

NATIONAL INFRASTRUCTURE ADVISORY COUNCIL

CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL EVENTS AND THE CRITICAL INFRASTRUCTURE WORKFORCE

FINAL REPORT AND RECOMMENDATIONS BY THE COUNCIL

JANUARY 8, 2008

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EXECUTIVE SUMMARY

Background and Methodology

The National Infrastructure Advisory Council (NIAC) convened a Working Group to study the impact of chemical, biological, and radiological (CBR) events on the critical infrastructure worker, and to make recommendations to the White House and the Department of Homeland Security that will strengthen our nation's ability to respond to a CBR event. The timing and methodology of such an event is difficult to predict, and estimates on its impact are wide-ranging. However, there are specific principles that, when effectively implemented, will improve our ability to identify, respond to, and recover from an attack on our critical infrastructure. The NIAC designed this report to identify attributes of different chemical, biological, or radiological event scenarios, identify key elements necessary to sustain critical infrastructure operations, and to make recommendations that will improve our ability to contain the impact, recover from its consequences, and restore the nation's critical infrastructure to a pre-event state.

Though its timing, severity, and ultimate impact remain a topic of much debate, a CBR event promises to test the critical infrastructure of the United States. The Federal government, even with its vast resources, plans, programs, and personnel, is incapable of shouldering the burden of CBR planning, response and recovery alone. The Federal government has, and must continue to, engage the critical infrastructure and key resources (CI/KR) broadly in a collaborative initiative that brings to bear the full spectrum of resources available in all forms of government and industry. Our nation continues to make much progress to shore up our ability to respond and recover from a CBR event. In addition to identifying key elements necessary to sustain critical infrastructure, the NIAC also designed this document to highlight the many positive efforts underway and make recommendations on key activities, which when fully implemented, will bolster our national state of preparedness.

Based on past experience in both the United States and the world, it is not a question of *if* a CBR event will occur, but effectively a question of *when* an event will occur. To avoid an economic and social catastrophe, CBR event preparedness in all its forms demands full participation from the public and private sectors. Accordingly, the NIAC accepted an invitation from the White House to study CBR event preparedness and response and to make recommendations that will ensure the survivability of the critical infrastructure in an adverse event.

The NIAC formed an approach to the CBR study that focused on six key questions. These questions were:

- Do organizations have programs focused on CBR event planning, preparedness, response or training?
- Is there a market or other financial incentive to invest in CBR planning, preparedness, response or training capabilities?

- Is there a sufficient communications infrastructure in place to support CBR event response and recovery?
- What tools and technologies are available, or should be made available in the future, to support CBR event planning, preparedness, response or training programs?
- Is there sufficient coordination between Federal, state, local, and private sector entities in support of CBR planning, preparedness, response, or training programs?
- What can the Federal government do to encourage or enhance planning, preparedness, response, and training capabilities across the public and private sectors?

In response to the request by the White House, the Council established a Working Group, co-chaired by Chief Rebecca F. Denlinger, Ms. Martha H. Marsh, and Mr. Bruce A. Rohde, along with other NIAC members. In turn, the Working Group created a Study Group to assist with the research. The Study Group investigated a variety of CBR planning, preparedness, response, and training-related issues across all CI/KR sectors in its attempt to answer the six key issues outlined above. Taking a holistic approach to its study, the Group interviewed an array of key stakeholders, including experts from academia, government, private industry, and trade associations to gather the necessary background information, context, and perspective. To familiarize itself with current developments in CBR preparedness and response, the group also examined numerous reports, dissected primary and secondary research studies produced by government and academia, attended multiple conferences, participated in numerous exercises, and conducted primary research, predominantly through surveys, to understand the full extent of the CBR problem statement, threats, vulnerabilities, and response capabilities.

After adding members and subject matter experts to the Study Group, the Council began by refining its approach to determine each sector's definition of critical and essential workforce. This critical infrastructure worker definition was critical to both the broader CBR topic, and specifically a sub-set of this topic, pandemic influenza prioritization. As defined by the Study Group, these workers ensure ongoing operations at businesses, organizations, and, by extension, entire critical infrastructures. At the Study Group's outset, the members decided to pursue four data collection methods:

- Distributing a sector assessment survey to CI/KR representatives and organizations;
- Researching and discussing public or private studies;
- Reviewing and/or participating in existing plans, programs, and exercises; and
- Interviewing key subject matter experts.

This Report addresses the rationale behind these questions in the Approach and Methodology section and it outlines the findings from these questions in the Findings section. It further defines attributes common to CBR events, and attributes unique to chemical, biological, or radiological events. Finally, the report makes recommendations on how the nation should maximize its opportunities to respond to and recover from a CBR event. The Executive Summary highlights key themes found throughout the document, and identifies a number of findings and recommendations that are common across CBR events. Included in subsequent sections are appendices that identify specific findings and recommendations unique to chemical, biological, or radiological events.

SCOPE OF STUDY AND ASSUMPTIONS

The CBR Study Group established a specific scope of study for each of the three distinct topics addressed. Supporting this approach were a core group of Study Group participants who facilitated the effort from end-to-end. Subject matter experts joined the Study Group during specified periods of research and deliberation to offer topical expertise. To ensure the broadest possible coverage of Study Group membership and subject matter engagement, the Study Group sought and retained representation from all critical infrastructure sectors, associations that represent sectors, and engaged experts from all levels of the public sector, including Federal, state, and local government. The Study Group employed a combination of research, interviews, surveys, conference participation, and other data collection means, and engaged subject matter experts from academia, corporations, and the public sector.

The CBR Working Group delivered its first report on biological events, and more specifically pandemic influenza, in January 2007. The Chemical Study Group reconstituted in February 2007, following the completion of the biological events Working Group's final report, and delivered the final chemical report in July 2007. The Working Group delivered the final radiological report in October 2007. The Working Group ensured that across these multiple streams of work, staffed by unique subject matter experts, the Study Group identified threats and vulnerabilities; reviewed preparedness practices and programs; identified gaps; and made recommendations to help ensure that Critical Infrastructure/Key Resources have the capability to continue operating and maintaining that infrastructure during and after a CBR event.

Chemical Event Findings

Since the events of 9/11, government and industry partners made significant progress expanding and improving efforts to prevent, detect, prepare for and respond to accidental and terrorist chemical events. Public and private sectors developed legislative, programmatic and regulatory initiatives to address threats based on risk and to better define, assess and fill gaps in preparedness and response. There are multitudes of variables that make planning for and responding to a chemical event a complex endeavor. These include:

THREATS AND VULNERABILITIES

- Depending upon a variety of factors, terrorist attacks and the release of dangerous chemicals have the potential to threaten thousands of people;
- Chemical weapons or products diverted for use as weapons could cause mass casualties. Implementation of the Chemical Weapons Convention has resulted in progress managing this threat, but international safety and security controls remain uneven and, in certain countries, may provide inadequate protections;

- The psychological effects of a chemical event could produce widespread negative consequences in the population at large and to the nation's critical infrastructure;
- Transportation of hazardous chemicals and efficacy of border controls require ongoing assessment and improvement;
- Improvements in surveillance and detection technologies are needed to ensure the safety of first responders and the public.

Supporting a complex threat and vulnerability picture are a number of planning, preparedness and response initiatives designed to hedge or minimize the impact of a chemical event. These include:

PREPAREDNESS AND RESPONSE

- DHS, EPA, DOT, TSA, OSHA, U.S. Coast Guard, FBI and other Federal, state and local agencies maintain strong regulatory control of the manufacture, storage and transportation of chemicals.
- In addition to voluntary security measures adopted by thousands of chemical facilities, recent legislation has mandated a risk-based security regulation, managed by the Department of Homeland Security, for more than 40,000 chemical facilities across the nation.
- According to the U.S Department of Labor, the chemical industry has the best safety record of all U.S. manufacturers. Companies following the Responsible Care® Management System demonstrated safety results 4.5 times better than other U.S. manufacturers.
- Emergency responders across the country continue to train, meet, and conduct exercises with each other and private-sector industry representatives to plan, coordinate and improve responses to chemical incidents.
- Fusion Centers -- coordinated local surveillance and information gathering efforts -- are being established and improved.
- The Chemical Security Coordinating Council and government entities continue to work together to develop chemical sector-specific plans and to coordinate safety and security training and support initiatives throughout the industry.
- In general, non-chemical-related sectors address chemical threats as part of overall "all - hazards" preparedness plans, while chemical-related sectors possess significantly higher levels of readiness, tools, and technologies.

Chemical Event Recommendations

Tremendous progress continues to be made to shore up our nation's ability to plan for, identify, and respond to a significant chemical event. Data gathered during this study suggest that there is a focused, deliberate, and well-coordinated series of efforts across and between the public and private sectors that continue to improve our defenses. In addition to these measures, the NIAC recommends the following:

- ***Evaluate chemical*** threats against comprehensive, national assessment priorities, and establish a risk-based prioritization schema for chemical response measures.

- **Support the development of second-generation surveillance and detection devices** for both indoor and outdoor use, including mobile applications for first responder vehicles; engage chemical industry more fully on research priorities; accelerate deployment of tools /technologies under development.
- **Provide accelerated development, training, and support of local Fusion Centers** to enhance robust on-the-ground capabilities. Continue joint training exercises conducted at chemical facilities to enhance and expand knowledge of chemical event responsiveness.
- **Improve information sharing** and outreach efforts via the Homeland Security Information Network (HSIN) chemical portal.
- **Ensure the availability of adequate funding and personnel** to support the implementation of the new Chemical Facility Anti-Terrorism Standards (CFATS).
- **Expand the Department of Homeland Security's Chemical Review Program** to multiple regions of the country to help reduce duplicative efforts and promote all hazards planning by emergency responders. Expand participation in the program to include other first responders, including local law enforcement.
- **Fully integrate lessons learned** into the National Incident Management System (NIMS) and other preparation and response programs.
- **Ensure full implementation** of the WARN act and SAFECOM.
- **Eliminate conflicting regulations** for the chemical industry among Federal agencies; eliminate or reduce duplicative requirements.
- **Continue to improve operability and interoperability of communications** among responders. Consider solutions to propagate communications technologies to those who may potentially engage in a chemical event response, including the private sector.
- **Improve controls over hazardous material transportation.** Work with the private sector to ensure controls are consistent with risk assessment results.
- **Assist responders in the identification and acquisition** of the most appropriate and effective tools for surveillance, detection, and mitigation. This is of particular importance to local fire, police and EMS.
- **Continue to build public/private-sector relationships** through the sharing of information and the protection of competitive and sensitive data. Assist the private sector to better identify information needed by governmental agencies.
- **Enhance efforts to obtain international support** for chemical safety and security initiatives. Work with International Coalition of Chemical Associations, or continue to work with U.S. based companies with significant overseas footprints to improve global chemical controls and response capabilities.
- **Evaluate the efficacy of border control measures** (e.g., C-TPAT) and ensure a robust customs and border control program.
- **Ensure all agencies follow the DHS** lead on facility, navigable waters, transportation and supply chain security, and disaster planning and response initiatives. Provide training for both the public and private sectors, especially local governments and responders, on implementation of NIMS and the new NRP Framework.

Radiological Event Findings

Radiological events possess an inherently unique set of threats and vulnerabilities, and accordingly, demand a unique set of countermeasures and responses. However, there are a number of attributes that, when aggregated with those identified in the chemical and radiological studies, merit consideration as part of an all-hazards response solution. Significant detail on the unique attributes of a radiological event is included in the Appendices.

Key findings from the NIAC included planning and preparedness, response, counter-measure, communications, and psychological components of radiological events. In summary, the Council found:

- **Time is of the essence.** Time-sensitivity of information suggests timely, accurate information is critical to save lives and manage fear.
- **Responders will look to the Federal government for information and direction.** The Federal government possesses deeper and broader expertise on radiological events than nearly all potential responders combined. First responders want and need radiological response information in usable format well in advance of an event.
- **Identify the experts and enable communications between responders and experts.** Many responders do not know which agency is the principal repository of nuclear effects expertise. Many responders do not know which Federal agencies are in charge of coordinating a response to a radiological event.
- **Public-private sector coordination and collaboration is critical.** Government participation in radiological exercises revealed the importance of public-private sector coordination, especially inter-dependent sectors (e.g. electric utilities, water, etc.).
- **Psychological effects of a radiological event will rival or surpass physical effects.** Radiation effects are unknown or misunderstood by those affected and possess tremendous psychological impact. Fear will impose heavy burdens, especially on the worried well residents of non-impacted cities or markets. Psychological impact of radiation will create other down-stream negative effects, including the damages of both necessary and unnecessary radiation-centric treatment of victims with trauma.

Radiological Event Recommendations

To enable a comprehensive planning, response, and recovery capability, and to address the findings identified above, the NIAC assembled the following recommendations to better prepare for, or respond to, a radiological event.

- **Develop and deploy training materials for all first responders.** Content is readily available and deployable; awareness and distribution could be enabled through directed marketing and communications, inclusion in structured exercises, or other mechanisms already in place.
- **Clearly establish, communicate, and reinforce a radiological event focal point, lead agency, chain of command, and protocol for response coordination and**

communication. Define and make widely known the roles and responsibilities for lead and supporting Federal agencies.

- **Leverage industry knowledge, tools, or experience in radiological event planning, preparedness, and response efforts.** Establish, in advance, mechanisms to leverage industry resources in radiological events. Employ tools and technologies in place today to further capabilities.
- **Continue to make progress on plans and response programs that assess and prioritize radiological threats and vulnerabilities within the context of other events (e.g., chemical and biological).** Improve knowledge around specific scenarios, impact, and likelihood of events. Assess the usability and availability of data; make necessary information available to first responders who will benefit from additional intelligence. Continue to deploy tools to support planning and response scenarios.
- **Maximize opportunities to advance technologies that will improve response capabilities.** Continue to fund collaborative, public-private efforts to develop more advanced detection solutions. Establish or align S&T roadmap with radiological event collection, analysis and reporting tools and technologies to improve event detection. Accelerate promising detection or response technologies currently under development; identify and employ commercialization opportunities for the same.

Biological Event Findings

NIAC Biological studies focused extensively on pandemic influenza. While clearly not the only form of potential, or even likely biological event to impact the U.S., the tenets of pandemic planning, preparedness, and response are largely usable in other forms of events. For example, many of the countermeasures appropriate for a biological event (e.g. social distancing or other containment measures, prioritization of anti-viral or prophylaxis resources, coordination of community capabilities, communications, and actions, etc) would be beneficial, if not central, to an alternative form of biological event.

Within this context, the NIAC conducted an extensive survey across the critical infrastructure to identify key resources needed to respond to or recover from a biological event. In addition, this survey assessed those resources needed to sustain the critical infrastructure during this episode, projected to potentially extend many months, or manifest itself in multiple waves.

The survey asked respondents to rank those critical goods and services that they would need to produce their critical goods and services. The priority assigned to each of these types and groups of others' goods and services was highly dependent on the respondent's particular production needs. Most of the top priorities across sectors were a basic good or service, such as electricity or communications, which a particular infrastructure needs to operate. Most priority goods and services were not specific or limited inputs (e.g., raw material), unless the sector essentially produces one major product, such as the Nuclear sector.

Key findings of the survey included the following:

- ***Interdependencies across critical infrastructure sectors*** are exceptionally high in a biological event and must be fully understood. The interdependent relationships most

often cited were for the basic municipal and other infrastructure support requirements, including energy, information technology, communications, and water.

- ***Subtle interdependencies between critical goods and services and the CI worker***, including basic physical security requirements, financial services for businesses and workers, and food and healthcare to sustain workers and their families, are no less important than the direct inter-dependencies.
- ***Supply chain interdependencies***, specifically the essential role transportation plays as a bridge between all levels of the supply and distribution chain, are yet another venue to be further studied and understood.
- ***Basic critical infrastructure sectors*** generally provide a limited number, but critical number of goods and services (e.g., potable water and wastewater treatment, electrical generation and distribution, and postal and shipping services).
- Some sectors, including Food and Agriculture, Commercial Facilities, and Chemical, manufacture and distribute goods that may require thousands of line items of goods to be assessed and prioritized to determine each one's criticality. More research is needed to better prioritize these sectors and their goods and services.
- There are numbers of geographically sparse, single-source businesses (e.g., baby formula producers) and goods/services (e.g., chlorine for water treatment, ATM maintenance) that represent potential single points of failure.
- The specific number of critical infrastructure workers needed to sustain the critical infrastructure during a biological event is known in some but not all sectors. Where this information is known, it is often prioritized by job function, type, or role.

Biological Event Recommendations

Bringing a decidedly infrastructure-centric approach to this study, the Council suggested there are opportunities to consider a differing prioritization framework and methodology to biological, and more specifically pandemic, planning, preparedness and response. Beyond this differing approach, the Study Group believes the private sector represents an invaluable partner in the effort to develop and implement a response and communications infrastructure, one that takes advantage of the vast distribution and communications infrastructures owned and operated by the private sector.

The Study Group acknowledges the work done to date with the private sector and critical infrastructure owner-operators on preparedness and recommends that the government continue to engage the private sector to augment the distribution of communications to the critical workforce. The following is a list of **communications-related recommendations**.

- Pre-define, to the greatest extent possible, a consistent biological event communications plan, complete with tailored communications to specific target audiences based on various possible scenarios.
- Develop and pre-position, to the greatest extent possible, communications in all distribution channels, including radio, television, telephone, print, and online media.
- Continue to engage the private sector to augment the distribution of communications to the critical workforce.
- The public- and private-sector Critical Infrastructure partners should continue refining their existing communications plans, processes, and success metrics through series of response exercises. These exercises should include participation from appropriate state and local representatives where feasible. The Federal government, in consultation with the critical infrastructure owners and operators, should develop a mechanism to refine and identify those priority workforce groups within and across the 17 CI/KR sectors.

Below is a list of **dissemination-related recommendations**.

- Continue developing a clearly defined vaccine and anti-viral medication distribution strategy. Consider the Study Group's work on biological events planning and preparedness as a starting, not an ending, point for further discussion and clarification about the Federal government's ultimate distribution strategy.
- Consider alternative distribution strategies and guidance to give critical infrastructure owner-operators a stronger voice in determining which employees receive higher prioritization for vaccines and anti-viral medications. Build flexibility into distribution frameworks to allow the private sector to receive, distribute, and, with appropriate medical support, dispense vaccine and anti-viral medications to their critical workforce.
- More clearly define response and containment roles and responsibilities. The Council asks the Federal government to continue to better define its expected response timelines and milestones.
- All public- and private-sector partners should continue educating their relevant stakeholders on biological plans, processes, and priorities.
- Engage appropriate resources to ensure adherence to the distribution strategy and the economical use of limited vaccine and anti-viral resources.
- The public and private sectors should align their communications, exercises, investments, and support activities absolutely with both the plan and priorities during a biological event. Continue data gathering, analysis, reporting, and open review.
- The Study Group directionally recommends that the Federal government improve its effort to engage key elements of the private sector in proactive surveillance and monitoring activities, including:
 - extend public health surveillance to occupational health professionals;
 - develop a formal framework designed to engage international components of U.S. corporations in global bio-data collection efforts;

- supplement existing surveillance investments, acquisition, monitoring, and response capabilities to increase threat visibility and geographic coverage; and
- engage data acquisition and management resources within the commercial workforce in surveillance, collection, and analysis.

Below is a list of **Response and Containment Recommendations**.

- Develop a clearly defined vaccine and anti-viral distribution strategy to ensure deployment as planned, and consider alternative distribution methods that engage the private sector in directly distributing antiviral medications and vaccines to in-scope critical workforce.
- Public and private partners should work closely to define more clearly response and containment roles and responsibilities, as well as response timelines and milestones.
- The Federal government must do a better job in educating all stakeholders on plans, processes, and priorities.
- Using this report's findings as a baseline for future work, the Federal government should develop an innovative and easy-to-use mechanism to clearly identify the priority workforce groups.
- Engage appropriate resources to ensure adherence to distribution strategies and the economical use of limited vaccine and anti-viral resources.

The work uncovered during these many months of research, study, analysis and deliberation on this topic is encouraging. It represents a sustained, organized, collaborative series of initiatives between all key stakeholders to design, develop, implement, and support a comprehensive, national capability to minimize the effects of a chemical, biological or radiological event. The right people are engaged, the right focus is applied, and the right leadership is in place to maximize our nation's opportunity for success.

This positive vector of progress should in no way minimize the seriousness with which we should continue to expand and improve upon our planning, response and recovery efforts. We are just now beginning to mobilize the public and private sectors in this endeavor and should strive to follow through on this joint commitment with the same degree of passion and resolve demonstrated by those on the other side of the table who seek to do us harm.

It is with tremendous appreciation for the hard work, sacrifice, and progress made to date by an uncounted number of Americans seeking to keep our nation safe, secure, and resilient against these threats, that we submit this report on chemical, biological, and radiological events and the critical infrastructure.

APPENDIX A: CHEMICAL EVENTS

EXECUTIVE SUMMARY

SCOPE AND METHODOLOGY

The chemical events Working Group of the NIAC CBR study reconstituted in February 2007, following the completion of the biological events Working Group's final report to the NIAC on pandemic preparedness. The chemical events Working Group identified continuing threats and vulnerabilities; reviewed current practices and programs; identified gaps; and made recommendations to help ensure that employees who operate and maintain Critical Infrastructure/Key Resources have the capability to continue operating and maintaining that infrastructure during and after a chemical event.

Ms. Martha H. Marsh, President and CEO, Stanford Hospital and Clinics, Chief Rebecca F. Denlinger, Fire Chief, Cobb County, GA Fire and Rescue, and Bruce Rhode, Chairman and CEO Emeritus, ConAgra Foods, Inc. co-chaired the Chemical Events Working Group. Other Working Group members included Chief Gilbert G. Gallegos, Police Chief (ret.), City of Albuquerque, N.M. Police Department, James B. Nicholson, President and CEO, PVS Chemicals, Inc., and NIAC Chairman Erle A. Nye, Chairman Emeritus, TXU Corp., and Mr. John W. Thompson, Chairman and CEO, Symantec Corporation. The Working Group recruited Working and Study Group members representing critical sectors to conduct research, interview subject matter experts, assess primary and secondary research, and make recommendations to the Working Group on issues surrounding chemical events.

To ensure the broadest possible coverage of Study Group membership and subject matter engagement, the Study Group sought and retained representation from all critical infrastructure sectors, associations that represent sectors, and engaged experts from all levels of the public sector, including Federal, state, and local government. The Working Group and its Study Group employed a combination of research, interviews, surveys, conference participation, and other data collection means, and engaged subject matter experts from academia, corporations, and the public sector.

FINDINGS

Since the events of 9/11, government and industry partners made significant progress expanding and improving efforts to prevent, detect, prepare for and respond to accidental and terrorist chemical events. Public and private sectors developed legislative, programmatic and regulatory initiatives to address threats based on risk and to better define, assess and fill gaps in preparedness and response.

Threats & Vulnerabilities

- Depending upon a variety of factors, terrorist attacks and the release of dangerous chemicals have the potential to threaten thousands of people;
- Chemical weapons or products diverted for use as weapons could cause mass casualties. Implementation of the Chemical Weapons Convention has resulted in progress managing this threat, but international safety and security controls remain uneven and, in some countries, may provide inadequate protections;
- The psychological effects of a chemical event could produce widespread negative consequences in the population at large and to the nation's critical infrastructure;
- Transportation of hazardous chemicals and efficacy of border controls require ongoing assessment and improvement;
- Improvements in surveillance and detection technologies are needed to ensure the safety of first responders and the public.

Preparedness and Response

- DHS, EPA, DOT, TSA, OSHA, U.S. Coast Guard, FBI and other Federal, state and local agencies maintain strong regulatory control of the manufacture, storage and transportation of chemicals.
- In addition to voluntary security measures adopted by thousands of chemical facilities, recent legislation has mandated a risk-based security regulation managed by the Department of Homeland Security, for more than 40,000 chemical facilities across the nation.
- According to the U.S Department of Labor, the chemical industry has the best safety record of all U.S. manufacturers. Companies following the Responsible Care® Management System demonstrated safety results 4.5 times better than other U.S. manufacturers.
- Emergency responders across the country continue to train, meet, and conduct exercises with each other and private-sector industry representatives to plan, coordinate and improve responses to chemical incidents.
- Fusion Centers -- coordinated local surveillance and information gathering efforts -- are being established and improved.
- The Chemical Security Coordinating Council and government entities continue to work together to develop chemical sector-specific plans and to coordinate safety and security training and support throughout the industry.
- In general, non-chemical-related sectors address chemical threats as part of overall “all -hazards” preparedness plans, while chemical-related sectors possess significantly higher levels of readiness, tools, and technologies.

RECOMMENDATIONS

- Evaluate chemical threats against comprehensive, national assessment priorities.
- Support the development of second-generation surveillance and detection devices for both indoor and outdoor use, including mobile applications for first responder vehicles; engage chemical industry more fully on research priorities; accelerate deployment of tools /technologies under development.
- Provide accelerated development, training, and support of local Fusion Centers to enhance robust on-the-ground capabilities. Continue joint training exercises conducted at chemical facilities to enhance and expand knowledge of chemical event responsiveness.
- Improve information sharing and outreach efforts via the Homeland Security Information Network (HSIN) chemical portal.
- Ensure the availability of adequate funding and personnel to support the implementation of the new Chemical Facility Anti-Terrorism Standards (CFATS).
- Expand the Department of Homeland Security's Chemical Review Program to multiple regions of the country to help reduce duplicative efforts and promote all hazards planning by emergency responders. Expand participation in the program to include other first responders, including local law enforcement.
- Fully integrate lessons learned into the National Incident Management System (NIMS) and other preparation and response programs.
- Ensure full implementation of the WARN act and SAFECOM.
- Ensure the elimination of conflicting regulations for the chemical industry among Federal agencies; eliminate or reduce duplicative requirements.
- Continue to improve operability and interoperability of communications among responders. Consider solutions to propagate communications technologies to those who may potentially engaged in a chemical event response, including the private sector.
- Improve controls over hazardous material transportation. Work with the private sector to help ensure controls are consistent with risk assessment results.
- Assist responders in the identification and acquisition of the most appropriate and effective tools for surveillance, detection, and mitigation.
- Continue to build public/private-sector relationships through the sharing of information and the protection of competitive and sensitive data. Assist the private sector to better identify information needed by governmental agencies.
- Enhance efforts to obtain international support for chemical safety and security initiatives. Work with International Coalition of Chemical Associations, or continue to work with U.S. based companies with significant overseas footprints to improve global chemical controls and response capabilities.
- Evaluate the efficacy of border control measures (e.g., C-TPAT) and ensure a robust customs and border control program.
- Ensure all agencies follow the DHS lead on facility, navigable waters, transportation and supply chain security, and disaster planning and response initiatives. Provide

training for both the public and private sectors, especially local governments and responders, in implementation of NIMS and the new NRP Framework.

DETAILS

MISSION AND METHODOLOGY

The NIAC convened the chemical events Study Group in January 2006 to identify threats and vulnerabilities; review current practices and programs; identify gaps; and make recommendations to help ensure that employees who operate and maintain Critical Infrastructure/Key Resources have the capability to continue operating and maintaining that infrastructure during and after a chemical event. At the request of the White House, the Working Group suspended work on the chemical event topic from July 2006 to January 2007 to use the already functioning Working Group to address pandemic influenza preparedness, prioritization of resources, and impact on the critical infrastructure. Following the delivery of the pandemic report to White House and DHS leadership in January 2007, the Chemical Study Group reconvened to continue work on the chemical subject.

From February 2007 through July 2007, the chemical events Study Group conducted weekly conference calls to engage Working and Study Group members; identify, recruit, listen to and question subject matter experts; and to discuss findings and formulate recommendations. SMEs included multiple representatives from DHS, emergency responders, the FBI, the NIH, chemical industry trade associations, academia, local government, and the Army National Guard. The Working Group delivered its final presentation to the NIAC in October 2007.

KEY QUESTIONS

The Council identified six key questions to guide the review process:

Question #1: Do CEOs of CI/KR and their organizations have employee awareness, preparedness, and response training programs?

- What is the nature of the training programs?
- Is this an enterprise issue?
- Are there industry leaders that excel at chemical incident preparedness?
- Are there lessons learned from chemical incident experiences?

Question # 2: Is there a market incentive to invest in chemical preparedness and response programs?

- How do organizations fund chemical event assessment, preparedness, and planning or response programs?
- Are there alternative mechanisms that hedge the potential impact of a chemical event?
- How do organizations make risk-based investment decisions around chemical events?

Question #3: Is there sufficient infrastructure in place to respond to a chemical event?

- How are owners/operators informed?
- How quickly is information distributed?
- Are there choke points in information dissemination?
- What role do Sector Coordinating Councils (SCCs) or Information Sharing and Analysis Centers (ISACs) play in addressing chemical events?

Question #4: What tools and technologies currently support chemical response capabilities?

Question # 5: Is there sufficient coordination among Federal, state, local, and private sector entities?

- What interdependent plans are currently in place?
- How is coordination managed among entities at multiple public and private sector levels?
- How is communication managed?
- Are there examples of successful exercises across entities?

Question #6: What can the Federal government do to encourage or facilitate enhanced preparedness and response capabilities across and between the public and private sectors?

THREATS

There is a great deal of disagreement over the probability and impact of a chemical event. The likelihood, impact in terms of loss of life and impact on the critical infrastructure, and the methods by which a chemical event occur are the center of continued debate. However, there are specific data points that suggest that malfeasants continue to attempt to obtain, or have successfully obtained the material necessary to conduct a chemical attack on the U.S. In addition, it is presumed that the probability of a chemical event is, by comparison to a biological or a radiological event, high. However, it is also suggested that the casualty rate of these higher probability chemical events is, again by comparison, lower than a biological or radiological episode.

These same analyses cautioned that we must realize important differences between accidental chemical incidents and those brought about intentionally. While both types of events can threaten the stability of the Critical Infrastructure and its workforce, it is important to understand the variations within and between the incidents in order to plan and allocate appropriate resources for protection, response and recovery from each type. For example, accidental chemical releases are more apt to be known substances and well-planned responses would more likely be in place. Even in the event of a larger accident, the physical and psychological impact on the workforce should be limited. However, an identical event that is suspected to be a terrorist event would be more likely to impact the nation and its economy on a somewhat larger scale due to delay in discovering chemicals used, and fear of additional incidents elsewhere, or collateral secondary events at incident sites. The required investigatory and public relations requirements would be far greater than those related to a local, accidental event.

Chemical Releases

Using worst-case scenario modeling, a 2003 EPA report identified 123 chemical facilities in 24 states where a release of dangerous chemicals could threaten more than 1,000,000 people. The same study identified 700 chemical facilities where a release could threaten more than 100,000 people. Recent DHS risk assessments identify a much smaller number of facilities (around 25) that have this potential impact. DHS modeling identified up to 3,000 chemical facilities where a release of dangerous chemicals could threaten more than 1,000 people.

The actual effects of a release are dependent on a variety of factors, including the type of chemical, amount of the release, the time of day, length of time of the release, wind and weather conditions and length of exposure.

A 2004 report found 75% of chemical plants surveyed had taken some steps to improve security since the 2001 terrorist attacks. That report also found that communications and emergency training needed improvement.

Chemical Weapons

The Chemical Weapons Convention (CWC) of 1993 identified 29 specific substances and 14 broad families of chemicals that could be used as weapons. The CWC and stringent import/export controls regulate movement of these chemicals. These include blister agents, such as mustards, that affect the skin and eyes and can be fatal if ingested; blood-borne agents, such as cyanide, that circulate tissue-destroying poisons throughout the body; nerve agents, such as sarin, that disrupt the body's nervous system; and thousands of industrial chemicals and pesticides that have the potential for use to cause mass casualties.

A chemical agent's effect depends on the purity of the chemical and its concentration in the air; wind and weather conditions; length of exposure; dispersion characteristics; access to significant volumes or concentrations; and the ability to design an effective delivery system.

The ability to develop and deliver chemical agents has proven challenging. As an example, Aum Shinrikyo, a Japanese religious cult, spent an estimated \$30 million on chemical weapons research. Their 1995 sarin attacks on the Tokyo subway system only killed 12 people. Had that same \$30 million been used to procure conventional explosives, and strategic placement of those explosives, a much higher casualty rate and destruction of critical infrastructure could have occurred.

Schedule 1 chemical weapons – those that are military weapons-grade (*e.g.*, ricin and sarin) are almost exclusively the property of several state parties and are all tightly controlled as they are being destroyed through the CWC requirements. Schedule 2 and Schedule 3 chemicals are primarily chemicals used in commerce for the everyday benefit of society, but can be stolen or diverted for use to make a chemical weapon. These chemicals are also tightly regulated by most state parties around the world—including the United States. Since the implementation of the treaty over a decade ago, regulators conducted over 3,000 inspections and identified no violations of the treaty.

The chemical events Study Group possessed access to and reviewed only very limited data on international chemical safety and security. However, recently reported events, such as chlorine attacks in Iraq, demonstrate that improper management of chemicals or the lack of appropriate laws or controls can result in chemicals stolen or diverted and used as a weapon. The weaponization of chemicals is an ongoing threat. In addition, international control efforts focus on containing the dispersion or distribution of large quantities of chemical weapons to ensure that nation-states that do not currently possess chemical weapons will be deterred from doing so. Conversely, the chemical acquisition needs of terrorist organizations may be small in relation to nation-states, hence able to escape detection or the controls of the Chemical Weapons Convention.

PREPAREDNESS AND RESPONSE

Surveillance and Detection

A variety of surveillance and detection equipment and programs are available to assist government and industry to identify and respond to hazardous substance emergencies. Selected examples include:

- **Toxic Exposure Surveillance System (TESS)** – The CDC and the American Association of Poison Control Centers use the TESS to improve public health surveillance of health hazards associated with chemical exposures. TESS is a national real-time surveillance database that records all human exposures to potentially toxic substances reported to U.S. poison control centers. TESS is used to facilitate early detection of illness associated with a chemicals release. By monitoring daily clinical effects reported to the database, TESS provides a real-time national surveillance and exposure database.
- **The Hazardous Substance Emergency Events Surveillance (HSEES) program**, operated by the Agency for Toxic Substances and Disease Registry, collects and analyzes information about acute releases of hazardous substances that require cleanup or neutralization, as well as threatened releases that may require evacuation. The goal of the HSEES is to reduce injury and death that result from hazardous substance events experienced by first responders, employees, and the public.
- **Electronic sensor capabilities** – (public) spectroscopic sensors, airborne spectral photometric collection technology, capillary electrophoreses: (private) electronic gas chromatography.

Government, industry and academia funded advanced detection solutions at facilities such as the Lawrence Livermore, Argonne, Brookhaven and Los Alamos National Labs. Discussions initiated to develop surveillance capabilities in cell phones or other personal devices. In November 2007, months after the Department of Homeland Security began talking about its idea of putting biological, chemical and radiation sensors in commercial cell phones, the department put out

its first official solicitation for the program. DHS' Science and Technology Directorate indicated the central benefit to the initiative is that it could create a huge sensor network — essentially, everyone with a properly equipped mobile communications device would be part of it. In theory, when the phones, personal digital assistants and other devices detect hazardous or explosive material, they would relay that information, along with the time and their location, to a central monitoring system. Calling the program "Cell-All Ubiquitous Biological and Chemical Sensing," S&T released a Broad Agency Announcement, calling for companies that can put together a proof-of-concept within three years. The DHS document indicated submissions should have chemical and biological sensing capability at first, and the ability to add radiation sensing later.

PLANNING, PREPAREDNESS, AND RESPONSE

Government and industry partners made significant progress expanding and improving efforts to prevent, detect, prepare for and respond to accidental and terrorist chemical events. Among DHS, OSHA, EPA and state and local initiatives, a sophisticated network of legislation, regulations, and voluntary initiatives has been implemented that seeks to address threats based on risk and to better define, assess and fill gaps in preparedness and response. Several of these initiatives include:

Chemical Facility Anti-Terrorism Standards

DHS possesses authority to set performance standards for chemical facility site security. DHS issued interim final rules April 9, 2007 that became effective June 8, 2007. The new standards will drive substantial security enhancements and provide uniformity across the country for security at chemical facilities; ensure recognition for earlier voluntary action; and create a new category of protected information (Chemical Anti-Terrorism Vulnerability Information (CVI) designed to protect information potentially exploitable by terrorists.

On November 3, 2007, DHS released a list of "Chemicals of Interest," the core of the Federal government's Chemical Facility Anti Terrorism Standards (CFATS) issued last June. Facilities with chemicals that exceed thresholds on the list must submit information to DHS so that DHS can determine if additional studies should be conducted. These assessments address potential terrorist threats ranging from theft and diversion of small quantities of chemicals to potential consequences of deliberate terror attacks against larger chemical facilities. A final determination will be made based on the security vulnerability assessment (SVA) as to whether a site is "high risk" and if the full regulations will be applied, including development of site-specific security plans and reduction of vulnerabilities.

DHS published the Chemicals of Interest list in the Federal Register on November 20, 2007 after which chemical facilities have 60 days to complete the DHS online top screen tool. Within 30 days after screening completion, facilities will be contacted by DHS to confirm either 1) that a facility is low risk and not subject to CFATS or 2) that a facility is subject to CFATS. A facility judged to be subject to CFATS will be assigned a preliminary tier ranking. High-risk sites will need to establish security enhancements against 18 performance categories. They will be required to develop and submit site security plans demonstrating that they have selected appropriate measures to reduce specific threat scenarios.

DHS estimates that 5,000 – 8,000 facilities will be classified as high-risk, 300 of which will comprise the top two tiers. There will be immediate implementation of new security enhancements at the highest risk facilities and a phased implementation at other facilities through 2008 and 2009.

DHS has audit and enforcement authority over implementation of these security plans. Non-compliance could result in fines of up to \$250,000 or, in the most serious cases, facility shutdown. Alternative security programs can be accepted if they substantially meet DHS rules requirements and demonstrate they will meet or exceed the DHS risk-based performance requirements.

This legislation specifically exempts facilities already subject to the Maritime Transportation Security Act. Public water systems and treatment works and any facility owned by the Department of Defense or Energy or any facility regulated by the Nuclear Regulatory Commission.

Chemical Comprehensive Review (CR)

The Chemical Comprehensive Review is a cooperative government-led analysis of Critical Infrastructure/Key Resource chemical facilities aimed at reducing the nation's vulnerability to terrorism by developing and coordinating plans to protect CI/KR and to deny their use as a weapon.

Six regions in the U.S. that contain groupings of potentially high-consequence chemical facilities (Detroit, Chicago, Northern New Jersey, Lower Delaware River, Houston and Los Angeles were selected for inclusion in the CR program). The program has been conducted in all areas and represents continuing progress in public/private partnerships. In Chicago alone, 70 state and local officials cooperated in chemical scenarios, including attack, chemical release and spread, and in identifying appropriate response.

The Chemical Comprehensive Review is a no-fault analysis of CI/KR facilities to determine exposure to potential terrorist attack, the consequences of such an attack, and the integrated prevention and response capabilities of the owner/operator, local law enforcement and emergency response organizations. Results are used to enhance the security posture of the facilities and community first responders by using short-term improvements in equipment, training and processes and by informing longer-term-risk-based investments and science and technology decisions.

The chemical CR focuses on the terrorist threat, but also provides an opportunity for affected stakeholders to identify and implement best practices for preparedness that may also apply to other catastrophic events affecting the nation's CI. The chemical CR enhances public safety by integrating Federal, state and local efforts; preventing and preparing for potential terrorist attacks; identifying opportunities to reduce consequences of an attack; and identifying opportunities to coordinate preventive and response capabilities.

Areas of focus include threat analysis; facility characterization; assault planning; explosive ordnance disposal; law enforcement resources; emergency preparedness; and maritime and transportation assessment.

The goal is to conduct a thorough and useful assessment of a region's ability to respond in an all hazards environment, with a particular focus on a terrorism attack involving a chemical facility.

The Chemical Comprehensive Review has three primary components:

- Buffer Zone Protection Program Technical Assistance Visits to provide technical assistance to local emergency services representatives to complete buffer zone plans for selected chemical facilities;
- Community Capability Assessment Tool (C-CAT) Workshops to assist community emergency services representatives to assess their organization's capabilities and to learn about each organization's capabilities;
- Emergency Services Capability Assessment (ESCA) – scenario-based roundtables designed to explore potential gaps in emergency services and planning and preparedness. Local, state, Federal and private sector representatives attend roundtables.

DHS designed the chemical CR process to reduce vulnerabilities; increase regional security; reduce duplication of efforts; and support efforts to guide the allocation of resources, based on cross-sector assessments.

Community Hazards Emergency Response Capability Assurance Process (CHER-CAP)

Readiness, planning, preparedness and response coordination is offered by regional FEMA offices to assist local communities and tribal governments in obtaining a greater understanding of community hazards risks, identifying planning deficiencies, updating plans, training first responders, and stimulating and testing the system for strengths and needed improvements. FEMA offered CHER-CAP as an additional tool for state and local governments to use as they develop and enhance preparedness and response capabilities that will address any hazards that communities may face.

As a voluntary program, CHER-CAP uses the skills and resources of Federal, state, tribal and local governments and industry partners. It is particularly helpful in enhancing a community's ability to operate within the National Response Framework.

Fusion Centers

State and local authorities, in partnership with DHS, have created multiple Fusion Centers in major urban areas across the country. This network is expanding and current capabilities continue to be enhanced.

The term “fusion” refers to the overarching process of managing the flow of information and intelligence across all levels and sectors of government and private industry. The fusion process

supports the implementation of risk-based, information-driven prevention, response and consequence management programs. At the same time, it supports efforts to address immediate or emerging threat-related circumstances and events.

Fusion Centers provide critical sources of unique law enforcement and threat information; facilitate sharing of information across jurisdictions and functions; and provide a conduit between people on the ground and state and Federal agencies. Analysts from the DHS Office of Intelligence and Analysis work side-by-side with state and local authorities.

National Incident Management System – (NIMS)

While most emergencies are handled locally, response to a major incident may require help from other jurisdictions, the state and the Federal government. DHS developed NIMS to enable responders from different jurisdictions and disciplines to work together more effectively to better respond to natural disasters and emergencies, including acts of terrorism. NIMS benefits include a unified approach to incident management; standard command and management structures; and emphasis on preparedness, mutual aid, and resource management

CHEMTREC®

Started in 1971, the CHEMTREC® program is a 24/7 emergency response center for any chemical related incident. CHEMTREC is recognized by DOT and other Federal agencies as a valuable source of information and counsel regarding hazardous materials incidents. When a chemical incident takes place, responders contact CHEMTREC immediately to determine the best way to handle a wide range of hazardous substances, including radioactive materials, infectious substances, biohazards and hazardous waste. In a chemical incident, CHEMTREC provides information on how the chemical is used, how it interacts, how to clean it up and how to protect emergency responders.

CSX Transportation and CHEMTREC partnered in a program to enhance information for responders during rail-related hazardous materials incidents. The program provided CHEMTREC staff with direct access to CSXT's Network Operations Workstation, a secure system that can identify the location of a train anywhere on CSXT's 21,000 mile network. Tools used provided CHEMTREC staff with a Web-based visual display of the train and its location, the location of railcars within the train, and the contents of each railcar.

CHEMTREC also collaborated with Dow Chemical Company to enhance railcar tracking and information sharing using GPS and sensor technologies. CHEMTREC distributed more than 1300 copies of the "Guide to CHEMTREC for Emergency Responders" in 2006, and handled over 100,000 calls.

TRANSCAER®

Transportation Community Awareness Emergency Response is a voluntary national outreach effort that helps communities prepare for and respond to possible hazardous material

transportation incidents. TRANSCAER sponsor organizations provide monetary resources and in-kind contributions. TRANSCAER partners include:

- American Chemistry Council;
- Association of American Railroads;
- Chemical Education Foundation;
- CHEMTREC®;
- National Tank Truck Carriers, Inc.; and
- The Chlorine Institute.

The U.S. Department of Energy, Environmental Management of Transportation is a TRANSCAER Partner. In 2005 alone, TRANSCAER held over 200 events across the nation, with over 8,500 attendees.

C-TPAT

Customs Trade Partnership Against Terrorism is a government-industry partnership to help ensure robust supply chain and border security. U.S. Customs works with businesses to help ensure the integrity of their security systems.

PHILIS

The DHS Science and Technology Directorate developed the Portable High Throughput Integrated Laboratory Identification System. PHILIS is a fleet of trucks and trailers staffed by a team of 12-15 scientists and engineers whose job is to gather information critical to recovery and cleanup operations that follow emergency response and forensics teams. PHILIS equipment and technology help ensure that most chemical releases can be detected and analyzed in the field quickly and surely

National Library of Medicine Resources for Emergency Responders

This NIH program provides real-time assistance to first responders. Its focus is on the identification of unknown substances and utilizes hand-held devices (WISER - Wireless Information System for Emergency Responders) that intuitively guide first responders through an extensive database of hazardous materials, their properties, and their effects.

Planning and Field Exercises

Local, state and Federal entities and private industry partners across the nation continue to plan and train for coordinated response to terrorist and natural disasters. Some of these efforts are conducted “live” in the field to provide hands-on training for how to evaluate and respond to an incident. Other training involves tabletop exercises that bring together these groups to conduct exercises focused on improving the response to a chemical incident. Local first responders, Civil Support Teams, EPA, DHS, facility personnel, law enforcement all work cooperatively to improve their skills and response time.

Communications

The Council identified multiple positive examples of initiatives designed to improve chemical event risk assessment, planning, preparedness, and response capabilities. Included in these examples are the following:

- **2006 DHS Survey** on incident response communications. Survey of 22,400 randomly selected police, fire and EMS agencies revealed that cross-jurisdictional interoperability was outpacing Federal-to-state or state-to-local interoperability progress.
- **WARN (Warning Alert and Response Network) Act** – enables an effective, reliable, integrated, flexible and comprehensive system to alert and warn the American people in situations of war, terrorist attack, natural disaster or other hazards to public safety and well-being.
- **SAFECOM** – a DHS communications program that provides research, development, testing and evaluation, guidance tools and templates on interoperable communications-related issues to emergency response agencies. SAFECOM works with existing Federal communications initiatives and key emergency response stakeholders to address the need to develop better technologies and processes for the multi-jurisdictional and cross-disciplinary coordination of existing systems and future networks.
- **Office of Emergency Communications (OEC)** – Congress established the Office of Emergency Communications at DHS. The OEC supports and promotes the ability of emergency responders and government officials to continue to communicate in the event of natural disasters, acts of terrorism, or other man-made disasters, and works to ensure, accelerate, and attain interoperable and operable emergency communications nationwide.
 - New Title XVIII of the 2002 Homeland Security Act directs that OEC develop a “baseline assessment” of Federal, State, local, and tribal governments that—
 - Defines the range of capabilities needed by emergency response providers and relevant government officials to continue to communicate in the event of natural disasters, acts of terrorism, and other man-made disasters
 - Defines the range of interoperable emergency communications capabilities needed for specific events
 - Assesses the current available capabilities to meet such communications needs
 - Identifies the gap between such current capabilities and defined requirements
 - Provides a national interoperable emergency communications inventory that—
 - Identifies channels, frequencies, nomenclature, and the types of communications systems and equipment used by each Federal department and agency

- Identifies the interoperable emergency communications systems in use by public safety agencies
- The OEC Baseline results and findings will provide valuable input into the development of the National Emergency Communications Plan (NECP), which will provide recommendations to—
 - Support and promote the ability of emergency response providers and relevant government officials to continue to communicate in the event of natural disasters, acts of terrorism, and other man made disasters; and
 - Ensure, accelerate, and attain interoperable communications nationwide
 - Title XVIII specifies that in developing the NECP, the OEC shall cooperate with the National Communications System (NCS) (as appropriate) and with—
 - State, local, and tribal governments
 - Federal departments and agencies
 - Emergency response providers, and
 - The Private sector

Sector Preparedness

In general, non-chemical related sectors address chemical events as part of their general “all hazards” preparedness plans. Chemical-related sectors possess significantly higher levels of readiness, tools and technologies. The Working Group established a sector chemical events capabilities stratification methodology that characterized sectors as “well prepared,” “moderately prepared,” or those with “limited preparedness.”

Organizations with demonstrated capabilities in planning, preparedness, communications and response tools/technologies included the following:

- Large communications companies
- Major metro fire/EMS
- Large IT companies
- Chemical facilities
- Nuclear facilities
- Large healthcare facilities, specifically, tier 1 trauma centers
- Large electricity companies
- Finance, as part of broad all-hazards capability
- Large water companies

Organizations making progress on planning, preparedness, communications and response tools/technologies characterized as moderately prepared included:

- Transportation, specifically urban mass transit

Organizations with limited or no capabilities on planning, preparedness, communications, and response tools/technologies included:

- Broad food and agriculture
- Small communications companies
- Small fire/EMS
- Small IT companies
- Small electricity companies
- Small water companies
- Small metro transportation
- Law Enforcement

The Chemical Sector

The chemical industry is a \$635B dollar per annum industry that provides critical goods and services to multiple sectors of the U.S. economy. More than 96 percent of manufactured goods, including 70,000 products, are touched by the products of the chemical sector.

Safety and security of operations and processes continue to be primary concerns of the chemical industry. Members of the American Chemistry Council did not wait for government action after 9/11 and invested over \$5 billion to upgrade security against terror threats at their sites. These efforts are in addition to previously existing efforts established a globally recognized safety record. The focus on chemical industry safety continued to be affirmed by the U.S. government. According to the U.S. Department of Labor, the chemical industry has the best safety record of all U.S. manufacturers.

The chemical industry worked hand-in-hand with the Department of Homeland Security in 2006 and 2007 to frame effective landmark Federal legislation and regulation that will ensure that all high-risk chemical facilities will step up their security measures to meet tough national security standards.

Chemical Sector Coordinating Council

The Chemical Sector Coordinating Council formed in 2004 by stakeholders within the chemical sector and currently includes representatives from 18 stakeholder associations, representing manufacturers, end-users, distributors and retail companies. The CSCC is managed by an elected owner / operator chairman and vice-chairman. The CSCC is a single point of contact to facilitate organization and coordination of sector policy, development, infrastructure protection planning and implementation activities.

The CSCC also works to ensure that value chain security is properly addressed, including inbound and outbound products and materials, and products for distribution and product stewardship activities.

The CSCC was the first Sector Coordinating Council to complete a Sector-Specific Plan aligned with the NIPP. The plan addresses goals, objectives and metrics for chemical security.

Sector Security Programs

While several members of the CSCC have security programs (e.g., National Association of Chemical Distributors and the Synthetic Organic Chemical Manufacturers Association), the American Chemistry Council (ACC) and its Responsible Care® Program provided leadership in this arena.

American Chemistry Council (ACC) members (representing over 90% of the productive capacity of chemical manufacturing at 2040 facilities) have proven 2.5 times safer than the rest of the chemical sector through implementation of their global award winning Responsible Care® program that drives performance for environmental health, safety, environment and security.

ACC members did not wait for government action after 9/11. More than 2000 member facilities have implemented the robust Responsible Care Security Code, including vulnerability assessments and implementation of security enhancements totaling over \$4.8 billion to date.

All American Chemistry Council members are required to participate in the Responsible Care Security Code program. The code covers all facets of security, including facility, perimeter hardening, employee surety, vulnerability and risk assessment, cyber and information security and transportation/supply chain and is designed to help companies continuously improve their security performance.

The Code expressly requires every ACC member facility to:

- assess and prioritize its vulnerabilities;
- implement security measures and management practices to address vulnerabilities;
- raise employee awareness and preparedness through training, drills and emergency response planning, and
- verify implementation through independent third parties, such as local law enforcement, emergency responders, insurance companies or security professionals.

The ACC Security Code has been approved as a template for members to follow in meeting most of the requirements of the new Federal site security regulations. All ACC members and Partners have fully implemented the Responsible Care Security Code.

ACC members work closely with marine, trucking and rail industries as well as appropriate state and local officials to develop more robust security operations, such as: enhancing inspections; increasing surveillance along roads, waterways and rail lines; employee screening; restricting access to facilities; conducting security audits; and using tamper-resistant seals.

APPENDIX B: BIOLOGICAL EVENTS

EXECUTIVE SUMMARY

BACKGROUND AND METHODOLOGY

Though its timing, severity, and ultimate composition remain a mystery, a biological event promises to test the critical infrastructure of the United States and the world. Public health officials have long maintained that the potential for biological events, including a pandemic influenza, is not a matter of *if*, but rather a matter of *when*. To avoid an economic and social catastrophe, biological preparedness demands full participation from the public and private sectors.

The NIAC established a Biological Event Working Group as part of the broader CBR study. In May 2007, leadership from the White House, DHS, and the Department of Health and Human Services asked the NIAC to focus their biological studies on a more specific sub-set of biological events, namely pandemic influenza. Numerous potential biological events exist in addition to pandemic influenza. The high-profile anthrax attacks on the U.S. capitol are but one example of biology exploited for malicious purpose.

Any of the biological scenarios contemplated during this study merit a great deal of research, consideration, deliberation, and articulation. This study does not attempt to project probabilities or impacts on this litany of possibilities, as the sheer magnitude of calculating a biological event would be mathematically difficult and ultimately, imprecise. The structure of the biological study will focus predominantly on a pandemic influenza scenario, primarily due to the amount, type, and quality of research done in support of the specific pandemic influenza sub-topic. However, there are broadly applicable lessons learned in this section that apply to biological events in all forms of manifestation.

The next influenza pandemic will generate significant impacts on the health, social stability, and economy on an unprecedented global scale. With its unequaled scope and scale, a severe or even moderate pandemic promises to impact businesses around the globe. Given these variables and warning signs, the Federal government has consistently asserted that it cannot handle all pandemic preparedness, response, and recovery efforts on its own. In their letter to the NIAC, the two secretaries highlighted the necessity for the public and private sectors to prepare for this serious threat. The secretaries also emphasized their understanding that successful pandemic planning requires coordination across all CI/KR sectors.

While many CI/KR businesses have contingency plans to respond to threats from natural and manmade disasters, most fail to account for the potential extreme health impact and containment strategies specific to pandemics. CI/KR owner-operators know the activities and personnel in their operations that are most critical and they know the considerations necessary to maintain essential levels of service; this knowledge must be linked with

knowledge of the impacts, response strategies, and countermeasures that will be available in a pandemic...¹

The secretaries asked the Council to address six specific issues key to protecting the nation's economy and social stability in light of the looming pandemic threat. The six key issues are:

- Identify and define "critical services" that must be maintained in a pandemic;
- Establish criteria and principles for critical service prioritization;
- Define critical services priority (with principles for variation, if needed);
- Identify critical employee group(s) in each priority critical service;
- Build a structure for communication and dissemination of resources; and
- Identify principles for effective implementation by DHS and HHS.

In response to the joint request by Secretaries Leavitt and Chertoff, and given the expedited nature of the request, the Council elected to reconfigure an existing NIAC Working Group, co-chaired by Chief Rebecca F. Denlinger, Ms. Martha H. Marsh, and Mr. Bruce A. Rohde, along with other NIAC members. In turn, the Working Group created a Study Group to assist with the research. The Study Group investigated a variety of pandemic preparedness-related issues across all CI/KR sectors in its attempt to answer the six key issues outlined above. Taking a holistic approach to its study, the Group interviewed an array of interested parties, including experts from academia, government, private industry, and trade associations to gather the necessary background information, context, and perspective. To familiarize itself with current developments in pandemic preparedness and response, the group also examined numerous reports, particularly those focusing on pandemic vaccine, and anti-viral prioritization.

After adding members and subject matter experts to the Study Group, the Council began by refining its approach to determine each sector's definition of critical and essential workforce. As defined in the HHS Pandemic Influenza Plan, these workers ensure ongoing operations at businesses, organizations, and, by extension, entire critical infrastructures. At the Study Group's outset, the members decided to pursue four data collection methods:

- Distributing a sector assessment survey to CI/KR representatives and organizations;
- Researching and discussing public or private pandemic studies;
- Reviewing existing pandemic plans, programs, and pandemic exercises; and
- Interviewing key subject matter experts.

To understand the private sector's needs and abilities in the face of a pandemic, the Working Group designed a pandemic survey, which it distributed through a number of channels across all CI/KR sectors. The survey asked respondents to answer six basic questions based on the six issues identified by the Secretaries of DHS and HHS. Of the survey's six questions, this Report addresses the strategic ones (Questions 5 and 6) and the operational- and tactical-level questions (Questions 1-4) in the Formal Recommendations section. This Report addresses, in detail, the rationale behind these questions in the Approach and Methodology section and it outlines the findings from these questions in the Survey Findings section.

¹ Letter from Secretary Michael Leavitt and Secretary Michael Chertoff to Erle A. Nye, NIAC Chair, 5/17/06

FINDINGS

Question 1 of the NIAC Survey asked respondents to rank those critical goods and services that they would need to produce their critical goods and services. The priority assigned to each of these types and groups of others' goods and services was highly dependent on the respondent's particular production needs. However, after the Study Group had reviewed the completed surveys a consensus began to emerge as a few specific choices began repeating themselves frequently across all of the surveys. Largely, most of the top priorities across sectors were a basic good or service, such as electricity or communications, which a particular infrastructure needs to operate. Most priority goods and services were not specific or limited inputs (e.g., raw material), unless the sector essentially produces one major product, such as the Nuclear sector.

To uncover any remaining critical interdependencies across sectors, Question 1 asked respondents to identify and define their company's key interdependencies to each critical good and service. As evidenced in the survey responses and the Study Group's workshop deliberations, all sectors generally identified similar cross-sector interdependencies and rationales. However, each sector placed different emphasis on the various interdependencies and rationales based on their goods and services and special business requirements unique to their sector. Regardless of the differences in goods and services produced by sectors, most sectors identified electricity (to include those who produce electricity) in their top priorities, followed by telecommunications, fuel, transportation, and water. All sector responses are available in the Report's Appendix C.

The Study Group identified and assessed the CI/KR cross-sector interdependencies to address the three key factors necessary to improve overall pandemic planning and response, including: identifying cross-sector impacts to specific critical sector operations; identifying the potential for significant cascading consequences; and prioritizing sectors to target support for vaccine allocation. While assessing the critical goods and services identified, the Study Group uncovered a number of key interdependencies relative to external critical goods and services.

- The interdependent relationships most often cited were for the basic municipal and other infrastructure support requirements, including energy, information technology, communications, and water.
- The surveys also identified some less obvious critical goods and services, including basic physical security requirements, financial services for businesses and workers, and food and healthcare to sustain workers and their families.
- The surveys highlighted the important role these interdependencies played in terms of a company's other supply chains, specifically the essential role transportation plays as a bridge between all levels of the supply and distribution chain.

Question 2 asked respondents to identify the criteria they used to prioritize the critical goods and services established in Question 1. Given the wide variance among the types of businesses across and within sectors, the survey first offered basic criteria and guidance designed to define "critical." To better assess the differences and similarities across businesses, the survey also asked for supplementary rationale that justified why each business responded for each item in a particular way. While the differences between businesses and sectors were difficult for non-

experts to identify and define, having the sector's narrative for how and why a sector selected particular goods and services as critical, significantly aided all the sector representatives. These narratives can be found in their entirety in Appendix C.

Survey responses included assumptions made about the criticality of goods and services based on individual business assessment of what respondents believed was important for the nation, such as basic energy and water products. In some instances, sectors defined "critical" based on outside influences, including corporate business operations plans or Federal, State, and local mandates, as was the case with several highly regulated sectors. While the survey provided an excellent start to this study and helped the Study Group improve its understanding of the issues, the Group believes much effort remains to fully define and refine these categories and justifications.

Question 3 asked respondents to describe what their company produces internally for critical goods and services. They were asked to identify and then rank their critical goods and services and to provide a justification for the impacts of "loss or diminishment" in the provision of these critical goods and services to their customers. Appendix C defines, to the best ability of the Study Group, the major critical goods and services for all sectors. Some of the findings include:

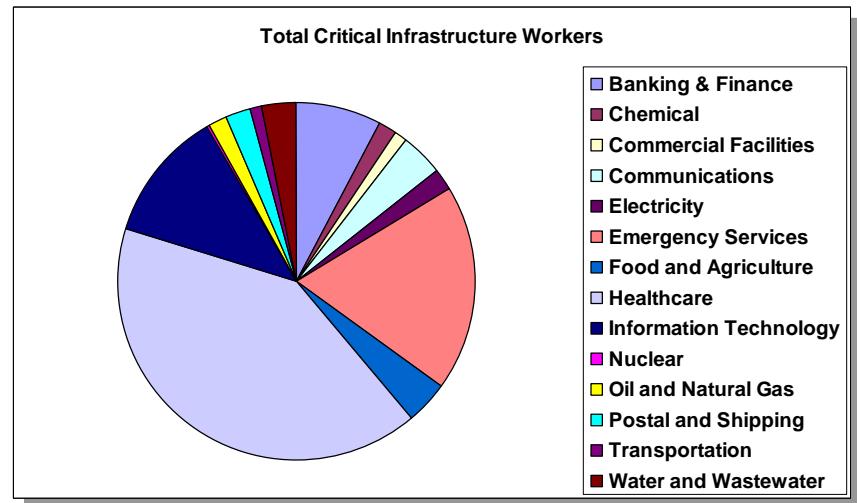
- Basic critical infrastructure sectors generally provide a few major critical goods and services (e.g., potable water and wastewater treatment, electrical generation and distribution, and postal and shipping services).
- Sectors, including Food and Agriculture, Commercial Facilities, and Chemical, manufacture and distribute goods that may require thousands of line items of goods to be assessed and prioritized to determine each one's criticality.
- There are numbers of low-density, single-source businesses (e.g., baby formula producers) and goods/services (e.g., chlorine for water treatment, ATM maintenance).

The last of the four operational survey questions gets to the heart of the NIAC's charge. The Survey asked respondents to not only identify their most critical worker types, but to provide total numbers of workers in these types for their business, to discuss the potential impacts if they were absent, and to describe what the business has already done to mitigate negative operational effects from their potential absence or loss.

Critical Employees: Tiers 1 -3

Banking & Finance: 1,562,000
 Chemical: 322,618
 Commercial Facilities: 84,000
 Communications: 796,194
 Electricity: 375,000
 Emergency Services: 1,997,583
 Food and Agriculture: 750,000
 Healthcare: 8,048,059
 Information Technology: 2,359,800
 Nuclear: 86,000
 Oil and Natural Gas: 328,600
 Postal and Shipping: 467,744
 Transportation: 198,387
 Water and Wastewater: 608,000

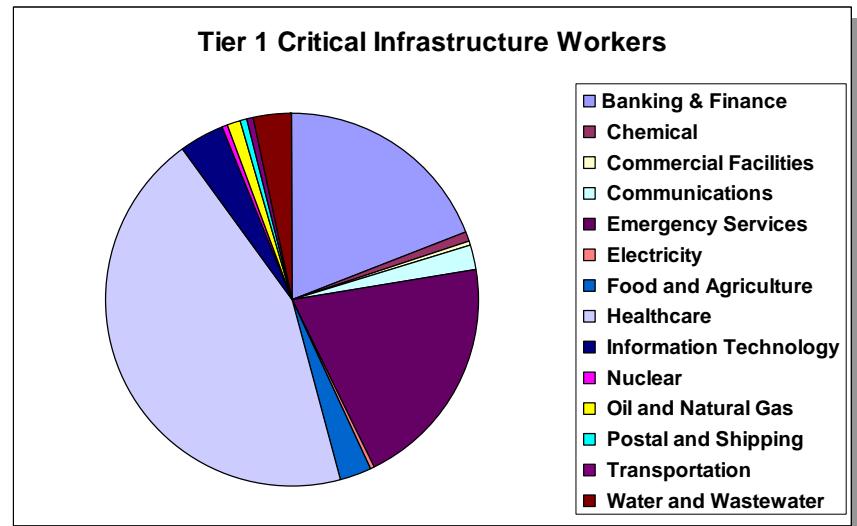
TOTAL: 17,983,985



Employees: Tier 1 Only

Banking & Finance: 349,500
 Chemical: 161,309
 Commercial Facilities: 42,000
 Communications: 396,097
 Emergency Services: 1,997,583
 Electricity: 50,000
 Food and Agriculture: 500,000
 Healthcare: 8,048,059
 Information Technology: 692,800
 Nuclear: 86,000
 Oil and Natural Gas: 223,934
 Postal and Shipping: 115,344
 Transportation: 100,185
 Water and Wastewater: 608,000

TOTAL: 13,370,811



Much of what the Study Group learned about critical workers followed directly and logically from what respondents had identified in the previous questions for critical goods and services and functions. For example, the worker survey response described a situation where some percentage of broadly classified worker types is required to sustain essential operations. Respondents did identify some unique worker categories, but respondents matched these broadly with the single-source critical goods/services provider. However, in all cases, these initial survey responses provided a good baseline from which to explore and refine worker categories and numbers. The categories and numbers provided in this final NIAC Report, Appendix C, reflect the exceptional efforts of the workshop participants and Study Group members to refine the findings further by utilizing the survey results as a baseline.

RECOMMENDATIONS

Bringing a decidedly infrastructure-centric approach to this study, the Study Group suggested there are opportunities to consider a differing prioritization framework and methodology. Beyond this differing approach, the Study Group believes the private sector represents an invaluable partner in the effort to develop and implement a response and communications infrastructure, one that takes advantage of the vast distribution and communications infrastructures owned and operated by the private sector.

The Study Group acknowledges the work done to date with the private sector and critical infrastructure owner-operators on preparedness and recommends that the government continue to engage the private sector to augment the distribution of communications to the critical workforce. The following is a list of **communications-related recommendations**. For a more detailed explanation, see the Directional Recommendation section of the Biological Report.

- A1. Pre-define, to the greatest extent possible, a consistent pandemic communications plan, complete with tailored communications to specific target audiences based on various possible pandemic scenarios.
- A2. Develop and pre-position, to the greatest extent possible, communications in all distribution channels, including radio, television, telephone, print, and online media.
- A3. Continue to engage the private sector to augment the distribution of communications to the critical workforce.
- A4. The public- and private-sector Critical Infrastructure partners should continue refining their existing communications plans, processes, and success metrics through series of response exercises. These exercises should include participation from appropriate state and local representatives where feasible. The Federal government, in consultation with the critical infrastructure owners and operators, should develop a mechanism to refine and identify those priority workforce groups within and across the 17 CI/KR sectors.

Below is a list of **dissemination-related recommendations**. For an explanation of all directional recommendations, see the Directional Recommendation section of the Biological Report.

- B1. Continue developing a clearly defined vaccine and anti-viral medication distribution strategy. Consider the Study Group's work on pandemic prioritization as a starting, not an ending, point for further discussion and clarification about the Federal government's ultimate distribution strategy.
- B2. Consider alternative distribution strategies and guidance to give critical infrastructure owner-operators a stronger voice in determining which employees receive higher prioritization for vaccines and anti-viral medications. Build flexibility into distribution frameworks to allow the private sector to receive,

distribute, and, with appropriate medical support, dispense vaccine and anti-viral medications to their critical workforce.

- B3. More clearly define response and containment roles and responsibilities. The Study Group directionally recommends the Federal government continue to better define its expected response timelines and milestones.
- B4. All public- and private-sector partners should continue educating their relevant stakeholders on pandemic plans, processes, and priorities.
- B5. Engage appropriate resources to ensure adherence to the distribution strategy and the economical use of limited vaccine and anti-viral resources.

The White House outlined three pillars – *Preparedness and Communication*, *Surveillance and Detection*, and *Response and Containment* – that frame the *National Strategy for Pandemic Influenza*. In turn, the NIAC Study Group used these pillars to frame its response to Question 6 of the survey. The following is a **directional recommendation related to Pillar #1: Preparedness and Communications**. For a detailed explanation of all directional recommendations, see the Directional Recommendation section of the Biological Report.

- C1. The public and private sectors should align their communications, exercises, investments, and support activities absolutely with both the plan and priorities during a pandemic influenza event. Continue data gathering, analysis, reporting, and open review.

Among the Study Group's most significant findings are the remarkable surveillance and detection capabilities inherent in the nation's critical infrastructure operating model. Below is a **directional recommendation related to Pillar #2: Surveillance and Detection**. For a complete explanation, see the Directional Recommendation section of this Study Group Report.

- D1. The Study Group directionally recommends that the Federal government improve its effort to engage key elements of the private sector in proactive surveillance and monitoring activities, including:
 - extending public health surveillance to occupational health professionals;
 - developing a formal framework designed to engage international components of U.S. corporations in global bio-data collection efforts;
 - supplementing existing surveillance investments, acquisition, monitoring, and response capabilities to increase threat visibility and geographic coverage; and
 - engaging data acquisition and management resources within the commercial workforce in surveillance, collection, and analysis.

Below is a list of **directional recommendations related to Pillar #3: Response and Containment**. For a detailed explanation of all directional recommendations, see the Directional Recommendation section of this Study Group Report.

- E1. Develop a clearly defined vaccine and anti-viral distribution strategy to ensure deployment as planned, and consider alternative distribution methods that engage

- the private sector in directly distributing antiviral medications and vaccines to in-scope critical workforce.
- E2. Public and private partners should work closely to define more clearly response and containment roles and responsibilities, as well as response timelines and milestones.
 - E3. The Federal government must do a better job in educating all stakeholders on plans, processes, and priorities.
 - E4. Using this report's findings as a baseline for future work, the Federal government should develop an innovative and easy-to-use mechanism to identify the priority workforce groups clearly.
 - E5. Engage appropriate resources to ensure adherence to distribution strategies and the economical use of limited vaccine and anti-viral resources.

DETAILS

APPROACH AND METHODOLOGY

In a May 17, 2006 letter, Department of Homeland Security (DHS) Secretary Michael Chertoff and Department of Health and Human Services (HHS) Secretary Michael Leavitt tasked the National Infrastructure Advisory Council (NIAC) with providing critical infrastructure prioritization recommendations, including distributing countermeasures, during a pandemic influenza event. The Secretaries identified six key issues for the Council to address:

- Identifying and defining "critical services" that must be maintained in a pandemic;
- Establishing criteria and principles for critical service prioritization;
- Defining critical services priority (with principles for variation, if needed);
- Identifying critical employee group(s) in each priority critical service;
- Building a structure for communication and dissemination of resources; and
- Identifying principles for effective implementation by DHS and HHS.

The Federal government established that it does not have the ability to handle all response capabilities needed to prepare for and respond to a pandemic influenza. The National Strategy recognizes that pandemic preparedness and response "cannot be viewed as a purely Federal responsibility, and that the nation must have a system of plans at all levels of government and in all sectors outside of government that can be integrated to address the pandemic threat."² Pandemic preparedness and response will require active participation from the private sector—an area where the NIAC can play an important role. In his letter to Secretary Chertoff, HHS

² <http://www.whitehouse.gov/homeland/pandemic-influenza.html>

Secretary Leavitt asserts that it is “essential for the U.S. private sector to be engaged in all pandemic preparedness and response activities and equally essential for CI/KR entities to be engaged in pandemic planning given our society's dependence upon their services.”³

The NIAC represents a coordinated effort by both government and private-sector entities to offer recommendations on national critical infrastructure security in key economic sectors⁴. NIAC Recommendations assist in the development of policy for either the White House or the Federal agency that the Council is tasked to support.

Given the NIAC’s past successes at bolstering the public-private-sector partnership and its proven ability to work under tight deadlines, Secretaries Leavitt and Chertoff identified the Council as an effective advisory body to address these pandemic-related issues. Since the Council’s inception, the President has also praised the value of its reports and recommendations. The Council’s mission, to aid in protecting national critical infrastructure sectors, represents an essential component of the Federal pandemic preparedness strategy.

Working Group Conversion

Rather than organize a new group, the NIAC decided to reconfigure a preexisting Working Group with the expertise to provide a report and recommendations on Chemical, Biological and Radiological (CBR) Events and the Critical Infrastructure Workforce. This group’s research on the impact on the critical infrastructure workforce from a biological incident naturally lent itself to a pandemic-specific challenge.

As the CBR Working and Study Groups shifted their focus to a pandemic influenza event in the United States, they also reevaluated their membership and looked to fill underrepresented areas and expand further into new areas. This process entailed using current members and subject matter experts to refer potential new members or speakers. Beginning on June 28, 2006, with weekly conference calls, the Group began incorporating new members from numerous different organizations and skill sets, including representation from HHS, DHS and the following CI/KR sectors as presented in Homeland Security Presidential Directive-7 (HSPD-7):

- Banking and Finance;
- Chemical;
- Commercial Facilities;
- Communications;
- Dams;
- Emergency Services;
- Energy (including Dams, Electricity, Oil and Natural Gas, and Nuclear)
- Food and Agriculture;
- Information Technology;
- Postal and Shipping;
- Public Health and Healthcare

³ Letter from Sec. Leavitt to Sec. Chertoff, 5/17/06

⁴ NIAC Charter

- Transportation; and
- Water and Wastewater Management.

BACKGROUND AND METHODOLOGY

After adding members and subject matter expertise to the Study Group, the Study Group began to refine its approach in determining each sector's definition of critical and essential workforce. As defined in the HHS Pandemic Influenza Plan⁵, these workers ensure ongoing operations at businesses, organizations and, by extension, entire critical infrastructures. At the Study Group's outset, the members decided to pursue four data collection methods:

- Distributing a sector assessment survey to critical sector representatives and organizations;
- Researching and discussing public or private pandemic studies;
- Reviewing existing pandemic plans, programs, and pandemic exercises; and
- Interviewing key subject matter experts.

The Study Group also identified four key analytical methods as tools to aid its efforts:

- Inductive data analysis
- Data modeling
- Expert opinion
- A sector assessment survey.

The sector assessment survey served as the focal point for all data collection efforts. The Study Group held numerous discussions intended to introduce and refine the questions it expected to generate the most important and useful hard data from the survey's recipients.

After careful consideration, the Study Group settled on six data collection questions linked to the issues in the NIAC charge. Each question also included clarifying questions to add a greater level of detail to the Council's understanding of critical goods, services, and workers. When applicable, the survey asked respondents to expand on their answers in the comments section.

Sector Assessment Survey

Question 1: Identify external critical services that must be provided to your organization in a pandemic in order for you to provide your essential services;

- A. What goods and services are critical to your operations?
- B. Please identify rationale for criticality ratings as public safety, public health, economic survival, interdependently critical, or other?
- C. Are there key interdependencies to each critical good/service?

After careful discussion, the Study Group defined goods and services as critical if they met the following four criteria:

⁵ <http://www.hhs.gov/pandemicflu/plan/>

- Essential to national security and homeland security;
- Components of systems, assets, and industries upon which the economy depends;
- Components of systems, assets, and industries upon which public health depends; and
- Fundamental to privately owned critical infrastructure.

Question 2: Establish criteria and principles for critical service prioritization;

- A. What criteria did you use for the prioritization of critical goods and services established in Question 1 (e.g., business function, exposure vulnerability, legal mandate)?

Question 3: Define internal critical service priorities;

- What is your company's #1 most critical good and service that you must continue to provide during a pandemic?
- What are your company's #2 most critical goods and services that you must continue to provide during a pandemic?
- What are your company's #3 most critical goods and services that you must continue to provide during a pandemic?
- What is the impact of the loss or diminishment of any of these critical goods and services to your customers or consumers?

Question 4: Identify internal critical employee groups within each critical service priority;

- What is critical employee group #1? How many are represented in this group?
- What is critical employee group #2? How many are represented in this group?
- What is critical employee group #3? How many are represented in this group?
- What is the impact of the loss or diminished availability of any of the critical employee groups?
- Has your organization identified a plan to reduce the vulnerability of exposure to the above groups? If no, will your organization develop such a plan?

Question 5: Make recommendations to build a structure for communication and dissemination of resources within your company;

- A. Has your company developed or is it developing a plan to ensure you can effectively communicate with your employees before and during a pandemic?

Question 6: Identify principles for effective implementation by DHS and HHS.

- A. What do you consider the most critical activities for DHS and HHS to undertake to support your company in the maintenance of essential services in a pandemic?

The survey also sought information that is more granular by asking recipients to provide specificity and examples to their survey responses whenever possible. Furthermore, it asked recipients to answer from both their company's perspective as a consumer, as well as a provider. For instance, the Water and Wastewater Management sector requires essential inputs like chlorine from the Chemical sector to produce an essential output for every other sector—clean, potable water.

To gather accurate and representative information, the Study Group distributed the sector assessment survey through the sectors by utilizing the Partnership for Critical Infrastructure Security (PCIS) and the National Security Telecommunications Advisory Committee (NSTAC). Each recipient who responded then emailed the completed survey back to the Study Group where it was “scrubbed” of any identifying characteristics such as a company name or easily recognizable product. After the removal of identifying marks, the Study Group then aggregated results and recorded response rates by sector. These rates can be seen below in Table 1.

The Study Group distributed 518 surveys and received varying rates of response and an overall response rate of 29 percent. Some sectors proved far more responsive than others did. Despite excellent coverage in certain areas, such as the Nuclear sector, the Study Group encountered a dearth of information in other areas, especially in some of the larger and more diverse sectors. While a 29 percent response rate often reflects solid participation for a typical “cold survey,” this survey was distributed to a focused group of sector representatives. Moreover, three sectors accounted for 90 percent of the total number of responses.

September 8, 2006 Workshop

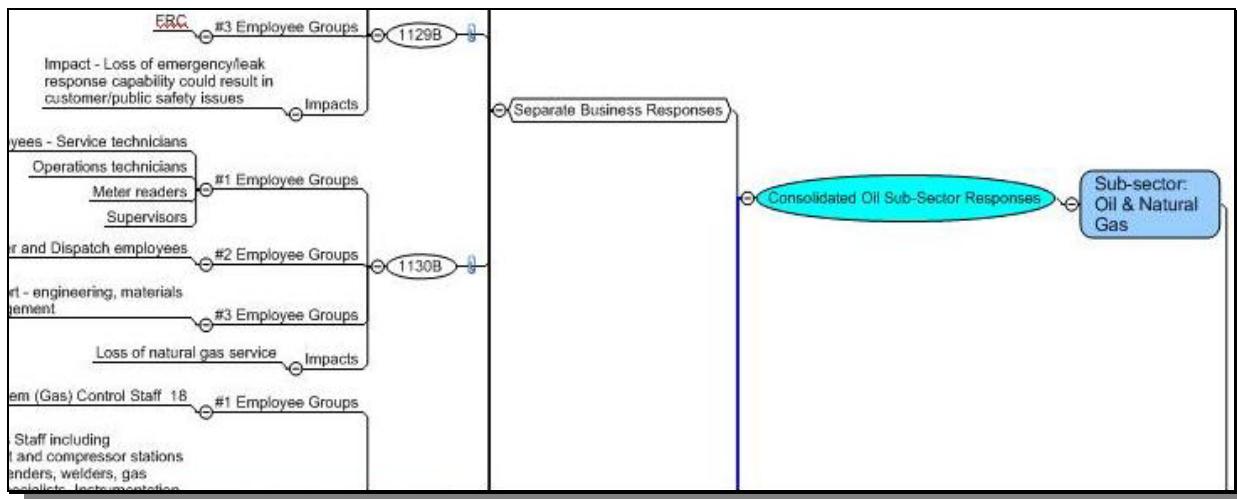
Another critical Study Group step involved convening an all-day meeting in Washington, D.C. in early September to discuss response rates, or lack thereof, to the sector assessment survey. At this meeting, the Study Group reasserted its mission and identified areas of opportunity to focus on as the Working and Study Groups began to develop recommendations for the Council’s review.

The workshop also allowed the Study Group to review its data collection and aggregation methods, particularly its visual mapping of sector responses. Before the meeting, the support team focused on inputting answers to Questions 1, 3 and 4 into a response map. For classification’s sake, Question 2 fell under Question 1. At this point in the research cycle, the Study Group kept aggregating Questions 5 and 6 for the final report and recommendations but deemed the responses less relevant to the workshop itself. The visual aggregation divides the assessment responses by questions, and then further divides the responses by sector and sub-sector according to question. The questions outlined in the map are:

- Identify external critical services that must be provided to your organization in a pandemic in order for you to provide your essential services. (Consumer response and Producer response);
- Establish criteria for critical service prioritization. (Consumer response and Producer response);
- Define internal critical service priorities. (Consumer response and Producer response) and
- Identify internal critical employee groups within each critical service priority.

Below represents a visual sample of the actual map used to support discussion during the September 8 workshop.

Figure 1



Other Methodologies

The Study Group also used other methods as ways to gather information, define and construct its approach. Beginning at its inception, the Study Group held weekly, well-attended conference calls where Working Group and Study Group members met with subject matter experts to:

- Receive briefings
- Develop the sector assessment survey
- Discuss responses as they arrived
- Identify areas of concern
- Address presentation and writing plans

These calls effectively highlighted both how the Study Group would move forward and the direction of its report and directional recommendations would take. In addition to the recurring Study Group calls, the Working Group also convened weekly to discuss progress and identify potential Study Group needs. These conference calls allowed Working Group members to voice concerns and provide necessary guidance as the report and recommendation progressed.

Following the sector assessment distribution, the Study Group also held numerous calls with recipients to answer questions and clarify the survey on a case-by-case basis. As the survey deadline neared, the Study Group held many open calls to make it available to any and all recipients who wanted more information or help clarifying their response. Many sectors also held their own private meetings to discuss aggregating their response and presenting a unified, overarching response.

ASSUMPTIONS

Before beginning its work, the Study Group agreed upon seven assumptions as a baseline for its pandemic prioritization study, adopting many of these assumptions from other government studies and planning documents, including the Homeland Security Council's *Implementation Plan for the National Strategy on Pandemic Influenza*⁶ and the Pandemic Influenza Plan from HHS.⁷ These assumptions are based on scientific data collected from past pandemics and other disease outbreaks, as well as established public health axioms regarding individual behavior and disease spread. The assumptions guiding the work of the Study Group are listed below:

- **Susceptibility to pandemic influenza virus will be universal.**
 - No one will have natural immunity,
 - A pandemic vaccine may not yet be widely available to cover large populations,
 - Antiviral medications will be in short supply
 - Non-medical countermeasures will have limited effect, thus
 - Once a pandemic begins, it may be unstoppable.
- **The clinical disease attack rate will be 30 percent in the overall population during the pandemic. Among working adults, an average of 20 percent will become ill from influenza during a community outbreak.**
- **Worker absenteeism may be as high as 40 percent during peak periods.**
 - Absenteeism will include those who are ill with pandemic influenza.
 - The “worried well,” those concerned they might have influenza or those who want to reduce contact with ill individuals, will be considered absent.
 - Include those who stay at home to care for ill family members.
 - May include otherwise healthy parents who remain at home to care for children out of school; and
 - Some individuals may get ordinary influenza, and assume it is pandemic influenza, and they may opt to stay at home.
 - Include misdiagnosis or overly cautious measures in absenteeism assumption.
- **Some persons will become sick from pandemic influenza, but may not develop clinically significant symptoms. These persons can transmit pandemic influenza and will likely develop immunity to subsequent infections.**
- **Each wave of the epidemic during its peak will adversely impact infected communities for six to eight weeks.**
- **Expect multiple waves of illness, with each wave lasting two to three months.**

⁶ <http://www.whitehouse.gov/homeland/pandemic-influenza-implementation.html>

⁷ <http://www.hhs.gov/pandemicflu/plan/>

- Waves will move across geographic areas so effects on communities will vary.
- Severity of waves, including symptoms and infectiousness, will vary by wave.
- **Effectively half of all infected will seek medical care.**

MAJOR CROSS-SECTOR INTERDEPENDENCIES

With his issuance of Homeland Security Presidential Directive-7 (HSPD-7), President Bush broadly and formally designated 13 Critical Infrastructure and 4 Key Resource sectors essential to the nation's economic security and social stability. The government largely treated these Critical Infrastructure and Key Resource (CI/KR) sectors as discrete and unrelated entities for public- and private-sector coordination and management.

As time has passed, public and private critical infrastructure partners recognized each of these individually complex entities links horizontally to each of the other 17 CI/KR sectors. In other words, each sector is interdependent and reliant on the critical goods and services of nearly all other sectors in order to sustain their critical operations. For example, the Water and Wastewater Treatment sector is fundamentally indispensable to all Americans; it is also indispensable to most, if not all, other CI/KR business sectors.

The Water sector is not alone. It, too, relies on other sectors for a host of critical functions, including:

- The **Energy** sector to power its equipment operations;
- The **Chemical** sector to provide materials necessary to treat the water supply; and
- The **Transportation** sector to deliver the critical supplies from the Chemical sector.

The interdependencies do not end there. The Water sector relies directly and indirectly on the Food and Agriculture sector as well as the Healthcare sector to protect the health and safety of its workforce and customers. In whatever way the sectors formally define and manage themselves, these operational “cross-sector-interdependencies” exist, and while they reflect national strengths, they represent one of the nation’s most critical and complex vulnerabilities.

The Utility of Single Points of Failure in Identifying Cross-Sector Interdependencies

Study Group members agree that effective pandemic, and all-hazards, disaster planning and preparedness must take into account the potential for major “single-point failures” within a sector. Though relegated to a single critical sector or sub-sector, these single-point failures have the ability to cause substantial economic or social disruption for a given region or even the nation as a whole. Single-point failures can be failures of individual businesses or failures of small numbers of similar businesses that are sole-source providers of an essential good and/or service. There are numerous examples of these types of sole-source providers and vulnerabilities

identified in the NIAC Survey within and across *all CI/KR sectors*, including, for example, vaccine manufacturers in the Healthcare sector, baby formula producers in the Food and Agriculture sector, and ATM maintenance workers in the Banking and Finance sector.

By themselves, single-point failures have the ability to cause extensive local, and in some cases, even national disruptions. However, when these single-point failures occur within interdependent sectors, these single-point failures may trigger additional interdependent failures that could cascade across sectors resulting in even greater national impact. In other words, the potential effects of single-point failures, coupled with functional intra- and cross-sector network interdependencies, significantly increase the opportunity for cascading consequences (*i.e.*, the August 2003 North American blackout⁸). To identify the most critical workers for vaccine priority, pandemic planners must assess the essential cross-sector CI/KR interdependent relationships, along with each sector's specific critical goods and services.

Public- and Private-Sector Pandemic Planning, Preparation, and Response

The Study Group believes strongly that given the scope and scale of the challenge of identifying and managing cross-sector interdependencies, neither a single business nor most major business associations have the ability to resolve this issue completely. It is incumbent on the Federal government, according to the Study Group, to assist CI/KR sectors and businesses recognize and manage their interdependent strengths and vulnerabilities for disaster mitigation. Furthermore, the Study Group believes that the private sector needs a better understanding of the likely implications and impacts of these interdependencies within and across sectors before, during, and after a pandemic outbreak.

If the Federal government can substantially refine its prioritization scheme for CI/KR sectors and their workers based on a comprehensive analysis of sector and cross-sector interdependencies, it will strengthen the nation. The Study Group presents its findings, including some key observations and recommendations, below for what the private sector and the government can do to improve their processes and outcomes in assessing both sector and cross-sector interdependencies, in reducing vulnerability to potential cross-sector failures, and in prioritizing critical workers.

NIAC SURVEY AND WORKSHOP FINDINGS

The findings from the NIAC Survey together with the Study Group's weekly teleconferences, and September 8, 2006 workshop discussions encouraged and facilitated a dialogue among the expert respondents, participants, and members that focused on identifying and defining key

⁸ The 2003 North American electrical blackout: An accidental experiment in atmospheric chemistry, www.atmos.umd.edu/~russ/BlackoutFinal.pdf

sector issues. The Study Group uncovered numerous cross-sector interdependencies. Through an iterative scheme of research, subject matter expert presentations, analysis of survey responses, and targeted collaboration with other sector experts, the Study Group has greatly improved its shared understanding of what constituted critical cross-sector interdependencies. Moreover, this study highlights the implications of disruptions to these interdependencies for the sectors in general and for critical worker prioritization specifically.

Goods and Services

Question 1 of the NIAC Survey asked respondents to rank order those critical goods and services that they would need to produce their critical goods and services. Of note, critical goods or services from other businesses consumed by the respondent business to produce their critical goods and services constitutes an interdependency with that other business or sector. From its review of the surveys, the Study Group was able to align these products into four general groups:

- **Direct Inputs** – Products (*e.g.*, raw materials, chemicals, key components and assemblies, equipment and repair parts, consumable supplies, and specialty contract services) directly input into a business' production processes.
- **Municipal and Other Infrastructure Goods and Services** – Products (*e.g.*, electrical, oil/gas, fuel, water, communications, and waste management) that support the production processes of a business.
- **Indirect Inputs** – Goods and services (*e.g.*, food and agriculture, emergency services and healthcare) that a business may not consume directly but ones that it deems essential if it is to sustain its workforce and the overall work environment.
- **Support Inputs** – Other goods and services (*e.g.*, transportation, postal and shipping, information technology and banking and finance) that support a business' process of receiving direct inputs, and producing and delivering the business' critical goods and services.

The priority assigned to each of these types and groups of others' goods and services was highly dependent on the respondent's particular production needs. However, after the Study Group had reviewed the completed surveys a consensus began to emerge as a few specific choices began repeating themselves frequently across all of the surveys. The top priorities began to emerge. Largely, most of the top priorities across sectors were a basic good or service, such as electricity or telecommunications, which a particular infrastructure needs to operate. Most priority goods and services were not specific or with limited survey inputs (*e.g.*, raw material), unless the sector essentially produces one major product, such as the Nuclear sector.

Repeatedly throughout the course of their deliberations, Study Group members addressed the inherent difficulty in defining the importance of one sector's goods and service vis-à-vis another sector's essential goods and services in the context of a pandemic outbreak. In general, the Study Group agreed the stated priorities for goods and services for all sectors are valid and defensible. However, the survey highlighted the fact that businesses may consider certain essential goods and services more critical given their link to the production functions of many, if not all, CI/KR sectors. For example, even though a business might find a particular raw material to be essential to the production of a critical good, most respondents cited the need for basic electricity

availability (“keeping the lights on”) as their highest priority. Respondents indicated that electricity has an indispensable role in sustaining overall production and business functions.

Clearly, if the United States cannot maintain electrical generation and distribution, most businesses will be unable to function. That said, even if the Energy sector is successful in keeping the lights on during a pandemic wave, no one should interpret this achievement as a pandemic panacea for all other sectors. As sector representatives repeatedly reminded the Study Group, even with an operating electric grid, sectors will still need raw materials to produce goods and services, to complete financial transactions to support employees and operations, and transportation assets to move raw materials and chemicals.

Interdependencies

To uncover any remaining critical interdependencies across sectors, the NIAC Survey, Question One, asked respondents to define, and if possible prioritize, the key interdependencies to each of their critical goods and service. Table 1 provides an example of the types of cross-sector interdependencies and assessment identified in this question as recorded for the Public Health and Healthcare sector.

Table 1: Healthcare Sector

Critical Goods/ Services	Rationale	Criteria	Inter-dependency
Water	Health and safety	Service delivery	Water – immediate
Electricity and Power	Health and safety	Service delivery	Electricity – beyond 24 hours
Transportation and shipping	Interdependency	Service delivery	Transportation of critical medical materi
Communications	Interdependency	Service delivery	Communications with suppliers, EMS, police, safety, employees
Food and agriculture	Interdependency	Service delivery	Provision of food for inpatients
Public safety, fire, and EMS	Health and Safety	Service delivery	Patient transport, physical security, triage assistance

As evidenced in their survey responses and their workshop deliberations, all the sectors generally identified cross-sector interdependencies and rationales similar to those noted for the Healthcare sector. However, each sector placed different emphasis on the various interdependencies and rationales based on their goods and services and special business requirements unique to their sector. Regardless of the differences in goods and services produced by sectors, most sectors identified electricity (to include those who produce electricity) in their top priorities, followed by communications, fuel, transportation, and water. Table 2 details the top priorities identified by a sampling of specific sectors in their surveys. Please note that all sector responses are available in the Report’s Annex A.

Table 2: Sector Examples

Priority	1	2	3	4
Water and Wastewater	Electricity	Chemicals	Fuel	Telecom
Food and Ag	Raw Materials	Power	Labor	Water
Energy	Electricity	Fuel/Coal	Water	Telecom
Banking and Finance	Electricity	Telecom/IT	Transportation	Fuel
Transportation	Fuel	Electric	Telecom	Water
Communications	Power	Fuel	Transportation	Water

Observations on Interdependencies

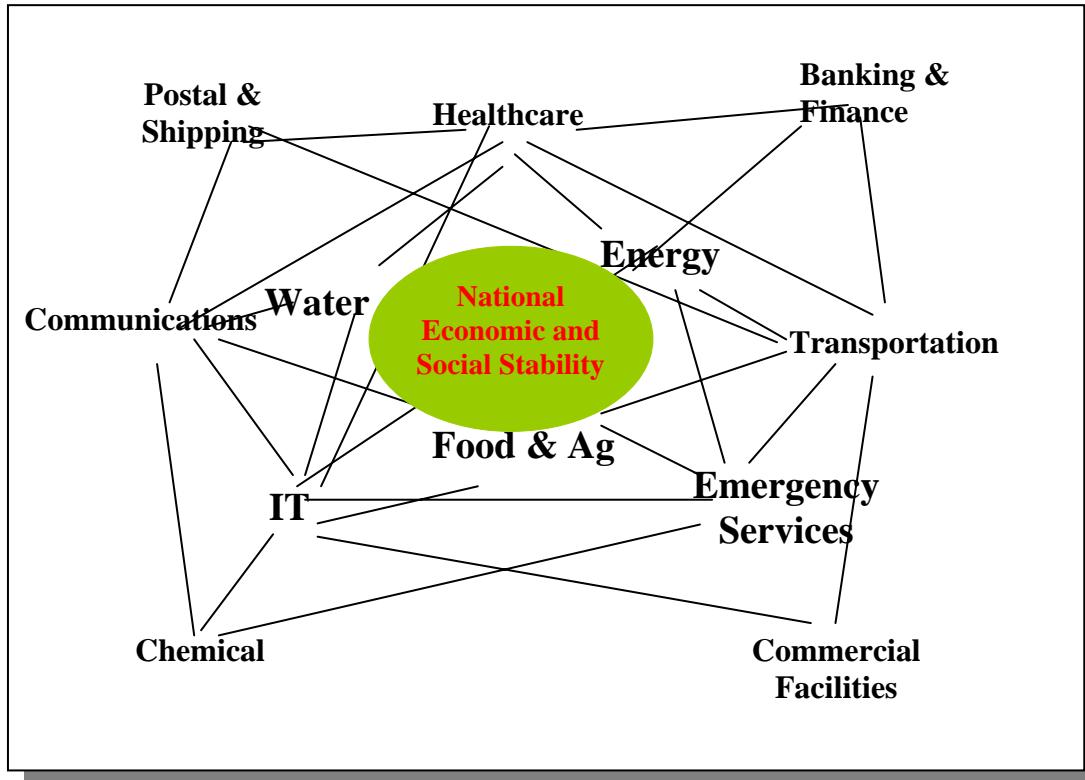
The Study Group believes it is important to comprehensively identify and assess the CI/KR cross-sector interdependencies so as to address the three key factors necessary to improve overall pandemic planning and response, including:

- Identifying cross-sector impacts to specific critical sector operations;
- Identifying the potential for significant cascading consequences and
- Prioritizing sectors and sub-sectors in order to target support for such as vaccine allocation.

Results from the NIAC Survey in conjunction with the Study Group deliberations began the process of resolving these three factors. The Study Group has noted that additional effort will be required to more fully explore the first two factors and model the interdependencies in a manner that would improve efforts to refine worker prioritization. Additionally, these follow-on efforts, the Study Group believes, would speed up the effort to make decisions on support during the pandemic response phases for potential cross-sector cascading failures. The Study Group has found that the third factor assigning sector prioritization has been the most difficult to resolve in a reasonable manner. For a host of reasons, the Study Group has concluded that deriving a clean “1 to n” sector prioritization list may not be possible. This report describes a partial list of these reasons below.

- While some sectors, such as Energy and Water, have few primary goods and services, many other sectors have a much more diverse and complex portfolio of products.
- For those more complex sectors, most have organized themselves functionally into a diverse group of sub-sectors.
- The array of individual products produced for those sectors with varied goods and services and sub-sectors is considerable, and their criticality, as it relates to pandemic preparedness and response, for each sector ranges from the decidedly essential to the clearly non-critical.

Figure 2: Sector Interdependent Relationships



The various ways in which sectors responded to the survey provided the Study Group with another significant challenge to prioritizing between sectors in an effective, efficient, and definitive manner. The interdependencies identified in this study reflect the relationships between the sectors in their provision of critical goods and services. Largely, the business-based interdependencies do not address from a national perspective the overarching goal of sustaining our nation's economy and protecting its social stability. As a result, the Study Group found that while rank ordering among sectors may not be practical, graphically representing the interrelationships based on their critical business-based and national goal interdependencies is useful. Figure 2 above depicts the relationships between sectors and the goal of sustaining national economic and social stability.

The Study Group is careful to note that, by no means, is the Figure 2 intended to depict a prioritization of sectors. Instead, the graphic underscores the point that certain sectors cited other sectors more often as it relates to the provision of their critical goods and services. Moreover, while not directly from the surveys, the graphic assumes how sectors, in general, may respond to the challenge of sustaining national economic and social stability over time. With this in mind though, all the sectors identified specific critical goods and services they produced and considered essential to sustain the other sectors and to realize the overall goal of sustaining national economic and social stability.

Directional Recommendations for the Next Level of Analysis

Throughout this study, sector respondents and Study Group participants provided expert insights, as well as qualitative and quantitative assessments of their sectors. These insights established a baseline for what constituted key CI/KR cross-sector goods and services and interdependencies. The Study Group believes the Federal government can use the interdependencies identified in this study to establish a follow-on study and the next level of analysis, to include the following:

- **Refine responses for each key Study area.** Given the limited time respondents had to answer the NIAC Survey, Question 1 answers typically included only broad definitions for goods, services, and worker types and cross-sector interdependencies. For example, one survey identified the transporting of critical medical material as critical, but the respondent did not specify types of critical materials, what priorities (if any) were established, or the quantity of medical material.
- **Broaden analysis to include a review across sectors based on national priorities.** From the broader context of overall “national interest,” the Study Group did not have enough information to formally assess or rank the sectors based on national criteria, such as sustaining basic subsistence support for their workers and customers, as well as the public. For example, while electricity and communications were top priorities for business, the more immediate national interest needs in a pandemic may be for food, drinking water, emergency services, and healthcare.
- **Extend the business-level analysis to uncover 2nd and 3rd order issues and effects.** The Study Group believes most respondents lacked sufficient time to assess fully the basic infrastructure support of their sector or their business. In general, responses contained only general statements about issues such as requiring electricity/power, water and/or transportation. Additionally, most survey responses lacked sufficient granularity in their data that might have answered questions like the following:
 - If a business says electrical power is a high priority for its sector, how many of that sector’s businesses already possess adequate reserves of electrical generation? Moreover, do these businesses have sufficient generator fuel onsite to support their own electrical requirements for an extended period?
 - If a business indicates water, fuel, and/or chemicals are critical goods and services necessary for production, how many of sector businesses have on-site reserve water and/or fuel tanks and chemical stockpiles to provide some level of backup for a specified period? How many days or weeks will those reserves last?
- **Define the impacts and implications caused by disruptions.** To date, the private sector has not fully developed the impacts of disruptions to the provision of a critical good or service, and the potential cross-sector implications and consequences, according to the Study Group.
- **Include data from critical medium and small businesses.** The Study Group found that survey respondents from the largest and most diverse sectors generally lacked the

necessary time and access to information about other partners in and across sectors, especially those potentially critical medium- and small-sized businesses.

SURVEY FINDINGS

Overview

The NIAC pandemic survey asked private-sector respondents to answer six questions, based on the six issues identified to the NIAC in the original charge from the Secretaries DHS and HHS. Of the six questions, this report addresses the strategic ones, Questions 5 and 6, in the Formal Recommendations section. Questions 1-4 are the operational- and tactical-level questions that respond to explicit concerns about critical goods and services, functions, and workers.

The following review describes how the Study Group formulated and presented these interrelated questions in its effort to have the survey flow logically from one to the other in answering the NIAC's charge. This review will also detail what the Study Group anticipated and realized for each question, as well as an analysis of what worked well and what members feel still the public and private sectors still need to accomplish.

Flow and Interrelationships

Prior to identifying the most critical workers, the study group initially needed to know the most critical products (at the national, regional, and local level) produced by the CI/KR businesses. The first four survey questions prompted business and sector representatives to identify these products and the community, commodity, and business practice that they affect. For instance, a highly critical sector, the Chemical sector, produces Chlorine, a critical input for several other sectors. The loss of Chlorine would adversely affect those sectors, compromising the ability to purify drinking water and generate nuclear power.

- The first question asked respondents to identify and rank their external critical goods and services according to specific criteria. Respondents ranked them based on the importance of the external critical goods and services that are necessary to their business' production and delivery efforts. In other words, respondents ranked their critical goods and services on their criticality down the chain through all their suppliers (*e.g.*, raw and finished component supplies and materials and municipal infrastructure support), as well up their delivery/distribution chain (*e.g.* final production, wholesale distribution and retail actions to the end-user/customer).
- The second question identified a company's most critical internal goods and services that they produce based on the criteria identified in the Survey instructions.
- The third question asked respondents to identify the critical internal goods and services essential to the operation of their business, and vital to creating and sustaining their critical internal goods and services.

- The fourth question asked respondents to identify the types of workers that are most critical to sustaining their company's operation and critical business functions. In other words, respondents used the critical functions that they had previously identified and prioritized to prioritize further the most critical workforce categories who they felt are essential to sustaining the functions needed to produce their most essential goods and services.

Additionally, based on the four primary question groups, NIAC workshop participants and Study Group members considered how the Study Group might differentiate these critical workers into “tiers” of criticality. In all cases, Study Group members had to justify how they came to their conclusions for each of their sectors. The way in which these four question groups interrelate and build on each other demanded that the business and/or sector respondents review and rework their earlier answers to ensure that they integrated and addressed the most critical issues.

Question 1: Identify and Define Critical Goods and Services

The survey’s first question targeted the external critical goods and services provided to (consumer) and provided from (producer) the respondent’s company and/or sector. Question 1 required respondents to rank these external critical goods and services. It also asked them to provide a rationale for their criticality ratings. Respondents could cite public safety, public health, economic survival, interdependently critical, or other. Finally, the survey asked respondents to describe and prioritize the key interdependencies noted between internal and external operations and critical goods and services.

The Study Group designed Question 1 to require the respondent to first look outward at the business’ operating environment. From this perspective, respondents would be better able to identify their operational context and the critical goods and services they need and provide to others in the supply and distribution chain. The Study Group believes that the survey responses coupled with the expert dialogue at the workshop highlighted many of the sectors’ key goods and services, thus fulfilling the general intent of this question. That said, given the time available, the Study Group was unable, in many cases, to explore the critical goods and services in detail. Largely, these critical goods and services were noted as critical variables (input and output), but neither the respondents nor the Study Group had sufficient time to investigate the second- and third-order implications of these critical input and output variables. Appendix C to this Report compiles the actual responses from the sectors to this question.

In the process of assessing the critical goods and services that were identified in the survey, the Study Group was able to uncover a number of key, and previously overlooked, sector and cross-sector interdependencies relative to external critical goods and services.

- The interdependent relationships most often cited were for the basic municipal and other infrastructure support requirements, including energy, information technology, communications, and water. These requirements serve as the operational foundation for nearly all businesses, to include energy, water, information technology, and communications.

- The surveys also identified some less obvious critical goods and services, including basic physical security requirements, financial services for businesses and workers, and food and healthcare to sustain workers and their families.
- In its review of the surveys, the Study Group highlighted the important role these interdependencies played in terms of a company's other business supply chains, specifically the essential role transportation plays as a bridge between all levels of the supply and distribution chain.

This Report's Major Cross-Sector Interdependencies Section provided a detailed review and analysis of the intra- and inter-sector interdependencies and recommendations of survey respondents, workshop participants, and Study Group members.

Question 2: Criteria and Principles for Critical Service Prioritization

The second question clarified and justified the responses provided in Question #1. Question #2 asked respondents, "What criteria did you use for the prioritization of critical goods and services established in Question 1 (*e.g.*, business function, exposure vulnerability, legal mandate)? And, if the correct response in your organization is 'I do not know, have not thought about it, or still being debated,' then provide that answer."

For this question, the Study Group intended to refine further the respondent's justifications in Question #1. In the first question, respondents identified their critical goods and services, but in Question #2, they were asked to justify their critical goods and services and they were asked to identify the factors underlying their decisions (*e.g.*, laws, regulatory mandates, and established business continuity plans). Given the wide variance between the types of businesses across and within sectors, the survey first offered basic criteria and guidance designed to define "critical". Then, in order to better assess the differences and similarities across businesses, the survey asked for supplementary rationale that justified why each business responded for each item in a particular way. While the differences between businesses and sectors were difficult for non-experts to identify and define, having the sector's narrative for how and why a sector selected particular goods and services as critical significantly aided all the sector representatives. Moreover, these narratives helped the Study Group better understand the expert responses from the other sectors.

Survey responses included assumptions made about the criticality of goods and services based on individual business assessment of what respondents believed was important for the nation, such as basic energy and water products. In some instances, sectors defined "critical" based on outside influences, including corporate business operations plans or Federal, State, and local mandates, as was the case with several highly regulated sectors. While the survey provided an excellent start to this study and helped the Study Group improve its understanding of the issues across sectors, group members believe that much effort remains to fully define and refine these categories and justifications.

Question 3: Defining a Priority for Critical Goods and Services

The survey's first two questions reviewed the external and internal operating environments. Question #3 asked survey respondent to describe what their company produces internally for critical goods and services. They were asked to identify and then rank their critical goods and services and to provide a justification for the impacts of "loss or diminishment" in the provision of these critical goods and services to their customers.

The Study Group designed this question to establish the business sectors' essential outputs as a baseline for identifying their critical functions and workers. Based on the survey responses, workshop discussions, and the efforts of Study Group members, Appendix C to this Report defines, to the best ability of the Study Group, the major critical goods and services for all sectors. From these responses, much has been identified that was anticipated about the sectors, and much has been learned about each of the sectors and sub-sectors that were not previously apparent. For example:

- Basic critical infrastructure sectors generally provide fewer major critical goods and services (e.g., potable water and wastewater treatment, electrical generation and distribution, and postal and shipping services).
- Sectors, including Food and Agriculture, Commercial Facilities, and Chemical, manufacture and distribute goods that may require thousands of line items of goods to be assessed and prioritized to determine each one's criticality.
- There are numbers of low-density, single-source businesses (e.g., baby formula producers) and goods/services (e.g., chlorine for water treatment, ATM maintenance).

Given, in part, to the inherent diversity and varying complexity of the sectors, the Study Group found it difficult to identify all critical single-source and second- and third-order goods and services in a number of sectors. In managing the survey and assessment process, the sectors generally fell into very diverse groups based on a number of variables. These differences had key implications for what was uncovered and for how much remains for each sector to address:

- For those sectors that are more uniform in operations (e.g., electricity and water), highly regulated (e.g., nuclear), and owned or operated by a limited number of large businesses (e.g., postal and shipping), the Study Group was able to better manage the assessment process, and the survey responses were more inclusive.
- In those sectors and sub-sectors in which operations are extremely divergent, the Study Group had a more difficult time managing the assessment, and the responses, to date, are less comprehensive and definitive.
- In nearly all cases, the sector and sub-sector survey respondents and NIAC work group members represent the larger businesses in a sector: thus, those medium to smaller businesses that may provide critical single-source goods and services did not have a direct voice in this discussion.

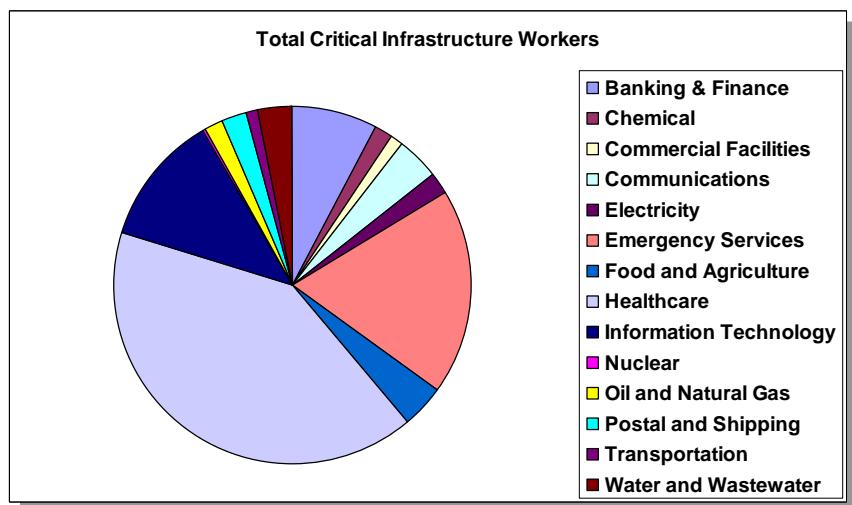
Question 4: Identifying Critical Employee Groups in Each Priority Service

The last of the four operational survey questions gets to the heart of the NIAC charge. The Survey respondents were asked to not only identify their most critical worker types, but to provide total numbers of workers in these types for their business. Furthermore, it sought to describe what the business has already done to mitigate negative operational effects from their potential absence or loss. Below are the numbers of employees that each CI/KR sector has indicated that are members of a critical workforce. Each sector provided a rationale for their definition of critical and for their reasoning behind their tiering strategy. These sections submitted by sectors can be found in Appendix C of this Report.

Critical Employees: Tiers 1 -3

Banking & Finance: 1,562,000
 Chemical: 322,618
 Commercial Facilities: 84,000
 Communications: 796,194
 Electricity: 375,000
 Emergency Services: 1,997,583
 Food and Agriculture: 750,000
 Healthcare: 8,048,059
 Information Technology: 2,359,800
 Nuclear: 86,000
 Oil and Natural Gas: 328,600
 Postal and Shipping: 467,744
 Transportation: 198,387
 Water and Wastewater: 608,000

TOTAL: 17,983,985



In 2005, the Department of Health and Human Services (HHS) commissioned two Federal advisory committees to provide guidance for planning purposes and to form the basis for further discussion, including this NIAC study, of how to allocate equitably the medical countermeasures that will be in short supply in the early stages of a pandemic influenza outbreak. The two advisory committees – the Advisory Committee on Immunization Practices (ACIP) and the National Vaccine Advisory Committee (NVAC) – both provided recommendations, which HHS has detailed in appendix D of its pandemic plan.⁹ Though comparing the two sets of numbers is complicated, there are a few interesting findings to note. For example, the final percentages for vaccine prioritization for critical workers detailed in this report are 15.8 percent of all critical workers in Tier 1 and 21.2 percent for all tiers. However, given their extreme requirements during a pandemic, the high percentage of Tier 1 critical workers in the Healthcare and Emergency Services sectors skews the data. If removed, the NIAC numbers for Tier 1 critical workers represent only 4.8 percent of the entire CI/KR workforce (excluding Healthcare and Emergency Services) and the numbers for all tiers of critical workers represents 11.4 percent of the total CI/KR workforce (excluding Healthcare and Emergency Services). The total for all

⁹ <http://www.hhs.gov/pandemicflu/plan/appendixd.html>

critical workers in all CI/KR sectors (including Healthcare and Emergency Services) in all tiers equals only one half of one percent of the total U.S. population.

It is also important to note that the NVAC/ACIP studies did not include all the sectors represented in the NIAC study. The HHS Plan excluded the Banking and Finance, Chemical Commercial Facilities, Food and Agriculture (except food transportation), and Postal and Shipping sectors. The HHS plan also used different definitions for “essential workers.” Moreover, other than Public Health and Healthcare, the HHS Plan placed all CI/KR workers in Tier 2. Even without factoring in sector differences, the NIAC study numbers represent an 11.4 percent decrease in the numbers of identified HHS Tier 1/2 critical workers. Moreover, adjusting the numbers to reflect only those sectors that were included in both the HHS and the NIAC study reveals that the NIAC Tier 1 is 39.5 percent smaller than the Tier 1/2 allotment of workers spelled out in the HHS plan.

NIAC Figures

Sector	Total	Tier 1	Percentage	Less Health/ES	Tier 1-3	Percentage	Less Health/ES
Banking & Finance	6,000,000	349,500	5.8%	5.8%	1,562,000	26.0%	26.0%
Chemical	1,825,300	161,309	8.8%	8.8%	322,618	17.7%	17.7%
Commercial*	19,872,800	42,000	0.2%	0.2%	84,000	0.4%	0.4%
Communications	1,818,622	396,097	21.8%	21.8%	796,194	43.8%	43.8%
Electricity	1,600,000	50,000	3.1%	3.1%	375,000	23.4%	23.4%
Emergency Services	2,257,419	1,997,583	88.5%	NA	1,997,583	88.5%	NA
Food and Ag	22,072,000	500,000	2.3%	2.3%	750,000	3.4%	3.4%
Healthcare	13,062,000	8,048,059	61.6%	NA	8,048,059	61.6%	NA
Information Technology	8,494,000	692,800	8.2%	8.2%	2,359,800	27.8%	27.8%
Nuclear	175,000	86,000	49.1%	49.1%	86,000	49.1%	49.1%
Oil and Gas	1,444,740	223,934	15.5%	15.5%	328,600	22.7%	22.7%
Postal & Shipping	1,720,000	115,344	6.7%	6.7%	467,744	27.2%	27.2%
Transportation	3,012,000	100,185	3.3%	3.3%	198,387	6.6%	6.6%
Water and Waste	1,480,000	608,000	41.1%	41.1%	608,000	41.1%	41.1%
	84,833,881	13,370,811	15.8%	4.8%	17,983,985	21.2%	11.4%

*Commercial sector total numbers do not include the 4 sub-sectors considered less critical in a pandemic.

HHS Figures – NVAC/ACIP Recommendations		
HHS Annex D	Tier 1	Tier 2
Banking & Finance	0	0
Chemical	0	0
Commercial Facilities	0	0
Communications	0	1,080,000
Electricity	0	364,000
Emergency Services	0	2,990,000
Food and Agriculture	0	**
Healthcare****	8,500,000	300,000
Information Technology	0	***
Nuclear	0	****
Oil and Gas	0	****
Postal & Shipping	0	0
Transportation	0	3,800,000
Water and Waste	0	****
Totals	8,500,000	8,534,000

**Food and agriculture, water, and fuel transportation are only included under Transportation.

***Information technology is included with Communications.

****Incorporates all power, water, and sewerage systems under "utility workers."

*****HHS number was between 8 and 9 million, this represents the mean.

10

HHS-NIAC Comparisons		
HHS-NIAC Tier 1/2 Comparison		
HHS	NIAC	Δ
17,034,000	17,983,985	>5.3%
HHS Tiers 1/2 vs. NIAC Tier 1		
HHS	NIAC	Δ
17,034,000	13,370,811	<27.4%
Revised NIAC Tier 1 Figures*		
HHS	NIAC	Δ
17,034,000	12,210,074	<39.5%
Revised NIAC Tier 1-3 Figures*		
HHS	NIAC	Δ
17,034,000	14,797,623	<15.1%

*excludes Postal and Shipping, Food and Agriculture, Commercial, Chemical, and Banking and Finance.

Much of what the Study Group learned about critical workers followed directly and logically from what respondents had identified in the previous questions for critical goods and services and functions. For example, the worker survey response was directly linked and described a situation where some percentage or number (if either was available) of broadly classified worker types are required to sustain essential operations. Given the limited time, available resources, and the difficulty in defining essential, survey respondents generally did not go into detail in discriminating between various worker types for specific critical functions. Respondents did identify some unique worker categories. However, in all cases, these initial survey responses provided a good baseline from which to further explore and refine worker categories and numbers. The categories and numbers provided in this Study Group Report, Annex A, reflect the exceptional efforts of the workshop participants and Study Group members to refine the findings further by utilizing the survey results as a baseline.

One of the most significant challenges for the sector representatives was identifying total numbers of broad categories of workers or the sector as a whole. The reasons for this difficulty stem mostly from a lack of common understanding and oversight mechanism in government or business for what fully constitutes most sectors and sub-sectors:

- HSPD-7 broadly identifies 17 CI/KR sectors but it does not detail all the sub-sectors and business types in each.
- Existing Bureau of Labor Statistics (BLS), Economic Census, and other national sources of business and worker type statistics do not align cleanly with each other or the HSPD-7 taxonomy for sectors.
- No other common, consolidated government or private-sector source exists for business information covering all details about all sectors and sub-sectors.
- For highly diverse sectors, ensuring full expert representation in the survey and work group membership was extremely difficult.
- No single expert source/group yet exists in government or the private sector for all CI/KR sectors, including the PCIS/SCC/GCC or trade associations.

Directional Recommendations from Survey Questions 1 - 4

The NIAC charge was an important and challenging one. Within the time and resources available, the Study Group was able to improve significantly the nation's overall awareness and understanding about the critical goods and services and critical workers across all CI/KR sectors. At each step in the process, the Study Group made substantial advances and identified areas for the Working Group where the Federal government, in coordination with its private-sector partners, should conduct additional study to further refine and validate the outcomes. The following are directional recommendations to address the issues raised in Questions 1-4:

- In collaboration with private-sector businesses, DHS should improve and validate the national definitions for CI/KR sectors, to include:
 - Defining all the types of businesses and functions that are included within each CI/KR sector and sub-sector;
 - Differentiating between businesses and operations within those CI/KR businesses that function in total or in part across sectors (*e.g.*, chemical and pharmaceutical manufacturers), and assigning these to specific sectors and sub-sectors; and
 - Distinguishing between worker categories that function across sectors (*e.g.*, pilots and truckers who operate within the Transportation sector and pilots and truckers who operate within the Postal & Shipping sector); and
 - Assigning cross-sector workers and functions to specific sectors and sub-sectors.
- DHS should coordinate with the BLS and the Economic Census Agency to develop consistent national categories for reporting based upon HSPD-7 that clearly discriminate between worker categories by sub-sector.
- Utilizing the outcomes outlined in this report as the baseline, DHS should create a comprehensive follow-on project to study each CI/KR sector and sub-

sector in detail in order to model and refine information on critical businesses, goods and services, and worker types.

- Utilizing the outcomes outlined in this report as a baseline, DHS should also establish a follow-on study to assess essential cross-sector interdependencies and identify resulting critical businesses, goods and services, and worker types.

DIRECTIONAL RECOMMENDATIONS

Question 5: Communication and Dissemination of Resources

In its discussions with pandemic influenza experts, its survey of hundreds of private-sector partners, and in ongoing internal discussions, the Study Group achieved consensus on several recommendations for this report. The Study Group feels strongly that, if enacted, these recommendations would represent a solid extension of the Federal government's ongoing work, and additional private-sector efforts to prepare this Nation for the potentially devastating and possibly crippling effects of a severe pandemic outbreak.

The series of directional recommendations outlined in this chapter of the report are rooted in two documents: the National Strategy for Pandemic Influenza and the HHS Pandemic Influenza Plan.¹¹ The Study Group believes both of these documents are essential building blocks to the nation's ability to prepare for, respond to, and recover from the challenges posed by a pandemic influenza outbreak in the United States. As Chief Rebecca Denlinger remarked during the October 12, 2006 NIAC Meeting, "Without this fine work, we would be significantly behind much of the modern world, and without the strategic framework from which we will continue to enhance our nation's preparedness and response capabilities."

As part of its pandemic assessment survey, the Study Group polled respondents directly regarding two distinct sets of recommendations. In Question 5 of the survey, the Study Group asked respondents to make recommendations to build a structure for communication and dissemination of resources within their own companies. The remaining question, Question 6, looked at the public sector response, and asked respondents to identify principles for effective implementation by the Departments of Homeland Security and Health and Human Services.

Given its decidedly infrastructure-centric approach to this study and report, the Study Group believes that there are opportunities to consider a differing prioritization framework and methodology. Beyond this differing prioritization approach, the Study Group would suggest that the private sector represents an important partner of the Federal government in the development and implementation of a response and communications

¹¹ <http://www.hhs.gov/pandemicflu/plan/>

infrastructure, one that leverages the vast distribution and communications infrastructures owned and operated by the private sector.

Each of the following recommendations by the Council addresses actions that the President, along with the Secretary of Homeland Security and the Secretary of Health and Human Services, can take to improve pandemic preparedness in the United States.

A. Directional Recommendations - Communications

The tremendous scope and broad reach of the impacts from an influenza pandemic underscore the importance of clear, concise, and consistent information from the public and private sectors, alike. The *National Strategy for Pandemic Influenza* recognizes that pandemic planning and response necessitates that government leaders at all levels articulate clearly the actions and priorities the government will take and those it expects its partners in the private sector to take. The following are a list of communications-related directional recommendations:

A1. Pandemic Communications Plan

The Study Group directionally recommends that the Federal, State, and local government officials pre-define, to the greatest extent possible, a consistent pandemic communications plan, complete with tailored communications to specific target audiences based on various possible scenarios as the pandemic may unfold. Under some scenarios, containment is working while other scenarios show containment fails to slow the transmission of the virus. In other scenarios, the outbreaks begin in large urban areas before the virus slowly moves into rural areas, while others predict a near-simultaneous spread across America's urban and rural landscapes. Regardless of how a pandemic outbreak eventually emerges, and regardless of the success of various response strategies, the communications plan must account for all scenarios, as well as the extended duration of the pandemic.

A2. Pre-Position Communication Channels

The Study Group directionally recommends that government develop and pre-position, to the greatest extent possible, multi-lingual communications and messaging in all distribution channels, including radio, television, telephone, print, and online media. The Study Group believes that these multiple distribution channels, when working in concert and delivering a consistent message, will provide the greatest communications coverage possible to every target audience, including those with special needs (e.g., mobility impaired, deaf, blind, etc.).

A3. Public-Private Engagement

The Study Group was careful to acknowledge the work of the Federal, State, and local governments have completed to date with private-sector critical infrastructure owner-operators on preparedness. To build on these achievements, the Study Group recommends that the government continue

to engage the private sector to augment the distribution of communications to the critical workforce.

A4. Ongoing Refinement

Finally, the Study Group directionally recommends that the public- and private-sector Critical Infrastructure partners continue to refine their existing communications plans, processes, and success metrics through series of response exercises. If the Federal government adopts the prioritization elements of the framework outlined in this report, the Study Group directionally recommends that the Federal government, in consultation with the critical infrastructure owners and operators, develop a mechanism to further refine and clearly identify those priority workforce groups within and across the nation's 17 CI/KR sectors.

B. Directional Recommendations - Dissemination of Resources

Similar to the tremendous progress made planning, rehearsing, and enabling communications, there are parallel success stories in the area of resource distribution and allocation. For example, the Study Group commended HHS, and more specifically CDC, for its earlier work in the area of prioritizing the critical worker within the health and public health provider sub-sectors. These efforts should continue to garner the priority and attention that they have warranted to date. The following is a list of resource dissemination-related recommendations for consideration by the Secretaries and the President:

B1. Clearly-Defined Strategy

Continue developing a clearly defined vaccine and anti-viral medication distribution strategy. The Study Group strongly believes this work on pandemic prioritization should be considered as a starting, not an ending, point for further discussion and clarification about the Federal government's ultimate vaccine and anti-viral medication distribution strategy in general and specially for the CI/KR.

B2. Private-Sector Distribution

The Study Group directionally recommends that the Federal government consider alternative distribution strategies and guidance that would give critical infrastructure owners and operators a stronger voice in determining which employees receive higher prioritization for vaccines and anti-viral medications. Federal, State, and local government officials should build flexibility into their distribution and dispensing strategy and framework, a flexibility that would allow the private sector to receive, distribute, and, with appropriate medical support, dispense vaccine and anti-viral medications to their in-scope critical workforce.

The Study Group doubts that government resources, at all levels of government, will be capable of coordinating with the entire critical infrastructure workforce in a timely, efficient, and accurate manner.

CI/KR owner-operators have tremendous transparency into the physical location and disposition of this workforce at nearly all times and all levels, and most large businesses have internal occupational health and other medical resources to assist in the process. This type of access and situational awareness could prove valuable as a key component of a medical countermeasures distribution strategy.

Cognizant, that many State and local planners have tried unsuccessfully to engage private-sector businesses and that legal concerns often stymie such discussions, the Study Group directionally recommends that private-sector planners meet with State and local representatives to help implement Federal guidance.

B3.

Roles and Responsibilities

Results of this study suggest that the Federal government has more work to do in its ongoing efforts to more clearly define response and containment roles and responsibilities for all public and private-sector partners. The Study Group urges the Federal government to more clearly define response and containment roles and responsibilities.

Throughout this study, private-sector participants expressed a strong degree of confusion over the roles of the multiple Federal, State, and local officials both now and in the future. The Federal government should continue to work with its private-sector partners to educate them on the framework that will detail how, when, and in what capacity State, local, and private-sector response participants will engage the Federal government before, during, and after a pandemic. Similarly, the Study Group recommends that the Federal government continue to better define its expected response timelines and milestones.

B4.

Continuing Education

The Study Group directionally recommends all public and private-sector partners continue educating their relevant stakeholders on pandemic plans, processes, and priorities, and test them on their understanding by requesting that they participate in exercises and drills.

B5.

Monitoring Distribution Metrics

Engage appropriate resources to ensure adherence to the distribution strategy and the economical use of limited vaccine and anti-viral resources. Furthermore, it is important that the Federal government identify, collect, and report success metrics once the distribution framework is enacted, metrics can and should include field applications (*i.e.*, real-life experiences and planned exercises).

Question 6: Principles for Effective Implementation by DHS & HHS

The *National Strategy for Pandemic Influenza*, which the White House released November 1, 2005, addresses the complete range of events that “link a farmyard overseas to a living room in America.”¹² Within that document, the White House outlined the three pillars that would frame the Federal strategy. The three pillars of the nation’s pandemic *Strategy* are:

- **Preparedness and Communication** – Activities that should be undertaken before a pandemic to ensure preparedness, and the communication of roles and responsibilities to all levels of government, segments of society and individuals.
- **Surveillance and Detection** – Domestic and international systems that provide continuous “situational awareness” to ensure the earliest warning possible to protect the population.
- **Response and Containment** – Actions to limit the spread of the outbreak and to mitigate the health, social, and economic impacts of a pandemic.

In light of these pillars, the Study Group decided to respond to the sixth question by using the three pillars as framework for its response. The Study Group believes strongly that the response plan and prioritization criteria, once agreed upon, are fundamental to a successful response scenario.

C. Pillar #1: Preparedness and Communication

C1. Aligning Plans and Priorities

The Study Group directionally recommends that the public and private sectors align their communications, exercises, investments, and support activities with their plans and priorities during a pandemic event. This alignment will require substantial executive-level sponsorship, governance, and oversight to ensure permeation through all levels of government and industry. At the same time, this clear alignment of message and activity will eliminate ambiguity, reduce potential for error in response, and streamline response activities by focusing on what industry deems “critical.”

- Continue data gathering, analysis, reporting, and open review.
- More clearly define roles and responsibilities across all stakeholders in both public and private sectors.
- Continue to develop and refine preparedness and response plans using the Partnership for Critical Infrastructure Security (PCIS) and/or the Critical Infrastructure Partnership Advisory Council (CIPAC) as a vehicle(s) to reach each CI/KR and Sector Coordinating Council (SCC).

¹² *National Strategy for Pandemic Influenza*, <http://www.whitehouse.gov/homeland/pandemic-influenza.html>

- Continue to engage the private sector in public-sector planning and response exercises via PCIS and/or CIPAC as a vehicle to reach CI/KR sector and SCC, as well as State and local entities (*i.e.*, the National Governors Association).

D. Pillar #2: Surveillance and Detection

Among the Study Group’s most significant, if not intuitively obvious, findings are the remarkable surveillance and detection capabilities inherent in the nation’s critical infrastructure operating model. The Study Group feels strongly that there is the potential for the Federal government to incorporate this surveillance measurement into the National Response Framework. Furthermore, the Study Group feels that there are other capabilities inherent in the private sector that the Federal government is not currently engaging in this effort, but may do so if facts offer some potential in a pandemic preparedness and response scenario.

D1. Bolster Surveillance and Monitoring Efforts

The Study Group directionally recommends the Federal government leverage key private-sector elements in proactive surveillance and monitoring activities, including:

- Extend Federal public health surveillance operations to occupational health professionals. Nearly every CI/KR sector has these resources and the Study Group would argue that by extending its surveillance capabilities to occupational health professionals, the Federal government would significantly augment its traditional surveillance and detection infrastructures.
- Develop a formal framework designed to engage international components of U.S. corporations in global bio-data collection efforts. The Study Group proposes a more robust partnership would further enhance data collection, aggregation, and analysis capabilities offered through relationships directly with host nations or other organizations, including the WHO.
- Supplement existing surveillance technology investments, acquisition, monitoring, and response capabilities in order to increase threat visibility and geographic coverage.
- Engage data acquisition and management resources within the commercial workforce in surveillance, collection, and analysis. Currently, there are massive computing capabilities in the private sector that are not being used to focus on the pandemic threat. If utilized, these capabilities could potentially significantly reduce the processing time required to identify a vaccine or anti-viral, or perhaps rapidly speed the time to market for either of these solutions.

E. Pillar #3: Response and Containment

The final pillar addresses the nation’s response to a pandemic. Mitigating the effects of any pandemic clearly hinges upon being able to apply a clear strategy in a rapidly

developing situation, identifying who is responsible for what, and elucidating a treatment distribution plan. These two core items can only be facilitated if the Federal government pushes for ongoing response education and clearly defines which workforce groups fall in to the essential category.

E1. Clearly Defined Strategy

The Federal government must develop a clearly defined vaccine and anti-viral distribution strategy to ensure deployment as planned.

- The Study Group urges the Federal government, in coordination with other key public and private stakeholders, to consider alternative distribution methods that engage private sector in directly distributing antiviral medications and vaccines to in-scope critical workforce.

E2. Roles and Responsibilities

The Study Group directionally recommends that the Federal government works closely with its partners in the CI/KR community to more clearly define response and containment roles and responsibilities.

- Better define response timelines and milestones.

E3. Continuing Education

The Federal government must do a better job in educating all stakeholders on plans, processes, and priorities.

E4. Defining Workforce Groups

Using this report's findings as a baseline for future work, the Study Group directionally recommends that the Federal government work with PCIS and/or the CIPAC to develop an innovative and easy-to-use mechanism to identify the priority workforce groups clearly.

E5. Refining Distribution Strategy

The Federal government should engage appropriate resources to ensure adherence to distribution strategy and the economical use of limited vaccine and anti-viral resources.

- Identify, collect, and report success metrics.

NEXT STEPS AND FURTHER STUDY

Based on the findings and directional recommendations in this Study Group Report, the Group believes that there is a sharp disparity between the need to protect critical workforce populations and the strategies of current government plans. While current plans tend to place a priority on protecting the most at-risk populations, many plans overlook workers who are critical to maintaining the country's infrastructure and critical services. The Study Group believes strongly that HHS, DHS and other Federal agencies need to retool their plans; specifically the Study Group urges HHS and DHS to focus on:

- Protecting safety and security within communities;
- Maintaining economic viability at a local and national level; and
- Protecting public health and welfare.

Next Steps

The Study Group identified multiple next steps that it believes needs to be taken in order to further the work of this group.

The work of the Study Group also demonstrates that DHS and HHS need to work more collaboratively. Specifically, they should foster more frequent and more meaningful communication on planning priorities and move forward on those priorities concurrently. The coordination between these two agencies should include representative organizations at the State and local level to assure that direction and guidance from the Federal level is actionable and understood by those individuals who will be executing strategies during a pandemic or other emergency. Ideally, this work will bring in private-sector owner-operators prior to incidents to review plans and communicate regarding shifting and competing priorities. Without integration of more assertive cross-organization collaboration at all levels of government that includes an ongoing dialogue with the private sector, no amount of planning will translate to achieved actions during a pandemic response.

The Federal government should examine whether its current plans have functionality at all levels of government and the private sector. This is particularly true of current vaccine and antiviral distribution plans, which do not consider private-sector critical workforce populations. For example, Appendix D of the HHS Pandemic Influenza Plan, which prioritizes reducing morbidity and mortality ahead of economic impacts, does not really address critical workforce employees' as a priority population, with the exception of healthcare workers (mentioned earlier). Instead, it places employees of critical sectors in the next-to-last tier. Federal and State government representatives must also devise a communication plan to disseminate information on planning changes to the local level. This plan should also consider how information will be passed to the private sector. Moreover, it should describe how the local-level responders and owner-operators could provide feedback to planners in as efficient a manner as possible.

The Group feels that the Federal government should commission an additional study to research the degree to which contract workers or full-time equivalents (FTEs), as well as employees overseas, play a role in the maintenance of the nation's critical infrastructure, including the operation of critical government programs and organizations. Many critical private-sector entities rely heavily on contract labor to conduct vital business functions. Often, talents these contractors possess are not readily available within their client organizations. These vital contract specialists include maintenance specialists at nuclear power facilities, line workers for power and telephone companies, ATM money handlers, and support specialists for computer software and hardware.

The Study Group believes that it is imperative that investigations into innovative methods to respond to critical infrastructure impacts during a pandemic should continue. For instance, more government responsibility and support in financial matters during a pandemic may assist critical entities in maintaining operations.

Federal government organizations need to continue streamlining planning mandates and funding streams to limit duplicative work among State, local and private-sector interests. Often, these duplicative efforts slow planning and, worse, slow response in times of crisis. Simplicity in planning and funding will provide a higher level of readiness and a more efficient response before, during, and after a pandemic outbreak strikes.

The complexity of interdependencies among CI/KR sectors cannot be understated. Furthermore, as business operations change and criticalities evolve, interdependencies shift in importance. The Study Group believes that these interdependencies must be mapped clearly so sectors are better able to protect their critical assets in the wake of a severe pandemic influenza and better prepared to defend themselves against potential cascading failures across sectors.

Finally, the government and private sector must continue to take steps to build and maintain public-private partnerships. These partnerships will be critical during both planning for and responding to a pandemic event. Sharing of information and communication of needs and potentially valuable assets will make preparedness efforts more thorough and effective. Similarly, these existing relationships will pay dividends during a response. Established lines of communications with previously identified partners will be the backbone of a streamlined response.

At the national level, organizations can continue to foster these relationships through the Critical Infrastructure Partnership Advisory Council (CIPAC), Partnership for Critical Infrastructure Security (PCIS), the Homeland Security Information Network (HSIN), the Overseas Security Advisory Council (OSAC), and other established nexus points. These partnerships also need to be established and maintained at the local level through face-to-face interaction and established collaboration systems that may be in place through state or local emergency management agencies (or homeland security offices).

Suggestions for Further Study

The Study Group also identified further areas of study it believes would provide added value to the work it was able to achieve on the issue of pandemic prioritization. While not formal recommendations, these suggestions are logical follow-on actions for the Federal government to enact based on the above and ensuing recommendations.

- The Study Group believes strongly that the Federal government should develop an appropriate forum to identify, quantify, and qualify potential prioritization and distribution methods and channels. This forum may fall under the purview of the Vaccine Prioritization Interagency Group. The Study Group understands that this group is scheduled to meet with representatives of the private sector, but the Study Group members feel strongly that this group, or another group, must have full participation from the private sector. Private-sector CI/KR representation must have a voice at the table alongside representatives from all relevant Federal departments and agencies.
- The Study Group has noted that its NIAC prioritization study and recommendations focus differs from existing Federal and State plans, including the findings of two Federal advisory committees, the Advisory Committee on Immunization Practices (ACIP) and the National Vaccine Advisory Committee (NVAC). Both the ACIP and NVAC provided recommendations to HHS on the use of vaccines and antiviral drugs during a pandemic influenza¹³. Unlike previous efforts, this study focused on the following four principles:
 - Maintaining national and homeland security;
 - Ensuring economic survival;
 - Maintaining public health and welfare; and
 - Identifying and addressing critical interdependencies and single points of failure.

The Study Group urges the Federal government to take the lead in resolving the differences in the findings and recommendations that resulted from the priority recommendations outlined in this report vis-à-vis other Federal and State prioritization methods and criteria.

- As public and private partners continue their ongoing dialogue regarding prioritization of vaccine and antiviral medications, one issue that the Study

¹³ HHS Pandemic Influenza Plan, Appendix D: NVAC/ACIP Recommendations for Prioritization of Pandemic Influenza Vaccine and NVAC Recommendations on Pandemic Antiviral Drug Use:
<http://www.hhs.gov/pandemicflu/plan/appendixd.html>.

Group feels demands further, more intensive study is the operational method of distribution for those medications. After all parties formalize the prioritization tiers and strategies to be used, it will still be necessary to determine exactly which critical workforce members will receive the allotted quantities for a particular sector and how the allotted vaccine will be distributed.

The Study Group believes it is important to study further whether manufacturers should deliver the ultimate allotments to Federal and/or State government public health officials or whether they should distribute the shipments directly to the private sector, allowing the owner-operators and managers to determine exactly which employees receive the vaccine and/or antiviral medication. The Study Group did not reach consensus on this issue. Many voiced the opinion that it would be best for the medications to go directly to the critical infrastructure companies because the managers on the ground would have the best feel for which of their employees should receive the vaccine and/or anti-viral medication. On the other hand, some in the Study Group expressed skepticism about this option, noting that it would put managers in an untenable position of deciding who would, and would not, be the recipient of a vaccine and/or antiviral dose.

This discussion also begs the question of who will be putting the actual shots in the arms of those employees. For large businesses with onsite medical personnel, this may not be a difficult question, but for smaller companies, there will need to be some arrangement made with outside medical providers to receive and administer the drugs.

- Finally, despite the best efforts of the Study Group, members acknowledge that there is a tremendous amount of work yet that all parties need to accomplish. The Study Group urges the Federal government to continue working with the private sector to refine further the critical worker definitions, priorities, and numbers that are contained in this report. Given the time constraints and uneven response to the survey and study by sectors, the Study Group believes this report represents a tremendous first step toward securing a realistic actionable and workable prioritization framework and strategy for workers in the nation's critical infrastructure sectors. In an effort to continue refining the critical workforce numbers and to build upon the achievements of this study, the Study Group suggests DHS continues to work with the Partnership for Critical Infrastructure Security (PCIS) as a vehicle to reach back into each CI/KR sector and SCC over the course of the next 12 months.

APPENDIX C: RADIOLOGICAL EVENTS

EXECUTIVE SUMMARY

BACKGROUND AND METHODOLOGY

Radiological events present a complex challenge to those who assess risk, are responsible for planning and preparedness, and for responders. Many experts suggest the preponderance of data points suggest that intentional radiological events are less likely to occur, and if they do, may cause considerably less damage than comparable biological or chemical events. However, many experts also suggest that there are risks inherent in radiological events that extend well beyond the immediate impact of the episode. Lessons learned from radiological events in both Brazil and the former Soviet Union identified tremendous negative psychological or psychosomatic outcomes from radiological events that had no clinical causal basis.

To study this problem, the NIAC established a radiological event Working Group as part of the broader chemical, biological, and radiological events study. The Working Group identified, recruited, and engaged representatives from nearly all of the critical infrastructure sectors, public service, including Federal, state, and local representation, and members of academia to serve on a radiological events Study Group.

Similar to scope management conducted by other Study Groups, the radiological team dedicated time and energy to address the appropriate question for a group of its composition. The Study Group focused largely on low-yield, dispersal devices, commonly known as “dirty bombs.” The Study Group focused on the low-yield scenario for a number of reasons, including:

- Nation-state nuclear weapons attacks are statistically less likely than the low-yield scenario;
- The impact of low-yield radiological events is one capable of being contemplated by the NIAC. Efforts to assess higher order scenarios and their impact are being conducted by DHS, who is better positioned with better data and facts to assess the probability and impact of such an event;
- Much of the data needed to assess more complex, higher order, or state-sponsored nuclear attacks is classified and not accessible by most Study Group members.

The Study Group benefited from access to multiple experts, research studies, and official program materials produced by the National Council on Radiation Protection and Measures (NCRP), the National Defense University, Department of Homeland Security and the National Response Framework, 9/11 Commission, and the Top-Off exercises.

FINDINGS

Key findings from the Study Groups efforts included those that addressed planning and preparedness, response, counter-measure, communications, and psychological components of radiological events. In summary, the Study Group found:

- **Time is of the essence**
 - Time sensitivity of information suggests timely, accurate information is critical to save lives and manage fear
- **Responders will look to the Federal government for information and direction**
 - The Federal government possesses deeper and broader expertise on radiological events than nearly all potential responders combined
 - First responders want and need radiological response information in usable format well in advance of an event
- **Identify the experts and enable communications between responders and experts**
 - Many responders do not know which agency was the principal repository of nuclear effects expertise
 - Many responders do not know which Federal agencies are in charge of coordinating a response to a radiological event.
- **Public-private sector coordination and collaboration is critical**
 - Government participant in radiological exercises stressed the importance of public-private sector coordination, especially inter-dependent sectors (e.g. electric utilities, water, etc.)
- **Psychological effects of a radiological event will rival or surpass physical effects**
 - Radiation effects are unknown or misunderstood by those impacted. They possess tremendous potential psychological impact.
 - Fear will impose heavy burdens, especially on the worried well residents of non-impacted cities or markets.
 - Psychological impact of radiation will create other down-stream negative effects, including radiation-centric treatment of victims with trauma

RECOMMENDATIONS

Following the findings identified above, the NIAC assembled the following recommendations to better prepare for, or respond to, a radiological event.

- **Develop and deploy training materials for all first responders.**
 - Content is readily available and deployable; awareness and distribution could be enabled through directed marketing and communications, inclusion structured exercises, or other mechanisms already in place.

- **Clearly establish, communicate, and reinforce a radiological event focal point, lead agency, chain of command, and protocol for response coordination and communication.**
 - Define roles and responsibilities for lead and supporting Federal agencies.
- **Leverage industry knowledge, tools, or experience in radiological event planning, preparedness, and response efforts.**
 - Establish, in advance, mechanisms to leverage industry resources in radiological events.
 - Employ tools and technologies in place today to advance capabilities.
- **Continue to make progress on plans and response programs that assess and prioritize radiological threats and vulnerabilities within the context of other events (e.g. chemical and biological).**
 - Improve knowledge around specific scenarios, impact, and likelihood of events.
 - Assess usability and availability of data; make necessary information available to first responders who will benefit from additional intelligence.
 - Continue to deploy tools to support planning and response scenarios.
- **Maximize opportunities to advance technologies that will improve response capabilities.**
 - Continue to fund collaborative, public-private efforts to develop more advanced detection solutions.
 - Establish or align S&T roadmap with radiological event collection, analysis and reporting tools and technologies to improve event detection.
 - Accelerate promising detection or response technologies currently under development; identify and seize commercialization opportunities for same.

DETAILS

KEY RESEARCH AND FINDINGS

Documentation and Exercises

The Study Group extensively used material developed by subject matter experts, including those from government, industry, and academia to establish a baseline understanding of radiological threats and vulnerabilities, potential impacts, response plans and programs, and the supporting tools, technologies, and solutions in place to help facilitate all of these processes. This research included material from the National Council on Radiation Protection and Measures, the National Defense University, the Department of Homeland Security and the National Response Framework, 9/11 Commission, and the Top-Off exercises.

NCRP Commentary Number 19, “Key Elements of Preparing Emergency Responders for Nuclear and Radiological Terrorism” published in April 2006 addressed many of the

tactical logistical elements surrounding first response scenarios. NCRP no. 19 established equipment requirements for first responders, addressed perimeter establishment and management, needed decontamination and medical equipment, on-scene event management, and training content recommendations for those supporting radiological first response efforts. It is considered one of the most comprehensive works published on radiological event response and first responder coordination.

The Department of Homeland Security published the **National Response Framework** for comment in September 2007. The NRF included all-hazards event planning and response content, including radiological event response. With a focus on short-term event response, the NRF outlines operating structures and tools, included a radiological event-specific annex, and included a wide range of radiological events (i.e. radiological dispersal devices, improvised nuclear devices, nuclear facility accidents, lost radioactive material, and transportation accidents). It further provides planning guidance, specifies Federal roles and responsibilities, communication and resource coordination protocols.

The **9/11 Commission Act of 2007** contained a substantial amount of radiological guidance and recommendations that established improved controls over radiological matter inside or traversing U.S. borders. Title V, Section 501 defined container restrictions and requirements for radiological scanning, in addition to methods to minimize or monitor potential container breaches. The Act further recommended the Secretary of Homeland Security promote international standards for container security with foreign governments and other international standards organizations.

DHS facilitated the conduct of **Top-Off-4** in October 2007. The exercise included more than 15,000 participants in multiple locations, both domestic and foreign. The exercise objectives included testing the flow of operational and time-critical intelligence data between agencies to prevent an attack, testing the flow of data between agencies in response to an incident, and testing the full range of procedures for domestic WMD incident management. Top-Off-4 further sought to test officials' capabilities to respond to an incident consistent with the National Response Plan and the National Incident Management System. Public information communication, coordination, and dissemination, deemed critical to a successful radiological event response, played a central role in the exercise.

The **National Defense University** produced a study on radiological events that included the following findings:

- Knowing who is in charge of an event response, especially the lead Federal agency and the chain of command is critical.
- Responders must receive timely and accurate information on how to respond (e.g. shelter-in-place, triage, movement from hot to clean zones, etc.).
- Most data available to responders today is post-World War II data that is neither contemporary or usable by first responders.
- Psychological effects of a radiological event will surpass physical events
 - Goainia, Brazil radiological event, 1987.

- Exposed 100 grams of abandoned radiotherapy waste.
- Resulted in 4 deaths; 260 showed signs of exposure; 49 required medical attention.
- Caused 112,000+ people to seek medical attention; stress-induced symptoms manifested themselves mimicking radiation poisoning, including blisters, burns, vomiting, reddened skin, etc.
- Residents faced nation-wide discrimination, including inability to travel, secure hotel rooms, establish credit, etc.

Surveillance and Response Capabilities

The Study Group identified a litany of tools and technologies supporting the radiological surveillance and response mission. These included capabilities in production for decades, in the case of legacy military systems, to leading edge solutions still working through development or proof of concept life-cycles.

Overall, the preponderance of technologies supporting radiological surveillance and detection fall into one of two categories: legacy military capabilities that have taken on a broader civil-military mission, and those solutions that have a high degree of portability across radiological, biological, or chemical all-hazards scenarios. Although the Study Group identified solutions that were neither military nor all-hazards capable, these were the minority of technologies assessed. This finding was neither surprising, nor considered a negative, but a recognition that there continues to be a need to balance all capabilities across a broad spectrum of potential threats, and legacy distinctions between military and civilian threats and vulnerabilities are becoming increasingly blurred in the post-Cold War era.

Examples of key all-hazards systems, many of which are discussed in detail in previous sections of this document, include:

- **Toxic Exposure Surveillance System (TESS)** – The CDC and the American Association of Poison Control Centers use the TESS to improve public health surveillance of health hazards associated with radiological exposures. TESS is a national real-time surveillance database that records all human exposures to potentially toxic substances reported to U.S. poison control centers. TESS is used to facilitate early detection of illness associated with a radiological release, by monitoring daily clinical effects reported to the database, TESS provides a real-time national surveillance and exposure database.
- **The Hazardous Substance Emergency Events Surveillance (HSEES) program**, operated by the Agency for Toxic Substances and Disease Registry, collects and analyzes information about acute releases of hazardous substances that require cleanup or neutralization, as well as threatened releases that may require evacuation. The goal of the HSEES is to reduce injury and death that result from hazardous substance events experienced by first responders, employees, and the public.

- **Electronic sensor capabilities** – (public) spectroscopic sensors, airborne spectral photometric collection technology, capillary electrophoreses: (private) electronic gas chromatography.
- **Community Hazards Emergency Response Capability Assurance Process (CHER-CAP)** - Readiness, planning, preparedness and response coordination is offered by regional FEMA offices to assist local communities and tribal governments in obtaining a greater understanding of community hazards risks, identifying planning deficiencies, updating plans, training first responders, and stimulating and testing the system for strengths and needed improvements. FEMA offered CHER-CAP as an additional tool for state and local governments to use as they develop and enhance preparedness and response capabilities that will address any hazards that communities may face.
 - As a voluntary program, CHER-CAP uses the skills and resources of Federal, state, tribal and local governments and industry partners. It is particularly helpful in enhancing a community's ability to operate within the National Response Framework.
- **Fusion Centers** - State and local authorities, in partnership with DHS, have created multiple Fusion Centers in major urban areas across the country. This network is expanding and current capabilities continue to be enhanced.
 - The term “fusion” refers to the overarching process of managing the flow of information and intelligence across all levels and sectors of government and private industry. The fusion process supports the implementation of risk-based, information-driven prevention, response and consequence management programs. At the same time, it supports efforts to address immediate or emerging threat-related circumstances and events.
 - Fusion Centers provide critical sources of unique law enforcement and threat information; facilitate sharing of information across jurisdictions and functions; and provide a conduit between people on the ground and state and Federal agencies. Analysts from the DHS Office of Intelligence and Analysis work side-by-side with state and local authorities.
- **National Incident Management System (NIMS)** - While most emergency situations are handled locally, response to a major incident may require help from other jurisdictions, the state and the Federal government. DHS developed NIMS to enable responders from different jurisdictions and disciplines to work together more effectively to better respond to natural disasters and emergencies, including acts of terrorism. NIMS benefits include a unified approach to incident management; standard command and management structures; and emphasis on preparedness, mutual aid, and resource management

Government, industry and academia funded advanced detection solutions at facilities such as the Lawrence Livermore, Argonne, Brookhaven and Los Alamos National Labs. Discussions initiated to develop surveillance capabilities in cell phones or other personal devices. In November 2007, months after the Department of Homeland Security began talking about its idea of putting biological, chemical and radiation sensors in commercial cell phones, the department put out its first official solicitation for the program. DHS' Science and Technology Directorate indicated the central benefit to the initiative is that it could create a huge sensor network — essentially, everyone with a properly equipped mobile communications device would be part of it. In theory, when the phones, personal digital assistants and other devices detect hazardous or explosive material, they would relay that information, along with the time and their location, to a central monitoring system. Calling the program "Cell-All Ubiquitous Biological and Chemical Sensing," S&T released a Broad Agency Announcement, calling for companies that can put together a proof-of-concept within three years. The DHS document indicated submissions should have chemical and biological sensing capability at first, and the ability to add radiation sensing later.

Communications

Similar to the findings identified in the chemical and biological studies, the Study Group identified multiple positive examples of initiatives designed to improve radiological event risk assessment, planning, preparedness, and response capabilities. Included in these examples are the following:

- In December 2006 DHS released its report on incident response communications and interoperability amongst first responders. It included data and feedback from 22,400 police, fire, and EMS agencies. The report concluded that interoperability amongst contiguous, cross-jurisdiction first responders outpaced Federal to state or state to local interoperability progress.
- **WARN (Warning Alert and Response Network) Act** – enables an effective, reliable, integrated, flexible and comprehensive system to alert and warn the American people in situations of war, terrorist attack, natural disaster or other hazards to public safety and well-being.
- **SAFECOM** – a DHS communications program that provides research, development, testing and evaluation, guidance tools and templates on interoperable communications-related issues to emergency response agencies. SAFECOM works with existing Federal communications initiatives and key emergency response stakeholders to address the need to develop better technologies and processes for the multi-jurisdictional and cross-disciplinary coordination of existing systems and future networks.
- **Office of Emergency Communications (OEC)**– Congress established the Office of Emergency Communications at DHS. The OEC supports and promotes the ability of emergency responders and government officials to continue to communicate in the event of natural disasters, acts of terrorism, or other man-made disasters, and works to ensure, accelerate,

and attain interoperable and operable emergency communications nationwide.

- New Title XVIII of the 2002 Homeland Security Act directs that OEC develop a “baseline assessment” of Federal, State, local, and tribal governments that—
 - Defines the range of capabilities needed by emergency response providers and relevant government officials to continue to communicate in the event of natural disasters, acts of terrorism, and other man-made disasters
 - Defines the range of interoperable emergency communications capabilities needed for specific events
 - Assesses the current available capabilities to meet such communications needs
 - Identifies the gap between such current capabilities and defined requirements
 - Provides a national interoperable emergency communications inventory that—
 - Identifies channels, frequencies, nomenclature, and the types of communications systems and equipment used by each Federal department and agency
 - Identifies the interoperable emergency communications systems in use by public safety agencies
- The OEC Baseline results and findings will provide valuable input into the development of the National Emergency Communications Plan (NECP), which will provide recommendations to—
 - Support and promote the ability of emergency response providers and relevant government officials to continue to communicate in the event of natural disasters, acts of terrorism, and other man made disasters; and
 - Ensure, accelerate, and attain interoperable communications nationwide
 - Title XVIII specifies that in developing the NECP, the OEC shall cooperate with the National Communications System (NCS) (as appropriate) and with—
 - State, local, and tribal governments
 - Federal departments and agencies
 - Emergency response providers, and
 - The Private sector

Nuclear Sector Preparedness

The Nuclear Sector possesses a robust and active coordinating council (NSCC) that serves as the overarching private security entity for all phases of the nuclear cycle and radioactive materials. Enabled by HSPD-7, the NSCC coordinates with a counterpart government council. Jointly, these organizations address reactor operations, medial and

industrial isotopes, research and test reactors, spent fuel storage sites, and the transportation and security of nuclear or radioactive material.

Compared to other sectors, the Nuclear Sector is well positioned to respond to or support response to a radiological dispersal device scenario. The sector possesses deep domain expertise, experience working with and handling radiological material, the necessary tools, technologies, and equipment, and a mature industry well grounded in radiological incident detection, reaction, containment, and clean up. In addition, the private elements of the Nuclear Sector posses a practical network of scalable capabilities through relationships with the Health Physics Society, American Nuclear Society, National Council on Radiation Protection, Nuclear Energy Institute, Department of Energy, and the Nuclear Regulatory Commission.

The Nuclear Sector offers additional potential benefits within an all hazards response scenario, including deployable, trained, and well organized emergency response teams, an all hazards approach to problem solving and the attendant training to execute multiple missions, and frequent participation in joint exercises with both public and private entities to further refine response capabilities.

RECOMMENDATIONS

Nuclear Sector Collaboration

The Nuclear Sector, in particular the private elements of the Nuclear Sector, possess a wealth of resources that could be brought to bear to respond to a nuclear incident. At a minimum, consider adopting the existing, tested, and well-documented training material in existence today. Second, consider establishing memorandums of understanding that would enable the public sector to engage private sector resources when needed. Finally, the Nuclear Sector possesses a robust communications capability, to include pre-defined content that is deployable through existing channels in a crisis. The use of the content, technologies, and communication channels could prove invaluable to reduce communication timelines, improve penetration of key messages to impacted persons, and enhance the quality and accuracy of much needed messaging.

Planning, Preparedness, and Response

Continued work on comprehensive, national risk assessments is a valuable endeavor that will appropriately prioritize radiological events within the context of other threats and vulnerabilities. In addition, a key message across chemical, biological, and radiological events continues to be the clarification of specific roles and responsibilities in CBR events. Clarifying roles for agencies that support prevention and detection (e.g. Customs and Border Enforcement, Transportation Security Administration, Department of Transportation, US Coast Guard, Nuclear Regulatory Commission, etc.) is critical. Establishing clear lines of responsibility and communications will measurably improve response capabilities and reduce the signal-to-noise ratio that plagued a number of contemporary event response efforts.

Make efforts to improve knowledge around specific event scenarios, their likelihood of occurrence, and their potential impact. Assess the availability and usability of this data through the lens of those who need it most – the first responder. If critical information is not made available to those responsible for event planning, response, and management, then it is effectively useless. Minimize barriers to information to improve the flow of information amongst those engaged in radiological events.

Tools and technologies that support training, risk assessment, and planning continue to be developed and deployed. This trend is commendable and should continue. There are capabilities, specifically technological, that could improve distribution, access, and penetration of training materials. Consideration should be given to the further adoption of online or web-based training systems that provide greater reach to communities not likely to be a priority focus.

A continued challenge experienced by first responders is the need to expand capabilities to support chemical, biological, and radiological events, but do so within exceptionally fiscally constrained environments. Consideration should be given to find ways to propagate the necessary tools and training to fire, EMS, and police forces at the state and local level that would benefit most from these added capabilities. In addition, law enforcement engagement in the existing fusion centers would help extend the footprint of potential response assets deployable during a radiological event.

APPENDIX D: SUMMARY OF SIGNIFICANT SOURCES OF INFORMATION

The following Appendix is included for informational purposes and includes an overview of the primary and secondary sources used during the study. It is not an exhaustive bibliography of resources available on chemical, biological, or radiological events.

Federal Resources

- The official Federal pandemic preparedness Website is www.pandemicflu.gov.
- The National Strategy for Pandemic Influenza, which outlines responsibilities that Federal, State, and local governments, as well as individuals and industry have for preparing for and responding to a pandemic, is available at www.whitehouse.gov/homeland/pandemic-influenza.html.
- The HHS Pandemic Influenza plan can be found at www.hhs.gov/pandemicflu/plan/.
- To reach the 24/7 CDC Hotline, call 800-CDC-INFO or email cdcinfo@cdc.gov.
- HHS Pandemic Influenza Specific Business Continuity Checklists are available at www.pandemicflu.gov/plan/tab4.html.
- HHS Pandemic Influenza Tabletop Exercise Materials are available at www.hhs.gov/nvpo/pandemics/tabletopex.html.
- For a detailed list of what HHS will recommend and do when WHO declares a new phase in the pandemic, visit www.hhs.gov/pandemicflu/plan/part1.html#5.
- The U.S. State Department has information on Avian Influenza at www.state.gov/g/oes/avianflu/. To read how the State Department is working with other countries to combat Avian Flu, visit www.state.gov/r/pa/scp/2005/55972.htm.
- The U.S. Agency for International Development provides information on its work in affected countries at www.usaid.gov/our_work/global_health/home/News/news_items/avian_influenza.html.
- For information on the U.S. Department of Agriculture's efforts to protect the United States against Avian influenza, visit www.usda.gov/wps/portal/usdahome?navtype=SU&navid=AVIAN_INFLUENZA.
- The U.S.G.S. National Wildlife Health Center provides information on avian influenza in migratory birds and the Department of the Interior will protect the health of employees and the 450 million people who visit Department-

managed lands each year. For more information, visit: www.nwhc.usgs.gov/research/avian_influenza/avian_influenza.html.

- DHS' National Response Framework contains a comprehensive all-hazards approach to enhance the ability of the United States to manage domestic incidents and is available at www.dhs.gov/dhspublic/interapp/editorial/editorial_0566.xml.
- The National Incident Management Systems (NIMS) Training Website is available at <http://training.fema.gov/EMIWeb/IS/is700.asp>
- A FEMA site for providing disaster assistance materials on all types of natural disasters is available at www.disasterhelp.gov/portal/jhtml/index.jhtml.
- Congress chartered the National Council on Radiological and Protective Measures (NCRP) in 1964 to "to formulate and widely disseminate information, guidance and recommendations on radiation protection and measurements which represent the consensus of leading scientific thinking." Relevant NCRP publications are available at <http://www.ncrponline.org/>
- NCRP Publications #65 "Management of Persons Accidentally Contaminated with Radionuclides" and #138 "Management of Terrorist Events Involving Radioactive Material" are the two most substantive references used in this study. Both are available at the NCRP website.

International Resources

- For more information and additional online resources about global surveillance and monitoring of the pandemic flu virus, visit <http://pandemicflu.gov/global/>.
- The pandemic preparedness Website for the World Health Organization (WHO) is available at www.who.int/csr/disease/influenza/pandemic/en/.
- The WHO checklist for pandemic influenza preparedness planning is available online at: www.who.int/csr/resources/publications/influenza/FluCheck6web.pdf
- To learn more about the WHO's November 2005 meeting concerning avian and human pandemic flu, visit www.who.int/mediacentre/events/2005/meeting_avian_influenza/en/index.html.
- For the most up-to-the-minute numbers on the pandemic influenza virus, visit www.who.int/csr/disease/avian_influenza/en/index.html.
- To reach the WHO Headquarters in Geneva, Switzerland, call 4122-791-2684 or 4122-791-3982. To contact the WHO Regional Office for the Americas in Washington, D.C., call 202-974-3458.
- The United Nations Food and Agriculture Organization has more information on pandemic preparedness available at www.fao.org/ag/againfo/subjects/en/health/diseases-cards/geneva-docs.html.
- To see more information on the United Nations Foundation on Pandemic Influenza, visit: www.unfoundation.org/features/avian_influenza.asp

- For a more comprehensive list of national pandemic plans from around the world, visit: www.who.int/csr/disease/influenza/nationalpandemic/en/index.html
- The Australian Pandemic Website is online at www.pandemic.net.au/newsletters/05Dec20.html.
- For more information related to pandemic preparedness for in Hong Kong, visit: www.info.gov.hk/info/flu/eng/files/checklist-e_flu_eng_20051105.pdf
- The European Union's Public Health and Influenza Website is available by visiting: http://europa.eu.int/comm/health/ph_threats/com/Influenza/influenza_en.htm
- For information about the World Bank's plan and investment in pandemic influenza, visit <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/0,,contentMDK:20711283~menuPK:208943~pagePK:146736~piPK:146830~theSitePK:226301,00.html>
- Pandemic Influenza Preparedness Plans for Pacific Island Countries are available at www.spc.int/phs/pphsn/Outbreak/Influenza/Pand-Preparedness-plans-Pacific-countries.htm.
- The Canadian Pandemic Plan can be found at www.phac-aspc.gc.ca/cpip-pclcp/index.html.
- Transcripts from sessions of the Council on Foreign Relations November 2005 Conference on the Global Threat of Pandemic Influenza are available at www.cfr.org/publication/9282/council_on_foreign_relations_conference_on_the_global_threat_of_pandemic_influenza_session_4.html?breadcrumb=b=default.
- In October 2006, HHS published its “Interim Guidance on Planning for the Use of Surgical Masks and Respirators in Health Care Settings during an Influenza Pandemic,” which can be found at <http://www.pandemicflu.gov/plan/maskguidancehc.html>.
- The Congressional Budget Office (CBO) released the A Potential Influenza Pandemic: An Update on Possible Macroeconomic Effects and Policy Issues in May 2006. It is available at <http://www.cbo.gov/ftpdocs/72xx/doc7214/05-22-Avian%20Flu.pdf>.
- CDC posts its document entitled The Economic Impact of Pandemic Influenza in the United States: Priorities for Intervention at <http://www.cdc.gov/ncidod/EID/vol5no5/meltzer.htm>.
- HHS included the NVAC/ACIP Recommendations for Prioritization of Pandemic Influenza Vaccine and NVAC Recommendations on Pandemic Antiviral Drug Use in Appendix D of its Pandemic Flu Plan. It can be found at <http://www.hhs.gov/pandemicflu/plan/appendixd.html>

State and Local Resources

- For links to state pandemic plans, visit www.pandemicflu.gov/plan/stateplans.html.
- For a complete list of state homeland security advisors, visit: www.dhs.gov/dhspublic/interapp/editorial/editorial_0291.xml
- For a comprehensive link to all State Emergency Management Agencies, visit: www.fema.gov/fema/statedr.shtml
- For a database of state health officials and agencies and public hotlines, as well as a search engine for public health sites, visit www.statepublichealth.org/index.php.
- For a comprehensive list of State and territorial public health officials, visit:
www.astho.org/index.php?template=regional_links.php&PHPSESSID=58b56231688358e09f989713c70ede0a.
- For a list of State health departments, visit www.phppo.cdc.gov/phtn/sites.asp#state.
- The National Association of Counties has information on pandemic influenza available at www.naco.org/Template.cfm?Section=Publications&template=/ContentManagement/ContentDisplay.cfm&ContentID=18621.
- For a list of United States Fire Administration State Points of Contact, visit: www.usfa.fema.gov/pocs/
- FEMA has 10 regional offices, and two area offices. For a contact list of all FEMA offices, see: www.fema.gov/regions/
- For more information on HHS offices and services available in each region, and how to contact HHS regional offices, please visit: www.hhs.gov/about/regions/.
- The National Governors Association (NGA) released its *Preparing for a Pandemic Influenza: a Primer for Governors and Senior State Officials* in 2006. It is available at www.nga.org/Files/pdf/0607PANDEMICPRIMER.PDF.

Private-Sector Resources

- For an overview of the roles and responsibilities for all public and private-sector partners, visit www.whitehouse.gov/homeland/pandemic-influenza.html#section9 and www.hhs.gov/pandemicflu/plan/part2.html#overview.
- The Financial Services Roundtable released its *Preparing for Pandemic Flu: A Call To Action* in November 2006 and it can be found at <http://www.fsround.org/publications/pdfs/PANDEMICFinal.pdf>
- For DHS basic preparedness information for businesses and individuals, visit www.ready.gov/.
- For information on pandemic preparedness from the U.S. Chamber of Commerce, visit: www.uschamber.com/issues/index/defense/pandemic_influenza.htm

- For a Congressional Budget Office report on the possible macroeconomic effects of a pandemic, visit www.cbo.gov/ftpdocs/69xx/doc6946/12-08-BirdFlu.pdf.
- “Avian Flu: Preparing for a Pandemic,” a report for employees and clients of Marsh on risk related topics is available at www.marsh-asia.com/birca/white_paper.pdf.
- Read an example of a Pandemic Influenza Workplace Plan, based on Shell Oil’s plans for operations in Oceana, at www.med.govt.nz/irdev/econ_dev/pandemic-planning/infrastructure/example/example.pdf.
- Pandemic Flu Planning Guide for Infrastructure Providers in New Zealand is available at <http://healthcareproviders.org.nz/publication/documents/v9PandemicPlanningGuide.doc>
- Download a copy of “Are You Ready? A Guide to Citizen Preparedness” at www.fema.gov/areyouready/.
- The National Fire Protection Association’s Guide to Business Continuity Planning for Disaster Scenarios is available for purchase at www.nfpa.org/catalog/product.asp?pid=160004&src=nfpa&order_src=A292.
- FEMA’s Emergency Management Guide for Business and Industry, available at www.fema.gov/library/bizindex.shtm, offers a step-by-step approach to emergency planning, response and recovery for companies of all sizes. FEMA’s Website is also an excellent resource for family disaster preparedness guides.
- The National Organization for Disability on Emergency Preparedness Website is available at www.nod.org/emergency/index.cfm and contains information on the needs of the disabled during an emergency. Visit www.nod.org/content.cfm?id=1380d for more on disability emergency preparedness, and www.nod.org/pdffiles/epi2002.pdf to view the "Guide on the Special Needs of People with Disabilities for Emergency Managers, Planners & Responders."
- The Institute of Medicine pandemic reports are available at www.iom.edu/?id=3783&redirect=0.
- The Occupational Health Disaster Emergency Network’s Website provides Pandemic-specific planning and preparedness tips for private industry. Visit <http://ohden.sph.unc.edu:9002/pandemic> for more information.
- Video and transcripts of the September 2005 conference in New York, “Bulls, Bears, and Birds: Preparing the Private Industry for Pandemic Influenza,” are available at www.upmc-biosecurity.org/pages/events/birds/index.html.
- Mercer Human Resource Consulting also released a document entitled *Preparing for a pandemic: Easing the Avian flu’s impact on employee welfare and productivity*. It can be found at <http://www.mercerhr.com/avianflu>.
- Booz Allen Hamilton published a document titled *Influenza Pandemic Simulation: Implications for the Public and Private Sectors*. This is located at www.boozallen.com/media/file/Influenza_Pandemic_Simulation.pdf.

- Barry, John M. (2004). The Great Influenza: The Epic Story of the Deadliest Plague in History. New York: Penguin Books, Ltd.
- Kao, Amy and Vidal, David J. (2006, July). The Conference Board Executive Action Series. The Corporate Response to the Avian Flu Crisis: Are Businesses Doing Enough To Prepare for a Pandemic? 204.
- Pandemic Preparedness: Frequently Asked Questions. The Conference Board Executive Action Series. (2006, September) 210.
- 10 Point Framework for Pandemic Influenza Business Contingency Planning. (2006, September). University of Minnesota, Center for Infectious Disease Research and Policy (CIDRAP).

Appendix E: NIAC History

PURPOSE

The National Infrastructure Advisory Council (NIAC) provides the President, through the Secretary of the Department of Homeland Security (DHS), with critical infrastructure security advice to support the economy. The Council's charter allows it to directly advise other agency heads who share responsibility for critical infrastructure protection. These agencies include Health and Human Services, Transportation and Energy. The President tasked the NIAC with improving the cooperation and partnership between the public and private sectors in securing critical infrastructure and advising on policies and strategies ranging from risk assessment and management to information sharing to protective strategies and clarification on roles and responsibilities between public and private sectors.

BACKGROUND

Executive Order 13231 (October 16, 2001) as amended by Executive Order 13286 (February 28, 2003) and Executive Order 13385 (September 29, 2005) created the NIAC. The Council is composed of not more than 30 members, appointed by the President and selected from the private sector, academia, and State and local government, representing senior executive leadership expertise from the critical infrastructure and key resource areas as delineated in Homeland Security Presidential Directive-7 (HSPD-7).

LEADERSHIP

The positions of NIAC Chair and Vice Chairs are named by the President. Currently, the NIAC Chair position is held by Mr. Erle A. Nye, Chairman Emeritus, TXU Corp.

NIAC SECRETARIAT

The National Protection and Programs Directorate (NPPD) within the Department of Homeland Security shall be responsible for providing financial and administrative support to the NIAC. Within NPPD, the Partnership and Outreach Division (POD) will provide this support.

NIAC OPERATIONS

The NIAC meets publicly four times each year, twice by teleconference and twice in-person. These meetings, whether in person or by teleconference, take place in Washington, D.C. in a venue open to the public, usually the National Press Club. The Council uses its public meetings as working meetings, focusing on progress reports from its Working Groups and deliberations producing useful, actionable recommendations in a timely manner. The Council addresses four to six major studies annually, with high performance goals of delivering quality, well-researched reports between 6-12 months from the inception of the selected studies. Its reports have drawn public and private-sector interest with regular requests from Congressional committees for copies. Public meetings are normally attended by several members of the Press. The President meets with the Council at least once a year and has directed very specific requests to the Council

for recommendations on issues of interest. The White House monitors the progress of the Council's studies on a regular basis between meetings through a liaison in the Homeland Security Council.

NIAC MEMBERSHIP

Chair - MR. ERLE A. NYE *Chairman Emeritus, TXU Corp.*

MR. EDMUND G. ARCHULETA *President and Chief Executive Officer, El Paso Water Utilities*

MR. CRAIG R. BARRETT *Chairman of the Board, Intel Corporation*

MR. ALFRED R. BERKELEY, III *Chairman and Chief Executive Officer, Pipeline Financial Group LLC (former Vice-Chairman, NASDAQ)*

MR. GEORGE H. CONRADES *Executive Chairman, Akamai Technologies Inc.*

CHIEF REBECCA F. DENLINGER *Chief, Cobb County (Georgia) Fire & Emergency Services*

LT. GEN (RET.) ALBERT J. EDMONDS *Chairman, Edmonds Enterprise Services, Inc.*

CHIEF GILBERT G. GALLEGOS *Chief of Police (retired), City of Albuquerque, New Mexico*

MS. MARGARET E. GRAYSON *President, Coalescent Technologies, Inc.*

COMMISSIONER RAYMOND W. KELLY *Police Commissioner, City of New York*

MS. MARTHA H. MARSH *President and Chief Executive Officer, Stanford Hospital and Clinics*

MR. JAMES B. NICHOLSON *President and CEO, PVS Chemicals, Inc.*

MR. THOMAS E. NOONAN *Chairman, General Manager, IBM-Internet Security Systems, Inc.*

THE HONORABLE TIM PAWLENTY *Governor, The State of Minnesota*

MR. GREGORY A. PETERS *Chairman and Chief Executive Officer, M1 Global Partners, Inc.*

MR. BRUCE A. ROHDE *Chairman and Chief Executive Officer Emeritus, ConAgra Foods, Inc.*

DR. LINWOOD H. ROSE *President, James Madison University*

MR. JOHN W. THOMPSON *Chairman and Chief Executive Officer, Symantec Corporation*