident data. Without an understanding of the chemical emergencies that are occurring and their effects, it is impossible to effectively plan for a chemical emergency. The types of surveillance data collected on chemical emergencies also need to be expanded.
- 6) The development of recommendations for chemical emergency and disaster preparedness based on information generated from the above elements. These should be included in training materials for first responders and receivers.

⁴⁵Note that these elements could be extrapolated to all-hazards preparedness as well.
Draft Action Agenda V12_clean

Additional Recommendations

Recommendation 7.4: A Presidential Executive Order or Homeland Security Presidential Directive⁴⁶ should be established that calls for the development of an overarching national vision for chemical emergencies and for each federal agency to develop its own supporting strategy for preventing, preparing for, responding to, recovering from, and mitigating chemical emergencies, and ensuring that preparedness momentum is maintained.

Successful implementation of this recommendation will require a commitment by all federal agencies and will indicate a significant paradigm shift, which calls for presidential action similar to that required to secure government-wide commitment to the principles of environmental justice. As chemical emergencies can affect multiple governmental departments and programs, it is important that such a commitment encompasses all programs and activities involving chemicals. The outcomes created from its implementation should more than justify the investment of time and commitment to government preparedness and response to chemical emergencies across all agencies and levels of government.

The administrators of the EPA and the Secretary of HHS or their designees should convene the Interagency Working Group on Chemical Emergencies (Working Group)⁴⁷ within three months of the date of the order. The Working Group will be responsible for developing a common and shared overarching vision to help guide the agencies as they develop their specific strategies. Ideally, the Working Group will collaborate with the federal Office of the Chemical Emergencies Coordinator, discussed in recommendation 7.4, to

- 1) coordinate with, provide guidance to, and serve as a clearinghouse for each federal agency as it develops a chemical emergencies strategy in order to ensure that the administration, interpretation and enforcement of programs, activities and policies are undertaken in a consistent manner;
- 2) assist in coordinating research by and fostering cooperation among the EPA, HHS, the Department of Education, and other agencies conducting research or other activities related to chemical emergencies;
- 3) assist in developing sources of information on safer chemicals and coordinating data collection;
- 4) examine existing data and studies on chemical emergencies; and
- 5) develop interagency model projects on chemical emergencies that demonstrate cooperation among federal agencies.

⁴⁶ An executive order would be a legally binding order given by the president, acting as the head of the executive branch, to the federal administrative agencies. Homeland Security Presidential Directives are issued by the president on matters pertaining to homeland security.

⁴⁷ The Working Group should be comprised of the heads of the following executive agencies and offices, or their designees: DOD; HHS; HUD; the Department of Labor; the Department of Agriculture; the Department of Transportation; the Department of Justice; the Department of the Interior; the Department of Commerce; DOE; the EPA; DHS (to include [FEMA, the Coast Guard, the Transportation Security Administration, the Science and Technology Directorate, the Office of Infrastructure Protection, and the Office of Health Affairs); the Office of Management and Budget; the Office of Science and Technology Policy; Office of the Deputy Assistant to the President for Environmental Policy; and such other government officials as the president may designate. The Working Group should report to the president through the deputy assistant to the president for environmental policy.

Draft Action Agenda V12_clean Page 67 of 71

Recommendation 7.5: The federal government should establish an office or program whose goal would be to serve as a coordinating unit, unifying and integrating the efforts of federal, state, local, and tribal government agencies with responsibilities related to preventing, preparing for, responding to, recovering from, and mitigating chemical emergencies, and serving as a central coordinating program charged with creating consistency and avoiding redundancy of information on chemical emergencies on the national, state, local, and tribal levels.

In response to the need for a central repository for information on chemical emergencies, the Office of the Chemical Emergencies Coordinator would serve a coordinating function to accomplish a variety of goals:

- 1) Integrating the frequently disparate data developed by federal agencies before, during, and after a chemical emergency, and proactively disseminating it to planners, responders, and, where appropriate, the public via a National Clearinghouse for Chemical Emergencies. The office should collect, develop and disseminate toxicological informational tools. It could serve to inform communities, first responders, and first receivers about current and past storage, use, spills, and releases of toxic chemicals in their areas, as well as information on hazardous activities and agricultural activities involving chemical uses. It would also be charged with receiving reports of chemical emergencies and coordinating timely responses through referrals to the agencies with proper jurisdiction. The office would be responsible for ensuring that responders at all levels have access to real-time information on regional resources and response capabilities. The recommended clearinghouse could emulate the national system of Poison Control Centers.⁴⁸
- 2) Conducting community outreach and volunteer training programs to promote and support individual and community preparedness (e.g., public education, training sessions, and demonstrations). The office would provide agencies and NGOs with a centralized location to report on their activities and programs, which would serve to avoid duplication of efforts and to update stakeholders. A comprehensive, easily accessible website should also be established for this service, with an eye toward providing ongoing education on chemical releases and their prevention.
- 3) Ensuring that chemical emergency prevention, preparedness, and response are prioritized among agencies charged with this area of work.

The Office of the Chemical Emergencies Coordinator should be independent and responsive to the concerns of local communities. Its major funding would come either from a pool of contributions by all relevant federal agencies or from funding triggered by a federal emergency declaration.

⁴⁸ A structure utilizing one or more regional PCCs might form the backbone of the emergency reporting and response system under this office. Mechanisms for raising awareness of PCC services already exist, and a modest expansion in the function and increase in dedicated funding to allow one or more PCCs to adopt this important function would shorten turn-around time for the creation of this office and to make it operational.

Recommendation 7.6: DHS should support the NLM and EPA in developing a single, user-friendly, accessible planning tool for toxicological hazard and hazard vulnerability analysis (HVA) for local response to chemical emergencies.

DHS should support the NLM and EPA in further developing, integrating, and disseminating modern response tools. The body of information within NLM's Wireless Information Systems for Emergency Responders (WISER) should be expanded to fully inform and educate planners, responders and receivers on chemical emergency response steps and needs. The database must be accessible to responders in the field by way of laptop, PDA, mobile smart phone, etc., as well as to receivers and members of the public via the internet. A critical component of this expanded body of information would be a functioning toxicologic hazard-vulnerability assessment tool that allows planners, responders, and receivers to correctly identify the nature and potential magnitude of a chemical event. This comprehensive tool should bridge the gaps between scientific knowledge, risk management and best practices response planning.⁴⁹

Training should be provided on the use and function of the program at no cost to the response community. DHS should task NLM and EPA to continuously upgrade and update the program in order to meet the constantly changing needs of the response community. The program should be implemented within two years, with tracking of program usage, updates, and upgrades to take place within two to three years.

Recommendation 7.7: Federal government agencies with responsibilities for providing applied research funding and other funding to tribes and state and local government agencies on chemical emergencies should require that relevant funding announcements include language strongly encouraging the development of partnerships with non-governmental organizations (NGOs), community-based organizations, academia, labor unions, and industry.

Partnerships are an important tool in preventing, preparing for and responding to chemical exposures. Ideally, partnerships will lead to information-sharing on processes and technologies that can eliminate major chemical hazards. Where appropriate, proposals for funding that include representatives from industry, academia, and community organizations/NGOs as co-equal partners should be encouraged and incentivized, and should receive priority for acceptance and funding. Roles and responsibilities should be shared and clearly delineated to avoid enlisting and creating participants in name only. Proposals that include more than one institution or industry partner as co-equal partners should receive bonus points during the review process. External auditors (one each from the funding source and recipient institutions) should annually review the structure, operating efficiency and results of any partnerships created as a result of

⁴⁹ Two future resources are in development. The NLM is currently developing an internet-based web portal to assist first responders, first receivers and emergency planners in preparing for and responding to chemical emergencies. The Chemical Emergency Medical Management (CHEMM) portal is under development and is similar to the popular internet site Radiation Emergency Medical Management (REMM). This portal will interact with WISER. Ideally, these products would be able to interact with tools such as CAMEO and MARPLOT that can help both identify and pinpoint hazards and assist with evacuation and containment modeling.

grant-related activities. If recipients are found to be non-compliant with the terms of this recommendation, funding may be reduced or withheld.

Recommendation 7.8: The federal government should provide funding and support for the ongoing development of a cadre of trained and experienced Emergency Support Function 8 (ESF 8 health and medical) planners⁵⁰ and responders who will improve emergency operational capabilities and critical decision-making, and also better integrate the tiers of private sector and government responses to public health emergencies during chemical disasters/events.

Planners must be educated and prepared to plan responses that integrate the capabilities and capacities of the many diverse agencies and organizations that may be called upon to respond to a chemical emergency at any geopolitical level. The strategic objectives of such a training program should be to:

- Educate medical, public health, and emergency management professionals to serve as ESF #8 (health and medical response) planners and response coordinators and to become leaders in this field along the lines of hazardous materials task forces
- Provide an experienced and prepared cadre of personnel that can coordinate or assist in ESF #8 planning and can augment ESF #8 response activities at the local, tribal, county, state and national levels
- Enhance effectiveness of ESF #8 regional planning and response partners at the local, county, state, tribal, and national levels by standardizing theory and methods
- Create a highly competent and dynamic faculty/staff that trains organizations by coordinating or assisting in multi-jurisdictional planning and responses, as well educating students participating in the program

Through prior planning and training, leaders at the federal, tribal, state, county, and local levels will be better prepared to help coordinate response planning involving all stakeholders.⁵¹ Implementation of the training program should occur within one to two years and be sustained over the long term.

Conclusion

In order to overcome some of the barriers to a functioning chemical emergency response system, the Leadership Council emphasizes both the need to foster planning and preparedness for emergency response on federal, tribal, state, and, in particular, local levels and the importance of harmonizing existing chemical exposure standards to better protect response workers. The

⁵⁰ Emergency Support Function #8 - Public Health and Medical Services (ESF 8) planners develop mechanisms for coordinated federal assistance to supplement state, tribal, and local resources in response to a public health and medical disaster, potential or actual incidents requiring a coordinated federal response, and/or during a developing potential health and medical emergency. See <http://www.fema.gov/pdf/emergency/nrf/nrf-esf-08.pdf>.

⁵¹ Such an ESF-8 program, the Yale/Tulane ESF-8 Planning and Response Program, is currently in the pilot-testing phase of development and is demonstrating promising results.

Council also prioritizes promoting improved coordination and communication among the diverse agencies and organizations involved in emergency response through establishment of an Office of the Chemical Emergencies Coordinator. To further facilitate the work of responders and receivers, the Council encourages the development of response planning tools and the creation of an accessible central location to house both the tools and relevant data on chemical emergencies. By undertaking these steps in prevention, planning, and coordination, the potential harm from chemical emergencies can be reduced.

DRAFT