

ENHANCING EMERGENCY PREPAREDNESS FOR NATURAL DISASTERS

Government and Oil & Natural Gas Industry
Actions to Prepare, Respond, and Recover

NATIONAL PETROLEUM COUNCIL

An Oil and Natural Gas Advisory Committee to the Secretary of Energy

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December 18, 2014

The Honorable Ernest Moniz
Secretary of Energy
Washington, D.C. 20585

Dear Mr. Secretary:

In a letter dated October 25, 2013, you asked the National Petroleum Council (NPC) for advice about Natural Gas and Oil Infrastructure Resilience (emergency preparedness for natural disasters). Your letter noted that recent natural disasters “have underscored the importance of having resilient oil and natural gas infrastructure and effective ways for industry and government to communicate to address energy supply disruptions,” and you specifically requested that the NPC address the following key questions:

- What vulnerabilities have recent storm activity exposed in U.S. energy infrastructure?
- What legal, procedural, and physical gaps need to be addressed by industry and government to improve response to disruptions?
- What strategies should be pursued to increase energy system resilience to storms and other potential disruptions?
- What actions can be taken to address the interdependencies between oil and natural gas systems and other critical infrastructure?

The attached report, *Enhancing Emergency Preparedness for Natural Disasters*, is the NPC’s response to your request based on over a year of review and analysis. The study team reviewed reports from recent natural disasters and collected insights through focused discussions with more than 100 experts and emergency response professionals from federal, state, and local governments, trade associations, industry, and non-government organizations. Based on this study, the Council found:

- It is critically important for government emergency response organizations to have a baseline understanding of the dynamic nature of the oil and gas supply chains.
- Improved situational awareness about the status of oil and gas infrastructure and service disruptions from industry would enable the Department of Energy (DOE) and other government agencies to more effectively respond.
- A major challenge during emergency response is effective communication between and within federal and state agencies and with industry.
- The development and maintenance of a trained, knowledgeable response organization within government agencies should be a priority with processes to sustain it.
- Leadership commitment and funding is required to continuously improve and ensure a state of readiness to respond to supply chain disruptions.

To address these issues, the Council offers seven primary recommendations—they fall into two broad categories: (1) leveraging institutional frameworks that are appropriately staffed and (2) maintaining readiness through sustaining mechanisms to address interdependencies, enhance capabilities, and continuously improve. This management system approach, applied rigorously by

industry and government, has been proven to increase energy system resilience to storms and other potential disruptions by enhancing preparedness and speeding response and recovery. The Council makes the following recommendations:

- Harmonize DOE's energy response team structure with the National Incident Management System (NIMS) Incident Command System (ICS).
- Leverage the Energy Information Administration's subject matter expertise within DOE's energy response team to improve supply chain situation assessments.
- Establish company liaisons and direct communication with DOE's energy response team to improve situation assessments.
- Streamline and enhance processes for obtaining temporary regulatory relief to speed up recovery.
- States should increase engagement with the oil and natural gas industry in their energy assurance plans, and industry members should assist states in such efforts.
- Both DOE and states should establish routine education and training programs for key government emergency response positions.
- Both DOE and states should improve their comprehensive drill and exercise programs and include industry participation. Reciprocal invitations extended by companies to DOE and states are recommended.

Implementing the study recommendations will build upon the progress already underway in advancing DOE's emergency response capability. Implementation of ICS, enhancing organizational capabilities, and building sustaining mechanisms—including education, training, drills, and exercises—are key actions to substantially improve situational awareness and the Department's capability to respond to disasters. The government and industry share a commitment to prepare for, mitigate the impacts from, and respond to the energy supply disruptions caused by natural disasters. The nation will benefit from improved systems and processes that result from that shared commitment to educate each other and communicate through a disciplined, practiced process.

Leadership commitment is a core element for a systems approach to incident preparedness and response. Senior government officials and industry executives, alike, set expectations and provide the resources for staffing, education, and training. Capturing the benefit expected from implementation of the study recommendations requires leadership commitment visible within respective organizations and accountability at all levels. The nature of managing significant incidents requires that participants at all levels have functional expertise in the systems presented in this report, including agency and industry executives.

Robust and resilient energy delivery infrastructure is vital to America's ability to develop its vast oil and natural gas resources, with far-reaching impacts to nearly every sector of the U.S. economy. As new policies are considered and infrastructure designs are reviewed, government policymakers should consider not only the project's environmental impact, but also the benefit to infrastructure resiliency and overall energy efficiency.

Approval of this report represents the NPC membership's commitment to work with DOE to implement these recommendations. While managing disaster response will always entail uncertainties and raise new challenges, creating a dynamic response system and mechanism for continuous

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improvement will serve the public, restore energy delivery as quickly as possible, and minimize adverse impacts to public health and the economy.

Similarly, industry recognizes the value of continuous improvement in company-specific activities, and also in support of DOE efforts. Accordingly, the study recommends that industry:

- Establish the link between company liaisons and DOE energy response teams to support situation assessment.
- Through the Oil and Natural Gas Sector Coordinating Council, expand support of preparedness and response including education and outreach, training, and joint government-company drills and exercises.
- Support government efforts to enhance their energy assurance plans including consideration of interdependencies.

NPC and DOE leadership anticipate that the recommendations will start to be implemented in 2015 in advance of the hurricane season, and a joint exercise will be conducted in 2015 to test the key recommendations of the study. The Council looks forward to sharing this study and its results with you, your colleagues, and broader government and public audiences.

Respectfully submitted,

A handwritten signature in black ink that reads "James T. Hackett". The signature is written in a cursive style with a large, sweeping initial "J".

James T. Hackett
Chair

Attachment

ENHANCING EMERGENCY PREPAREDNESS FOR NATURAL DISASTERS

Government and Oil & Natural Gas Industry
Actions to Prepare, Respond, and Recover



Committee on Emergency Preparedness
Marvin E. Odum, Chair

NATIONAL PETROLEUM COUNCIL

James T. Hackett, *Chair*
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U.S. DEPARTMENT OF ENERGY

Ernest J. Moniz, *Secretary*

The National Petroleum Council is a federal advisory committee to the Secretary of Energy.

The sole purpose of the National Petroleum Council is to advise, inform, and make recommendations to the Secretary of Energy on any matter requested by the Secretary relating to oil and natural gas or to the oil and gas industries.

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Emergency Preparedness

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Emergency Preparedness

PREFACE

NATIONAL PETROLEUM COUNCIL

The sole purpose of the National Petroleum Council (NPC) is to provide advice to the federal government. At President Harry Truman’s request, this federally chartered and privately funded advisory group was established by the Secretary of the Interior in 1946 to represent the oil and gas industry’s views to the federal government: advising, informing, and recommending policy options. During World War II, under President Franklin Roosevelt, the federal government and the Petroleum Industry War Council worked closely together to mobilize the oil supplies that fueled the Allied victory. President Truman’s goal was to continue that successful cooperation in the uncertain postwar years. Today, the NPC is chartered by the Secretary of Energy under the Federal Advisory Committee Act of 1972.

Over time, Council membership has increased in both number and diversity. Approximately 200 in number, Council members are selected by the Secretary of Energy to assure well-balanced representation from all segments of the oil and gas industry, academic, financial, research, Native American, and public interest organizations and institutions. The Council provides a forum for informed dialogue on issues involving energy, security, the economy, and the environment in an ever-changing world. A further description of the Council and a list of members can be found in Appendix A and at www.npc.org.

STUDY REQUEST

By letter dated October 25, 2013, a copy of which is contained in Appendix A, Secretary of

Energy Ernest Moniz formally requested the National Petroleum Council’s advice on three topics:

- Natural gas and oil infrastructure resilience (emergency preparedness for natural disasters)
- Maximizing the climate benefits of natural gas (detection and reduction in methane emissions)
- Arctic research (technology advances needed and research to be pursued by DOE).

This report addresses the first of his requests. On that topic, the Secretary noted that recent natural disasters “have underscored the importance of having resilient oil and natural gas infrastructure and effective ways for industry and government to communicate to address energy supply disruptions.” He further noted that “key questions to be addressed on this topic include:

- What vulnerabilities have recent storm activity exposed in U.S. energy infrastructure?
- What legal, procedural, and physical gaps need to be addressed by industry and government to improve response to disruption?
- What strategies should be pursued to increase energy system resilience to storms and other potential disruptions?
- What actions can be taken to address the interdependencies between oil and natural gas systems and other critical infrastructure?”

The Council accepted this request from the Secretary and the NPC Committee on Emergency Preparedness was established to supervise preparation of a draft report for the Council’s consideration. The Committee’s leadership consisted of a Chair, three Vice Chairs, and a Government

Cochair. The Council also established a Coordinating Subcommittee to support the Committee. Additionally, four subgroups were established subordinate to the Coordinating Subcommittee—Analysis and Planning, Communication and Information Management, Oil and Natural Gas Supply Chains, and Legal and Regulatory. Due to the interconnection of the subject matters under review by the Supply Chain and Communication subgroups, these subgroups worked in collaboration. The organization of the study committees is shown in Figure 1, and Table 1 lists those who served as leaders of the groups that conducted the study’s analyses. Rosters of the study groups are contained in Appendix B.

STUDY SCOPE

The NPC emergency preparedness study provides advice on how the oil and natural gas industry and government at all levels can better prepare for and respond to defined emergencies. The scope of the study was approved by the NPC in January of 2014, and bounded by the time and resources required for the NPC to conduct the appropriate analysis of the issues and to provide meaningful, actionable, and timely advice in response to the Secretary’s request. Emergencies considered in this study included significant

disruptions to oil and gas supply chains such as what might occur from hurricanes, earthquakes, floods, or other natural disasters, but not disruptions caused by sabotage, cyber-attacks, or other catastrophic events. Also explicitly excluded from the scope was facility hardening, which had been addressed in previous reports such as the August 2010 DOE study *Hardening and Resiliency: U.S. Energy Industry Response to Recent Hurricane Seasons*. Examination of strategic product reserves was also excluded from the study scope due to time and resource constraints.

The Department of Energy is responsible for addressing all types of energy emergencies beyond those considered for this study. Although this study focuses on a limited number of emergency scenarios, the outcomes from this study will be useful to DOE and industry in responding to impacts from a much broader range of potential incidents and vulnerabilities that result in energy emergencies.

Based on the study request and subsequent interactions with DOE representatives, the following key topics of interest to the Department of Energy were identified and addressed:

- **Actions by government and industry to improve their interactions to prepare for and**

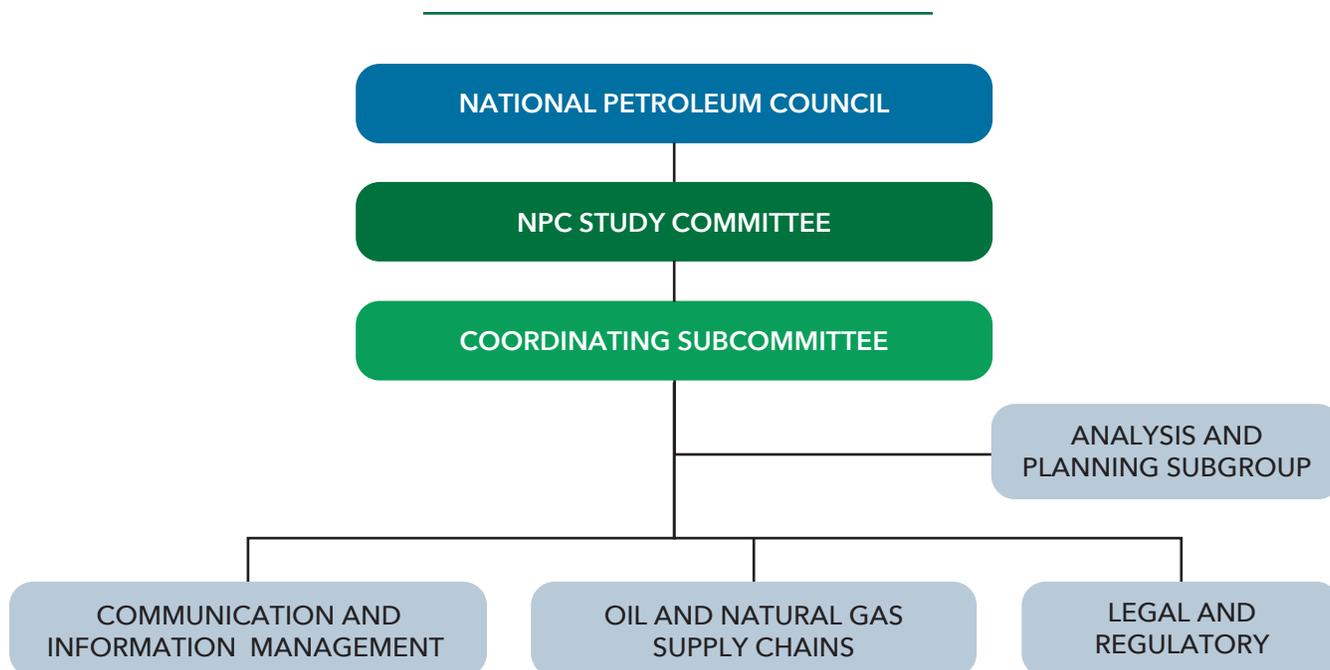


Figure 1. Structure of the Emergency Preparedness Study Team

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* Replaced by E. Sherwood-Randall.

Table 1. *Emergency Preparedness Study Leaders*

respond to emergencies that can disrupt oil and natural gas supplies and other dependent critical services

- Understanding, implementing, and practicing institutional frameworks for effective communication and collaboration
- Improving ongoing education and outreach at multiple levels of government and industry

- **Data, technologies, or other capabilities to improve situation assessment**

- Understanding the nature and severity of emergencies as they progress
- Assembling and summarizing damage assessments of the oil and natural gas infrastructure and system-wide impacts to supply chains and their interdependencies

- Developing information to support decision-making and action-planning to effectively manage and expeditiously recover from supply disruptions
- **Legal, procedural, or physical challenges to emergency response and restoration, and strategies to improve emergency preparedness and resiliency**
 - Identify potential regulatory relief and a standardized, expedited process for temporarily removing regulatory requirements
 - Ascertain support required for emergency supplies and resources (people, equipment) to speed recovery
 - Highlight policy changes to enable increased resiliency in the fuel distribution system, including expeditious recovery from disruptions in the event of emergencies
- **Strategies to address interdependencies among oil and natural gas and other critical infrastructure.**

PREVIOUS NPC WORK ON EMERGENCY PREPAREDNESS

The NPC has addressed emergency preparedness issues in many of its earlier reports. Specific advice has been provided on the role of public and private stocks during emergency situations, understanding and estimating refining and product transportation capacities, and the availability of real-time industry information. Advice has also been provided on legal issues that must be considered during emergency situations, tactics and strategies for cyber protection, and issues related to international interactions. Three NPC reports focusing on issues related to emergency preparedness contain very useful advice: *Petroleum Storage & Transportation – Volume II, System Dynamics (1989)*; *Industry Assistance to Government – Methods for Providing Petroleum Industry Expertise During Emergencies (1991)*; and *Securing Oil and Natural Gas Infrastructures in the New Economy (2001)*. However, the increased segmentation of facility ownership/operatorship points to a need for an improved communications process during energy emer-

gencies to both assess the situation and coordinate the response, as well as a need for improved planning, education and drills and exercises programs.

The 1991 NPC report, *Industry Assistance to Government*, offered three distinct types or levels of support by the petroleum industry that were considered in this study:

- Company Emergency Contacts (Level 1), for use in all types of supply disruptions and emergencies. Recommendations to improve the effectiveness, quality, and timeliness for this support level are developed in this study.
- Executive Advisory Group (Level 2), where the Secretary calls upon a cross-section of the petroleum industry to provide group advice and counsel. As noted in the 1991 report, and discussed in this report, the information that can be discussed at such meetings is limited due to competitive and antitrust concerns.
- National Defense Executive Reserve (Level 3), where conflict of interest concerns have been and continue to be major impediments and would require legislative action to address.

The current study, building on the prior studies and accounting for the changing supply chains and industry dynamics, focuses primarily on the area of the first recommendation, and provides extensive information about how to enhance the information flow and communications between industry members and the government.

The second 1991 recommendation remains unchanged as the Secretary may call an ad hoc meeting of industry executives to discuss an event of national significance. This study also discusses a possible use of a Voluntary Agreement under the Defense Production Act to provide additional direct assistance to the Secretary in a very rare major disaster. For antitrust and competitiveness reasons, however, companies may be reluctant to participate in such a Voluntary Agreement.

This study does not address the third 1991 recommendation, the National Defense Executive Reserve concept, since it is not of current interest to the Department.

STUDY METHODOLOGY

The study methodology consisted of two main components. First, after-action reports from previous natural disasters were reviewed, and key findings and lessons from these reports were identified.¹ A summary of the after-action reports can be found in Appendix C.

Second, a series of four engagement sessions were held to gather input from multiple levels of government, a broad spectrum of industry, and other stakeholder representatives on a regional basis to solicit their thoughts, concerns, and advice on ways to improve preparation, response, and recovery in the event of natural disasters. The invitation to the engagement sessions explained: “The study will focus on the petroleum industry supply chains, market dynamics, interdependencies, the challenges posed when adversely impacted by natural disaster events, and the framework to restore normal operations and expeditiously supply consumers with fuel (including refined products and natural gas). We need your input to provide the Secretary of Energy advice on strategies and actions to i) enhance communications between the petroleum industry and government, as well as interdependent industries like electricity and transportation, to enable informed decisions in a dynamic environment and ii) improve emergency preparedness and supply chain resiliency.”

In advance of the engagement sessions, participants were provided background information to help focus the discussions during the sessions.

¹ An after-action report is a formal analytical document intended to serve as an aid to performance evaluation and improvement, by registering situation-response interactions, analyzing critical procedures, determining their effectiveness and efficiency, and proposing adjustments and recommendations.

A summary of the input received can be found in Appendix D.

Based on the review of the after-action item reports and the output from the engagement sessions, the Supply Chain, Communications, and Legal/Regulatory subgroups, with the input of a wide array of industry experts, developed draft findings and recommendations for consideration by the Coordinating Subcommittee and ultimately the Study Committee and the Council.

REPORT STRUCTURE

The report presents background information on the vulnerabilities identified from recent emergency events and those identified during the study sessions, and an overview of current dynamics in the oil and natural gas sector and how those dynamics impact emergency response. Based on these factors, the report then presents the organizational structures under and through which government and industry response teams can effectively coordinate resources and share information to respond to fuel supply chain disruptions. Specific recommendations regarding how to organize teams and properly staff positions are provided. Communication flows, requests for assistance, and regulatory relief are some of the functions that are expedited and facilitated through the implementation of these organizational structures. Mechanisms for sustaining organizational structures, planning for the management of interdependencies in the supply chains, education, and exercising for enhancing readiness and how those endeavors can be supported through engagement and policy considerations are explored. Finally, the report presents three theoretical scenarios of varying size and complexity to illustrate how the mechanisms and structures presented in this report could be applied to actual incidents.

Emergency Preparedness

EXECUTIVE SUMMARY

INTRODUCTION

Recent natural disasters affecting U.S. oil and natural gas infrastructure and operations, including Superstorm Sandy in 2012, prompted the U.S. Department of Energy (DOE) to seek enhancements to improve energy system resiliency and mechanisms for improving preparedness and response to fuel supply disruptions.

As part of the federal government's review, the Secretary of Energy requested the National Petroleum Council's advice on how best to minimize the impact of energy disruptions to public health and the economy. In his letter to the NPC, the Secretary of Energy formally requested advice on natural gas and oil infrastructure resilience to natural disaster impacts. Through additional discussion, the Department of Energy requested specific, actionable steps that would improve preparation and response to natural disasters through improved communications, information sharing, organizational structures, and advance planning.

The federal government has an important role in supporting and assisting the preparedness and response efforts of industry as well as local and state governments. The oil and gas industry has the primary role in helping our nation prepare for, respond to, and recover from the broad range of potential emergency situations that can disrupt the normal operations of energy supply systems. After a disruptive event, returning the energy system to steady state operations as quickly as possible is a goal shared by both the oil and natural gas industry and the government. Companies have systems in place for responding to supply

chain disruptions. Government organizations, from local fire departments all the way to the White House, also have systems for responding to emergencies. This study seeks to identify opportunities to improve the interactions between the federal government and industry with the goal of improving response and expediting recovery.

Resiliency means the ability to absorb, adapt, and/or rapidly recover from a disruptive force such as a hurricane.

Under normal conditions, the U.S. oil and natural gas supply chains—from production of crude oil and natural gas, through transportation and processing, to distribution to retail facilities and end users—are robust and highly resilient. This resiliency can be witnessed almost daily as companies involved in the production and distribution of fuels routinely make adjustments to their systems to compensate for both planned and unplanned temporary variations, including disruptions. These routine adjustments maintain a steady supply of fuel to consumers. A key source of this resiliency and robustness comes from diversity of supply sources and diversity of distribution channels, including the following:¹

- 2.1 million miles of natural gas utility distribution and service pipelines providing service in all 50 states
- 306,000 miles of wide-diameter, high-pressure interstate and intrastate natural gas pipelines

¹ Data in first four bullets are 2013 data from the Energy Information Administration.

- 192,000 miles of crude oil and petroleum products (gasoline, diesel, jet fuel, natural gas liquids, etc.) pipelines
- 142 refineries nationwide
- 1,305 petroleum products terminals²
- 8,000 independent marketers of gasoline, propane, diesel, and home heating oil.³

The refineries, processing facilities, terminals, pipelines, and other transportation systems within the United States form the backbone of this energy delivery system. Furthermore, the U.S. oil and natural gas energy supply is largely a continental supply with 75% of oil and 93% of natural gas demand being supplied from production in the United States, Canada, and Mexico.

Diversity of both supply and distribution creates options that can be used to compensate when components of the system are disrupted. Multiple sources of supply, transportation modes, and processing alternatives provide companies, and the industry as a whole, the ability to shift supply sources on fairly short notice if normal sources are disrupted and to maintain supply to markets using the most efficient and cost-effective method. As has been witnessed, natural disasters can impact the normal operations of energy infrastructure and interrupt supply chains. In severe cases, those disruptions can have far-reaching impacts. Even after such large disruptions, the resiliency of the supply chain system allows energy suppliers to quickly restore supply.

Recent storm activity has highlighted the importance of a resilient U.S. energy supply system and reinforced the need for industry and government to establish more effective ways to communicate and collaborate during energy supply disruptions. Table 2 illustrates both the potential magnitude and the range of impacts to energy systems and infrastructure during recent storms. Each natural disaster has unique elements and presents unique challenges. An effective response system must be

based on a sound foundational system and processes and must also be adaptable to the specific circumstances of the disruption.

The study team reviewed after-action reports on these and other natural disasters and collected insights through focused discussions with more than 100 experts and emergency response professionals from federal, state, and local governments, trade associations, industry, and non-government organizations. A number of recurring issues and challenges were identified, with the key opportunities for action in three primary areas: enhancing emergency preparedness, improving emergency response, and speeding energy system recovery. **In developing its findings and recommendations, the NPC has identified the need for a commitment by DOE and industry to institutionalize a system that will foster continuous improvements as a key element of developing and sustaining government and industry processes to improve energy system resiliency.** Further, the NPC identified the following as guiding principles in restoring the energy system to steady state operations:

- Response to supply chain emergencies are best managed when there is advance planning, preparedness, and private and public sector collaboration.
- Collaboration and coordination of activities and resources are enabled through adhering to the established common frameworks and management systems.
- Allowing markets to function normally provides for the quickest and most efficient restoration of supply to impacted areas.
- Industry must conduct its operations in compliance with the law.
- Industry is responsible for restoring oil and gas supply.
- Priority for electricity restoration should be on critical infrastructure.
- Supply chain interdependencies across segments/regions should be recognized.
- Regulatory barriers to restoring supply should be removed through government-issued temporary regulatory relief, where possible.

² IRS, “Terminal Control Number (TCN)/Terminal Locations Directory,” updated October 21, 2014. <http://www.irs.gov/Businesses/Small-Businesses-&Self-Employed/Terminal-Control-Number-TCN-Terminal-Locations-Directory>.

³ The Petroleum Marketers Association of America, “About PMAA,” <http://www.pmaa.org/aboutpmaa/>.

Event	Geographic Area	Energy Impacts
Superstorm Sandy 2012	New York, New Jersey, Northeastern U.S.	<ul style="list-style-type: none"> • Extensive power outages in impacted areas • Local liquid fuel distribution interrupted • Natural gas distribution systems damaged <p>No impact to energy production systems; very limited impact to energy processing/refining complex</p>
Hurricanes Gustav/Ike 2008	Gustav - Louisiana Ike - Texas	<ul style="list-style-type: none"> • Extensive power outages in impacted areas • 14 refineries offline, primarily in Louisiana • Significant offshore oil and natural production shut-in but largely recovered within 12 weeks (12 weeks after Gustav, approximately 20% of production remained shut-in) <p>Hurricanes Gustav and Ike made landfall within two weeks of each other, increasing the impact across the energy producing and processing Gulf Coast</p>
Hurricanes Katrina/Rita 2005	Katrina - Louisiana Rita - Texas/Louisiana	<ul style="list-style-type: none"> • Extensive power outages in impacted areas • 27 refineries offline because of the combined impacts of both storms in Texas and Louisiana • Historic outage of oil and natural gas production from the Gulf of Mexico (12 weeks after Katrina, 90% of production remained shut-in) <p>Hurricane Rita made landfall 26 days after Hurricane Katrina, exacerbating the energy impact to the hub of natural gas processing and oil refining for the United States</p>

Table 2. *Impacts of Recent Storms*

FINDINGS

The NPC found that specific attention is merited for the following factors related to preparing for and responding to oil and natural gas disruptions:

- **It is critically important for government emergency response organizations to have a baseline understanding of the dynamic nature of the oil and gas supply chains.** There appear to be varied levels of understanding within government agencies of the complex nature of oil and gas (O&G) infrastructure, interconnectivity across geographic regions, interdependencies, and industry’s response capabilities. A common understanding across these organizations can be achieved through increased training and education. A functional knowledge of the O&G supply chains and energy response plans is needed by emergency response teams, private and public, to prepare

for and effectively and quickly respond to supply chain disruptions.

The O&G supply chains are complex, highly dynamic, integrated geographically, and are interdependent with other critical infrastructure—most notably the electric sector. Furthermore, the supply network is changing significantly with new crude oil and natural gas production. Government understanding of the supply chains and their interrelationships is required to perform an adequate situation assessment and to constructively respond to private-sector requests. For example, federal and state government consideration of fuel waiver requests requires an understanding of how a fuel shortage in one area can spread to other areas. This supply chain interconnectivity was illustrated during hurricanes in 2005 and 2008, when storm damage from severe winds and significant flooding on the U.S. Gulf Coast, with its heavy concentration of refining

capacity, disrupted local fuel supply as well as fuel supply to the U.S. East Coast, which the Gulf Coast region normally supplies. Similarly in 2012, the storm damage from Superstorm Sandy reduced product demand along the U.S. East Coast, and created product containment concerns for the Gulf Coast refiners that normally supply the East Coast. In addition, storm damage can significantly impact community infrastructure such as roads, utilities, and businesses, which can impede the pace and increase the complexity of recovery.

- **Improved situational awareness about the status of oil and gas infrastructure and service disruptions from industry would enable DOE and other government agencies to more effectively respond.** Providing an accurate situation assessment is essential for decision-making across federal agencies and is consistent with DOE’s responsibilities as the lead federal agency for the energy sector during a crisis. The content of such an assessment should include the nature and severity of the incident as the emergency progresses, damage assessment of the oil and gas infrastructure, and system-wide impacts to supply chains and their interdependencies and to potential cascading implications. The development of the assessment also requires a timely flow of information, analytical tools, and knowledgeable staff.

A number of factors make it challenging to compile and synthesize the supply system information needed across federal agencies for decision-making and for crafting accurate and useful communications to the public—the continued expansion of the oil and gas supply chain infrastructure, the diversification of asset ownership, and increasingly complex market structures, to name a few. The development of accurate and useful situation assessment requires a substantial level of energy supply chain expertise. Converting energy supply data into actionable information depends on a comprehensive understanding of supply chain interdependencies, infrastructure limitations, and the regulatory frameworks in which industry operates.

Emergencies challenge even the most experienced organizations and personnel. Often, the impacts of natural disasters are unpredict-

able—this unpredictability makes it challenging for emergency responders to identify the impacted services, owners, operators, and suppliers. In the oil and natural gas sector, identifying the owner or operators of an impacted supply chain segment is especially challenging. The O&G market is no longer composed of large integrated companies that own and operate the infrastructure all along the supply chain, so the holder or steward of a product is not often the owner. This diversity of owners, operators, and assets, and the dependencies within the supply chains create complexities that do not exist in other sectors such as the electric sector. Nevertheless, the reactions and responsiveness of individual entities and the overall petroleum and natural gas supply chains are highly predictable. The O&G supply chain complexities make it critical that DOE understands the O&G sector and has established interfaces to interpret events when they occur.

Individual companies are typically effective at addressing their respective local issues and generally communicate well to local responders and with emergency service providers (fire, police, etc.). At the national level, however, a strong link has not been established between impacted companies and government agencies to communicate an overview of their supply system status. The after-action report on Hurricane Sandy noted “DOE struggled to meet this requirement (coordinate Federal efforts related to energy restoration) and lacked the operational capability to fully engage supporting Federal departments and energy-sector partners in addressing energy-restoration challenges.”⁴ This difficulty was due in part to:

- Inconsistent understanding of fuel supply chains; implication of commodity/product operatorship vs. asset ownership; interdependencies between oil and natural gas and other infrastructures; and industry response plans and capabilities
- Unclear communication paths with industry and/or lack of organizational authorities, which impact accurate and timely

⁴ Federal Emergency Management Agency, *Hurricane Sandy FEMA After-Action Report*. July 1, 2013.

development and sharing of overall situation assessment

- The Paperwork Reduction Act of 1980, which limits the Energy Information Administration’s (EIA) authority to survey affected companies during and after an event without going through a series of steps and inter-agency approval.

Improving situational awareness during an emergency is a shared responsibility. DOE should take steps to elevate the organizational competency within DOE’s response team to enable more effective communication with industry and within the government. Companies should take steps to understand and anticipate the types of information needed by government before, during, and after such events, and seek opportunities to improve government access to information from their respective incident command structures used during emergencies.

- **A major challenge during emergency response is effective communication between and within federal and state agencies and with industry.**

Critical to effective response is a standardized, rehearsed approach to expanding and escalating response support and communications as events unfold. The National Response Framework (NRF) and National Incident Management System (NIMS) provide the frameworks to coordinate communications and collaboration across multiple levels of governments and industry participants, using a well-established, disciplined, standardized approach.

One of the most important “best practices” incorporated into NIMS is the Incident Command System (ICS), a standard, on-scene, all-hazards incident management system used extensively across the public and private sectors. The NRF does not provide guidance on formal mechanisms for communication and collaboration between federal agencies and the O&G sector.

Implementation of the ICS, under NIMS, however, is not consistent across organizations and first responders at all levels of govern-

ment. Although many agencies at local, state, and federal levels use ICS, the variability in application undermines the efficiencies gained through standardization—a notable example is the different organizational structure and processes adopted by DOE’s energy response team (ERT). A consistent, disciplined process for communication between federal agencies and with industry can lead to more timely and high-quality information to support situational awareness and decision-making during natural disasters.

When standardized communication processes between and within federal and state government and industry are ineffective or not followed, there is an over-reliance on communications through historical, personal relationships—this undermines command and control structures, leads to confusion, and adds distraction and increases the potential for inaccurate information. Additionally, information exchange that is dependent on specific individuals and personal relationships between subject matter experts in government and industry is inherently at risk from turnover or availability. DOE, recognizing these aspects of effective communication, is taking action to address these concerns and to make investments that standardize DOE’s role as the communications channel from industry to other federal agencies.

- **The maintenance of a trained, knowledgeable response organization within government agencies should be a priority along with processes to sustain it.**

As industry dynamics change and as organizations and personnel turn over, processes and mechanisms need to be in place to maintain organizational readiness. Maintaining trained, knowledgeable response organizations within governments is challenging and complicated by:

- High turnover of government officials across the multiple agencies involved with emergency response
- Relative infrequency of natural disasters and lack of first-hand experience in crisis response

- Varied levels of understanding of supply chains across government agencies involved in emergency response
- Need for education, training, drills, and exercises in areas of strategic importance.

Knowledgeable, trained staff are needed for an understanding of supply chains and the primary factors that impact their functioning, and for effective communication and coordination between responding entities. Absent that, the response is prone to confusion, misunderstanding, and potentially misdirected or ineffective actions.

After-action reports reviewed for this study point to lack of understanding of oil and natural gas supply chains and markets. As a case in point, during Superstorm Sandy, some government agencies were frustrated by terminal operators' inability to communicate inventory levels by owner to government or to distribute the product physically available—in this situation, the terminal operator was the product steward, and discussions of individual company inventories and allocation needed to be directed to the product owner. Likewise, during previous Gulf Coast hurricanes, approvals for product specification waivers were not timely in part because the supply chains were not well understood by regulators. As a result, the effective window was missed for industry to supply alternate product along the Atlantic Coast. Building on lessons from the Gulf Coast hurricanes, the waiver request and approval process was much improved for Superstorm Sandy—a success of the collaborative approach between industry and government agencies.

- **Within industry and across all levels of government, leadership commitment and funding are required to continuously improve and ensure a state of readiness to respond to supply chain disruptions.**

Lessons from each event or drill need to be assessed and incorporated, as appropriate, into continuous improvement activities. This ability to learn and improve capability from each event is especially important given the limited number of actual events or drills and the potential

loss of institutional memory between events. A disciplined approach to continuous improvement and utilization of lessons learned are standard industry practice among the larger companies. Evidence of repeated recommendations documented in after-action reports suggests there is an opportunity for similar advances to be made by state and federal government agencies, including DOE.

RECOMMENDATIONS

Reliable supplies of oil and natural gas are essential to our nation's energy and economic security, and mitigating disruptions in oil and natural gas supplies has clear public benefit. The oil and gas industry carries the responsibility for maintaining the fuel supply system to meet the needs of the nation. When the supply chains are disrupted by a natural disaster, industry owners and operators have the primary responsibility, skills, and experience to stabilize and restore critical services. DOE's role as the lead federal agency for the energy sector during a crisis is to assist the efforts of government and private-sector stakeholders to overcome challenges associated with reestablishment of energy systems.

During a response to a natural disaster, gaps may arise between local response capabilities and response needs, or there may be conflicting priorities, reflecting the often-chaotic nature of significant events. Therefore, it is in the best interest of both the public and private sectors to maintain communications before, during, and after an event to ensure access to physical resources, pertinent information, or those responsible for the administration of both.

The following primary recommendations are aligned with proven strategies to increase energy system resilience to storms and other potential disruptions by enhancing preparedness and response, and speeding recovery. At a high level, the recommendations fall into two broad categories:

1. Establishing institutional frameworks that are appropriately staffed
 - Aligning and executing proven NIMS ICS operational models for emergency response,

and enhancing DOE's ERT organizational structure and competencies

- Establishing formal communication interfaces between industry and DOE to support DOE in development of broad situational awareness, and expediting regulatory relief to restore supplies and the supply chain
2. Maintaining readiness through sustaining mechanisms
- Improving plans to address interdependencies
 - Sustaining emergency preparedness capabilities through i) administering effective, routine education and training, ii) leveraging comprehensive drills and exercises to increase the understanding of response frameworks and energy systems, and iii) expanding the role of the Oil and Natural Gas Sector Coordinating Council (ONG SCC), consisting of oil and gas trade associations, to provide assistance and support to both states and DOE to help sustain emergency preparedness and communications channels.

Establishing Institutional Frameworks and Trained, Knowledgeable Staff

Effective response to a nationally significant incident requires efficient delivery of resources and information to ensure that populations are secured and critical services are restored in a timely manner. The National Response Framework, established under Presidential Policy Directive 8: National Preparedness (PPD-8), provides the framework for how the nation responds to all types of disasters and emergencies.⁵

The National Incident Management System, developed by the Department of Homeland Security and issued in March 2004, provides a comprehensive national approach to incident management. One of the most important “best practices” incorporated into NIMS is the Incident Command System, a standard, on-scene, all-hazards incident management system. ICS

has been adopted by NIMS as the standardized incident organizational structure for the management of all incidents. The ICS approach is also widely used in large companies across the oil and gas sector for emergency management—this approach to preparedness and response has been demonstrated to be effective in managing supply chain disruptions regardless of cause, scale, geographic region, or complexity.

Recommendation 1: Harmonize DOE's energy response team structure with the NIMS Incident Command System (ICS).

Standardizing the organizational structure, processes, and tools used by response teams will improve communications between agencies and with the private sector. ICS is the management system for command, control, communication, and coordination of a response and provides an avenue to coordinate the efforts of individual agencies and industry as they work to achieve response objectives. This recommendation is a cornerstone for all subsequent recommendations.

Implementing NIMS ICS, as designed, includes the following benefits:

- Standardized response organizational structure with clearly defined roles and responsibilities
- Integrated communication that facilitates upward communication of issues, situation assessment, a common operating picture, and coordination of response across agencies and sectors
- Common terminology essential to any emergency management system, especially when diverse or other than first-response agencies are involved in the response
- Unified command structure that facilitates alignment across jurisdictions
- Manageable span of control that promotes organizational effectiveness
- Comprehensive resource management for efficient allocation of resources that is adaptable to varying incident sizes, complexity, geography, and jurisdictions for both the public and private sectors

⁵ U.S. Department of Homeland Security, *National Response Framework*, Second Edition, May 2013. <https://www.fema.gov/media-library/assets/documents/32230>

- Effective (for DOE response organization) management of incidents regardless of whether the response is carried out under the Stafford Act or not (the statutory authority for most federal disaster response activities especially as they pertain to FEMA and FEMA programs)⁶
- Effective management of incidents for organizations responsible for tactical emergency response as well as those, like federal agencies, responsible for broader issues management such as impact analysis.

The foundation of effective coordinated response efforts is a common process or model that all participating organizations use when responding to an incident. This ensures that all parties—whether private or public and whether local, state, or federal—are able to communicate and coordinate their efforts to bring about an efficient and effective response. This common framework establishes defined and understood channels and processes to enable timely and effective communication and joint operations within these structures when an event occurs and demands are being made across organizations and communities in the heat of the moment. Modifications to the implementation of ICS within responding organizations hamper both the timely handling of top-down and the bottom-up communication flow.

This study recommends that DOE fully align its ERT structure with the standardized NIMS ICS, including its defined roles. Lack of full alignment in the past has hindered communications and caused confusion when interacting with other agencies and the private sector.

The ICS organizational structure is illustrated in Figure 2. Recognizing DOE’s responsibilities during emergency response, this study identified key roles to clarify and resource within DOE’s ERT: Incident Commander (overall responsibility for DOE ERT during the event), Public Information Officer, Liaison Officer, and the staff designated within the Situation Unit.

Many incidents are local, but when faced with the large events, all responding agencies must be able to interface and work together. The ICS facilitates that interface, but only if the foundation has been laid and aligned from the local level through to the national. If local jurisdictions adopt a variation of ICS that is not scalable or is not applicable to other disciplines, the critical interface between responding agencies and jurisdictions cannot occur when the response expands. Similarly, the national level must be aligned to manage the interface with multiple local and state jurisdictions and the private sector, so that the information can be aggregated and acted upon effectively.

When implemented and executed rigorously, ICS enables clear, effective communications and collaboration across all levels of the response organizations.

Recommendation 2: Leverage EIA’s subject matter expertise within DOE’s energy response team to improve supply chain situation assessments.

Under the ICS structure, the Situation Unit is responsible for the collection, evaluation, and dissemination of incident information. Information to be produced includes an understanding of the current situation, an estimation of the probable course of events, and incident status reports.

The EIA is uniquely qualified to provide supply chain knowledge, market insights, and analytical capabilities and can be leveraged to enhance situation assessment during supply chain disruptions. EIA’s support to the Situation Unit under the ICS structure should be formalized, and training on emergency response protocols should be provided to involved EIA personnel. Individual subject matter experts from EIA considered for these roles should have broad knowledge of the oil and gas supply chains. Their knowledge, including industry terminology and experience in managing company confidential discussions, will enhance information gathering and analysis, as well as the quality of discussions with industry.

⁶ Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288) as amended, <http://www.fema.gov/robert-t-stafford-disaster-relief-and-emergency-assistance-act-public-law-93-288-amended>.

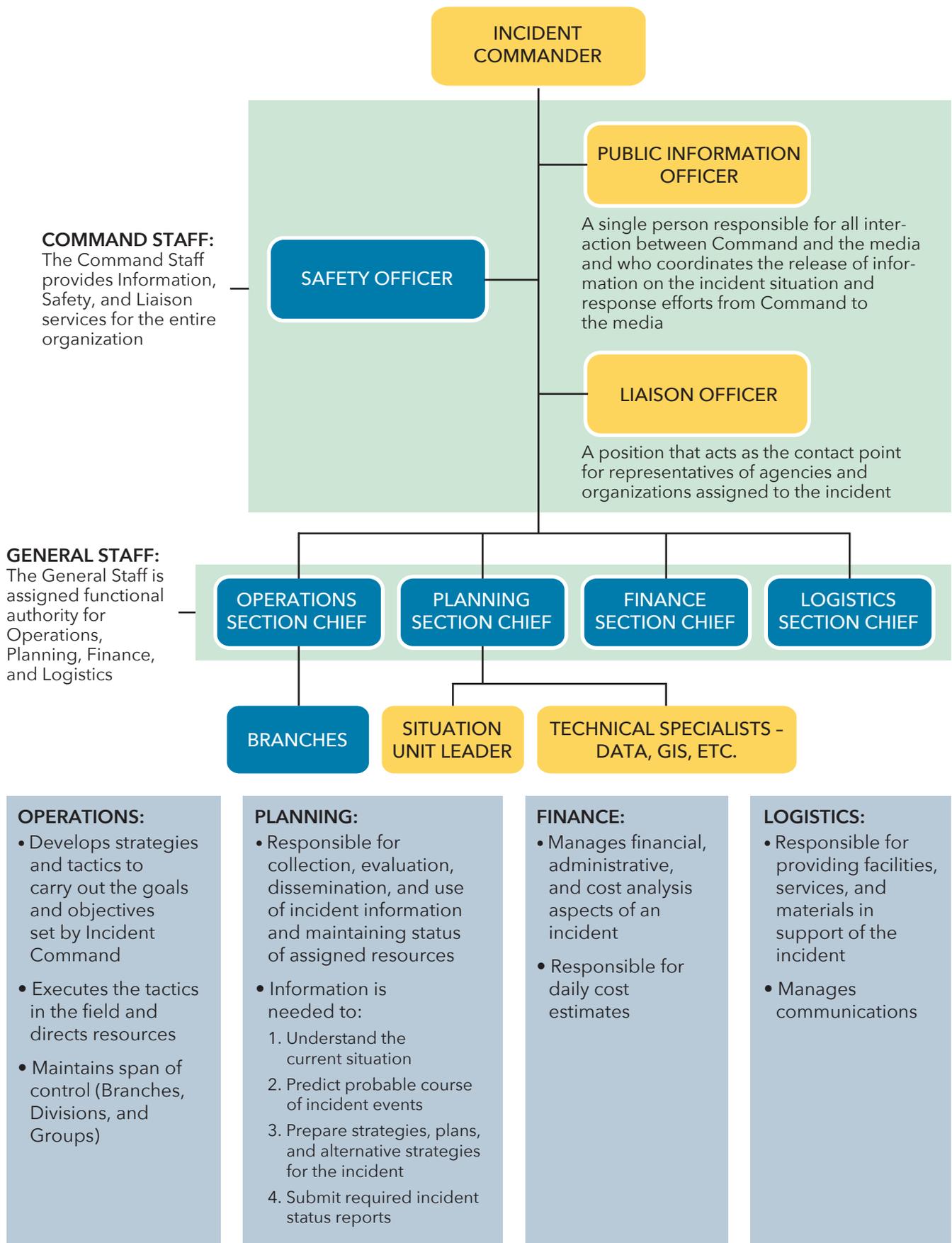


Figure 2. Incident Command System Organizational Structure

Recommendation 3: Establish company liaisons and direct communication with DOE's energy response team to improve situation assessments.

DOE needs information from the companies operating in the affected areas and/or impacted through cascading events along the supply chain to conduct analysis and develop situational awareness. Implementing the first two recommendations and communicating the changes to all stakeholders will aid the information exchange with local and state government agencies and impacted companies through established, clear processes.

Additionally, industry should establish direct communications between the DOE ERT and company Liaison Officers. The Liaison Officer role, under ICS, provides the structured linkage to support the communication interface. Liaison Officers can extend communication channels to involve DOE Situation Unit members and company-specific supply chain experts. To formalize this interface, contact information should be provided by owners and operators to the DOE ERT, for its exclusive use, to facilitate timely communications. Standardizing this direct, one-on-one process based on position or role—from which relationships can grow—does the following:

- Supports effective and appropriate information sharing during an event to improve the quality, timeliness, and accuracy of DOE's overall situation assessment, which allows DOE to validate/improve their assessments and is legally supportive (complies with antitrust, regulatory, and legal requirements, and protects confidentiality of company proprietary information).
- Provides both industry and DOE with agreed-upon mechanisms to avoid multiple requests for information from multiple parties, and in doing so, supports and asserts DOE's role as the lead federal agency for information pertaining to the oil and gas sector during emergencies.

The ONG SCC will expand its charter to include the following: (1) support DOE's role in the annual updating of the emergency contact list and (2) in

event of a disruption, aid DOE in identifying owners and operators whose systems may have been impacted.

It is important to note that the primary information exchange should follow the bottom-up approach designed into the NRF and NIMS ICS frameworks, which reinforces that incident response ultimately occurs at a local level.

The overall flow of information under the NRF, with the first three recommendations, is illustrated in Figure 3. Rigorously following this process will enable high-quality information to quickly flow from industry participants to the government, and then between government agencies, to enable the government to quickly establish situational awareness. In turn, this situational awareness will help decision-makers to make more informed decisions on issues such as deployment of resources and issuance of temporary regulatory relief.

In anticipation of or during the course of a major event, the Secretary of Energy has in the past, and may in the future, request leaders of companies with operations that are directly or indirectly impacted by the event, to participate in group emergency meetings on short notice. Recommendations in this study for improving the flow of situational awareness information to the Department of Energy are expected to reduce the need for such meetings in the future. However, in order to ensure that the Secretary has ready access to the appropriate leaders in unusual and rare situations where the escalation to such a meeting is deemed appropriate, the industry will also undertake to secure and update at least annually an emergency leadership contact list for the Secretary's use of the top executive and/or senior officers at the entities in each of the U.S. upstream, midstream, and downstream oil, natural gas, and petrochemical sectors; industry, with DOE's support, will develop the mechanism to execute this process as part of the study implementation plan. Such leaders should possess the authority to execute or cause to be executed critical operating decisions in an emergency situation where time is of the essence and should be apprised of the importance of their timely participation when called upon to participate in such meetings.

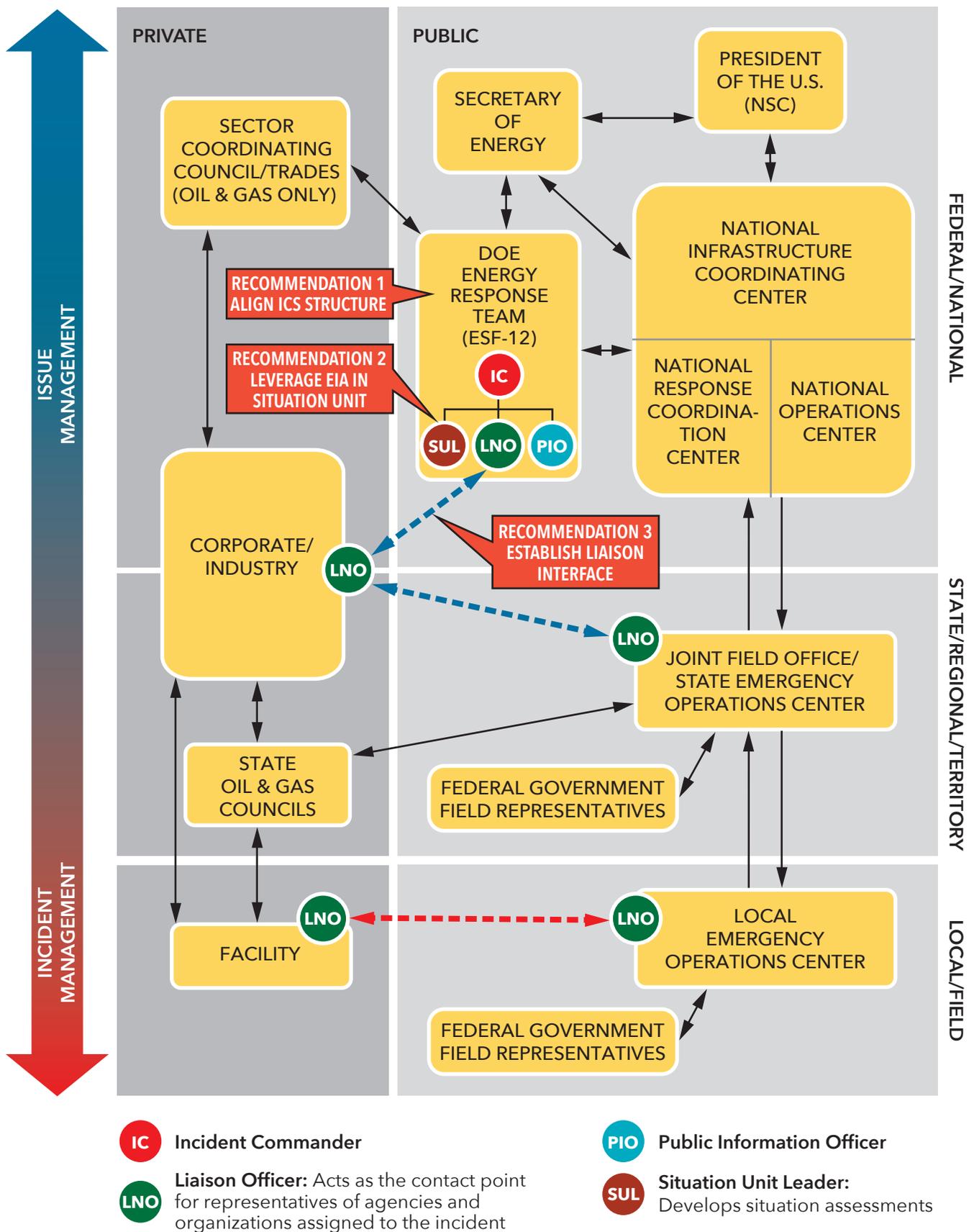


Figure 3. Role of Liaison Officer and Situation Unit Leader in the National Response Framework

DOE and company officials participating in these meetings would be expected to understand the importance of avoiding discussing or asking about actions or proprietary company information that might create potential antitrust concerns. The Secretary of Energy shall make every effort to ensure that discussions are limited to issues related to normalizing operations on an expeditious basis and do not result in inappropriate coordination among competing market participants.

Recommendation 4: Streamline and enhance processes for obtaining temporary regulatory relief to speed up recovery.

The oil and natural gas industry operates under a myriad of regulations that dictate product quality, ensure safe operations, and protect the environment. During supply chain disruptions, some regulations can impede the quick restoration of fuel supply. To speed up restoration of fuel supplies, the industry may request temporary relief from selective regulations that limit industry's ability to access fuel supply from other regions, use alternate modes of transportation, change supply routes, and/or use temporary distribution facilities. The following are examples of typical regulatory relief requests:

- Product specification waivers may be requested to expand the pool of available supplies across wider geographies. The reformulated gasoline waivers issued after Superstorm Sandy were flexibly worded from the Environmental Protection Agency (EPA), and set the new standard for how such waivers should be structured.
- Department of Transportation hours waivers (which increases flexibility for truck drivers) may be requested to help keep service stations supplied as drivers need to travel longer distances to load fuel from alternative terminals.
- Jones Act Waivers may be needed from the Department of Homeland Security to provide more marine shipping capacity, facilitating increased product supply to the impacted area.

The need for temporary regulatory relief is very time sensitive, and delays in the process can exacerbate fuel supply disruptions. Having an

accurate assessment of the supply situation from industry and a broad understanding of how supply disruptions will impact consumers will enable quicker and better decision-making by regulators to process waiver requests. Consistent with DOE's responsibilities under Emergency Support Function 12 (ESF-12), DOE can assist the government and industry by providing an accurate situation assessment for making regulatory relief decisions.

The main body of this report includes several suggestions to expedite temporary regulatory relief. Suggestions are also provided to improve regulatory certainty regarding the regulations being waived, such as the use of uniform language to remove ambiguity, and harmonize EPA and states waiver language. (The EPA "Fuel Waiver Concerning Shelby County, TN" issued on June 6, 2014, had clear language and should be used as a template for future waivers. A copy of this waiver can be found in Appendix E.) While enforcement discretion is sometimes used as a mechanism for temporary regulatory relief of facility regulatory requirements, care must be taken to avoid introducing legal vulnerabilities for industry that may reduce the effectiveness of this mechanism for expediting recovery from natural disaster.

Readiness through Sustaining Mechanisms

Sustaining emergency preparedness requires leadership commitment to maintain both a ready, capable workforce and adequate funding between emergency events. Further, it requires leadership commitment to update plans, maintain communications contacts and systems, conduct drills and exercises, and administer effective ongoing education and training programs. In the O&G sector, this is maintained through their safety and risk management systems, including business continuity and response plans, which are tested and improved continuously. **To sustain an effective emergency preparation and response process, DOE's emergency preparedness and response program needs to have an assigned process owner.** This designated role must be identified, resourced, staffed, and funded appropriately to fulfill the following responsibilities:

- Ensure harmonization of the ICS within the energy response team

- Clarify DOE-wide roles and responsibilities for individuals outside the response team
- Ensure that ICS members have appropriate skill, knowledge, and training
- Create and maintain training and education programs
- Coordinate drills and exercises (both among federal and state agencies as well as with the private sector)
- Continuously assess the maturity of DOE’s preparedness and response program, and make recommendations for improvement.

The ONG SCC, consisting of national oil and gas trade associations, has agreed to expand its role to provide assistance and support to both states and DOE to help sustain emergency preparedness and communications channels and to promote greater use of ICS within the industry.

Recommendation 5: States should increase engagement with the oil and natural gas industry in their energy assurance plans, and industry members should assist the states in such efforts.

Energy assurance plans are the mechanism for states and localities to plan for and respond to incidents involving the energy sector. Under the American Recovery and Reinvestment Act of 2009, DOE funded the development of new or improved energy assurance plans by 47 states, the District of Columbia, and 43 localities that participated. The plans are owned by the states and localities, and they incorporate approaches, tools, and other “best practices.” Additionally, a nationwide network was created including federal, state, and local governments and representatives from related organizations interested in sharing information to foster energy assurance and resilience.

To sustain this preparedness initiative and expand this capability, it is imperative that programs be staffed and resourced at requisite levels, in order to achieve a robust and lasting energy infrastructure resilience program for state and local energy assurance. These plans should identify infrastructure interdependencies for sup-

ply chains across multiple states and industries, and include measures for mitigating disruptions. Plans should also clearly define the stakeholder accountability, fuel supply, and distribution points for first responders.

The energy assurance plans should be integrated into other emergency response plans where applicable. State emergency managers should conduct joint planning and exercises with industry on a regular basis. Industry should participate in planning, training, and exercises at the local, state, regional, and national levels.

Owners and operators of energy infrastructure should be engaged in the planning process to provide direct supply chain expertise to state and local governments. Identifying and understanding interdependencies through coordinated state and industry energy assurance planning activities will also enable industry to incorporate the knowledge gained into their business continuity and emergency response plans.

Recommendation 6: Both DOE and states should establish routine education and training programs for key government emergency response positions.

To enhance competency, both DOE and states should identify the key positions in their organizations that are responsible for coordinating response to energy emergencies. New, existing, and incoming personnel filling those roles should be required to complete in-depth training on oil and natural gas supply chains, emergency plans, and emergency response frameworks. Establishing a Management of Change process for key positions will assist with identifying minimum training requirements for each position, and with ensuring that appropriate training and job hand-over are effectively managed as people move into and out of positions.

In addition, DOE and FEMA, working with applicable states, should conduct annual hurricane preparedness education for stakeholders across the energy sector, and the public.

The ONG SCC has adopted the American Petroleum Institute’s *Oil and Natural Gas Industry*

Preparedness Handbook as a common reference tool to explain the oil and gas supply chains, elements of planning and preparedness, the operational response models, potential regulatory relief actions, and collaboration between the industry and government. Jointly referencing this material will assist in developing a common understanding across both the public and private sectors.

Through the ONG SCC, industry should continue to provide support for education and training of DOE and state response teams and maintain and enhance the *Oil and Natural Gas Industry Preparedness Handbook*. Enhancements identified by this study include expanded discussions on supply chain complexities, interdependencies, and roles and responsibilities.

Recommendation 7: Both DOE and states should improve their comprehensive drill and exercise programs and include industry participation. Reciprocal invitations extended by companies to DOE and states are recommended.

Drills and exercises are critical to sustaining and improving response readiness. Drills and exercises provide the most effective method to ensure that response plans are well thought out, roles and responsibilities are understood, supply chain education is enhanced, and communications paths are effective. Well-designed exercises provide an ongoing feedback loop for continuous improvement that informs updates to current operations, response plans, and training programs. DOE should ensure that a dedicated training and exercise program is part of its ERT policies, plans, and procedures.

The drill and exercise program scope should involve other federal and state agencies, and should include participation by senior decision-makers and first responders. Additionally, drill and exercise plans should include the use of exercise objectives that adequately test the understanding of roles, communication processes, and interdependencies and should include industry participation. In addition, industry should invite DOE and state officials to participate in their drills and exercises, as applicable, in order to share sup-

ply chain knowledge and enhance effectiveness of the overall response system.

OTHER TOPICS OF INTEREST

Interdependencies

The Secretary of Energy’s study request identified as a topic of interest “actions to address the interdependencies between oil and natural gas systems and other critical infrastructure.” The actions are imbedded in the strategies above and may be summarized as follows:

Improve Preparedness:

- Ensure that interdependencies are addressed in State Energy Assurance Plans; increasing private-sector engagement in Plan development and reviews will improve the assessment of vulnerabilities and mitigation actions across the supply chains. The collaboration may also result in opportunities for companies to enhance their respective Business Continuity and Response Plans.
- Drills and exercises should be enhanced to test plans, interdependencies, and response priorities and protocols.
- Education materials, including the *Oil and Natural Gas Industry Preparedness Handbook*, will be expanded to provide considerations and examples of interdependencies.

Enhance Response:

- Unforeseen issues identified during a disruption will be prioritized and resolved through effective execution of the NIMS ICS and the NRF Request for Assistance process.

Legal Considerations

The Secretary of Energy’s study request identified as a key topic of interest any “legal, procedural or physical challenges to emergency response and restoration.” Prior NPC studies have noted that the antitrust laws may, at times, impose constraints on the ability of industry participants to respond collectively to a supply disruption resulting from a catastrophic event. In the vast majority of circumstances, those antitrust constraints

encourage the competitive process that, in nearly every instance, offers the most efficient and effective way to resolve supply disruptions following a natural disaster or other emergency. Further, the antitrust laws do not prevent a company from providing competitively sensitive information directly, and in confidence, to responsible government officials so that adequate information is available about supply conditions. All in all, the antitrust laws generally facilitate, rather than impede, the industry emergency supply response process.

The industry has a strong track record of effectively responding to emergencies while remaining compliant with the antitrust laws. In disaster (and non-disaster) situations, industry participants often cooperate to resolve supply disruptions through legal, arms-length arrangements such as bilateral product sales and swaps and development of technical standards that ease interoperability. Government and industry also have taken significant strides to improve the flow of information to government officials in charge of managing emergencies.

As noted in the 1991 NPC report, *Industry Assistance for Government*, bilateral exchanges of information between an individual market participant and government officials rarely pose anti-trust concerns, while the availability of accurate information about aggregate supply conditions may prompt companies to independently increase their supply to an affected area.

In this vein, market forces have served to quickly and adequately address supply disruptions in the past, including those caused by severe disasters. In the Federal Trade Commission's (FTC) 2006 *Investigation of Gasoline Price Manipulation and Post-Katrina Gasoline Price Increases*, for example, the FTC concluded that "suppliers responded quickly to the supply disruptions caused by the hurricanes" and there was "no evidence suggesting that the recovery should have occurred in a shorter timeframe." This prompt and effective response occurred without any direct inappropriate coordination among competing market participants, and thus in compliance with antitrust law. There is no reason to believe that additional centrally planned coordination would have aided

petroleum companies in improving their response to this type of major supply disruption.

During the study process, there was much debate on the options for information sharing and potential legal barriers to such information sharing. The options considered included models used in other sectors, formation of an Executive Advisory group representing a cross section of the petroleum industry, and an operating provision of voluntary agreements under the Defense Production Act of 1950 (DPA) to provide advice and counsel in larger supply disruptions. The DPA was enacted upon the commencement of the Korean War to provide the President with a broad set of authorities to meet national defense needs. Section 708 of the DPA authorizes the President, upon finding that certain conditions exist, to solicit the participation of industry representatives in voluntary agreements and voluntary actions for national defense purposes. Although Section 708 and Executive Order 13603 require or direct the federal agencies to promulgate implementing regulations, no such regulations have been promulgated. Section 708's inherent legal, structural, and procedural complexities limit its utility for emergency response coordination. It also fails to address a company's legitimate business concerns about exposing its non-public, proprietary, operating information to competitors. A more full discussion of the DPA is included later in the report and in Appendix F. With full consideration of all legal issues and options, the proposed enhancements to the information sharing process—through the disciplined bottom-up ICS approach, involving subject matter experts, supported by industry supply chain liaisons—will best serve the needs of all stakeholders.

Policy Consideration: Resiliency, Efficiency, and Environmental Regulations

In addition to the sustaining mechanisms mentioned above, an important component for maintaining and improving the nation's collective response to natural disasters is understanding how policies impact infrastructure decisions made by industry. Disruptions to the energy supply chain from natural disasters could potentially be ameliorated by new and/or expanded

infrastructure that connects demand centers with emerging unconventional oil and gas supplies. Expanded infrastructure adds flexibility to the supply systems and brings with it added robustness in the energy delivery mechanisms, which will enhance supply chain resiliency in the event of natural disasters.

Robust and resilient energy delivery infrastructure is vital to the nation's ability to develop its vast oil and natural gas resources, with far-reaching impacts to nearly every sector of the U.S. economy. In fact, significant midstream infrastructure investment will be prompted by rising production and consumption of oil, natural gas, and natural gas liquids (NGLs) in North America.⁷ According to a 2014 study conducted by energy analyst ICF International, more than \$640 billion in total midstream capital expenditures are forecasted in the United States and Canada from 2014 to 2035 (\$313 billion for natural gas, \$272 billion for crude oil, and \$56 billion for NGLs).⁸ Increasingly, this infrastructure is interdependent between natural gas, NGL, and crude oil; the lack of or delay in infrastructure development in any one area may hinder growth and development in other areas. For example, NGL infrastructure needs to be recognized as a valuable component in the natural gas supply chain and has a significant and growing role in infrastructure resiliency.

As policies are considered and infrastructure designs are reviewed, policy makers should consider not only a project's environmental impact, but also infrastructure resiliency and overall energy efficiency. Complex and duplicative regulations cause delays in the development of new infrastructure and thwart investments, impeding infrastructure development. Therefore, it is imperative that industry collaborate with stakeholders such as DOE to ensure that the permitting and regulatory process allows for improvements to resiliency through energy infrastructure investment.

⁷ The midstream industry includes natural gas gathering systems, processing, and transmission pipelines. See Appendix H for a comprehensive description of the natural gas midstream industry.

⁸ INGAA Foundation Report, Prepared by ICF International, "North American Midstream Infrastructure through 2035: Capitalizing on Our Energy Abundance," March 18, 2014.

CONCLUSION

The government and industry both share a commitment to mitigating the impacts of natural disasters to the energy supply systems of the country. The nation will benefit through actions focused on improving systems that enhance preparedness, improve response, and speed system recovery.

Implementing the study recommendations will build upon the progress already underway in advancing DOE's emergency response capability. Implementation of ICS, enhancing organizational capabilities, and building sustaining mechanisms—including education, training, drills, and exercises—within DOE are key actions to substantially improve situational awareness and the Department's capability to respond to disasters.

Similarly, industry recognizes the value of continuous improvement in company-specific activities, and also in support of DOE efforts. Accordingly, the study recommends that industry:

- Establish the link between company liaisons and DOE ERT to support situation assessment.
- Through the ONG SCC, expand support of preparedness and response including education and outreach, training, and joint government-company drills and exercises.
- Support government efforts to enhance their energy assurance plans including consideration of interdependencies.

NPC and DOE leadership anticipate that the recommendations will start to be implemented in 2015 in advance of the hurricane season, and a joint exercise will be conducted in 2015 to test the key recommendations of the study. Leadership commitment is a core element for a systems approach to incident preparedness and response, and a theme throughout the recommendations. Senior government officials and industry executives, alike, set expectations and provide the resources for staffing, training, and operations of their emergency response program. Capturing the benefit expected from the implementation of the study recommendations requires continuing leadership commitment, visible within respective organizations, and

accountability at all levels. The nature of managing significant emergencies and events requires that participants at all levels have functional expertise in the systems presented in this report, including agency and industry executives.

Approval of this report represents the NPC membership's commitment to support DOE

through the implementation of these recommendations. While managing disaster response will always entail uncertainties and raise new challenges, creating a dynamic response system and mechanism for continuous improvement will serve the public, restore energy delivery as quickly as possible, and minimize adverse impacts to public health and the economy.



Chapter 1

CASE FOR ACTION

Natural disasters can disrupt energy supplies, and in extreme cases supply disruptions can have far-reaching and significant impacts to communities and the economy. The government and industry both have vital roles in restoring fuel supply systems for the well-being of the nation and its citizens after a natural disaster. The federal government's role in emergency preparedness, response, and recovery efforts should support the needs of the public. Core elements of this role are: supporting efforts of industry to restore and secure critical resources, including responsible alleviation of lower value regulatory obstacles to recovery; assisting response efforts by prioritizing additional resources when appropriate; and facilitating communication between coordinating government entities at the federal and state levels and with the public. Another important element of the government's role is the development of broad situational analysis. The oil and gas industry has the primary role in helping our nation to prepare for, respond to, and recover from the broad range of potential emergency situations that can disrupt the normal operations of oil and natural gas supply systems. Both the federal government and the oil and natural gas industry share the goal of returning the energy system to normal operations after a disruptive event such as a natural disaster.

The U.S. oil and natural gas supply chains are highly resilient. This resiliency is evidenced daily as companies involved in the production and distribution of fuels routinely make adjustments to their distribution system to compensate for both planned and unplanned temporary disruptions while maintaining a constant fuel supply to cus-

tomers. Recent storm activity has highlighted the importance of enhancing and maintaining this resiliency, and reinforced the need for industry and government to institutionalize processes with continuous improvement measures to effectively respond to energy supply disruptions.

DOE and the oil and gas industry seek to enhance preparations, interactions, and communications to support response and recovery from the impacts of disruptions to the supply system. Specifically, the following factors affecting government preparation for and response to oil and natural gas disruptions have been identified in this and the aforementioned prior studies as warranting action:

- Varied levels of understanding of the dynamic nature of the oil and gas infrastructure and market among government decision-makers
- Difficulty in collecting information for developing broad situation assessments and sharing these assessments in an expedient and efficient manner
- Communication issues and ineffective collaboration between and within federal agencies and the oil and gas sector due to a lack of common formal processes, organizational structures, and procedures
- Difficulty maintaining a trained, efficient response organization within some government agencies due to personnel turnover and the lack of ongoing training programs
- Inconsistent integration of lessons learned from events and drills into continuous improvement activities.

OIL AND NATURAL GAS INDUSTRY DYNAMICS

Understanding the dynamics of the oil and gas supply chain is very important in the situation assessment of an energy disruption after a natural disaster. Changes to the flow of refined petroleum products and natural gas mean that local and state governments need to be more perceptive to emergencies that are taking place outside of their jurisdictional area. Development of adequate situation assessments requires that the federal government knows who to contact, what information is required/relevant, and how to compile that information into an aggregate view.

The oil and gas industry has changed substantially over time, but particularly in recent years. The robustness of the petroleum and natural gas systems as a whole have improved within the last three to five years and are expected to continue to do so. Keeping current with these industry dynamics is critical to communication and response during emergencies. The increased North American oil and gas production and the associated construction of new infrastructure include the following:

- Domestic crude oil production has increased by 1.64 million barrels per day between 2000 and 2013.¹
- Natural gas production has increased 3,818 billion cubic feet annually between 2000 and 2011.²
- Total liquids pipeline mileage has grown by 9.3% in the last 5 years, with crude oil pipeline mileage growing 15.5% since 2009.³
- Crude oil pipeline capacity will increase significantly over the next 20 years—an average of 0.2 million barrels per day of capacity growth is expected per year from 2014 to 2035.

1 U.S. Energy Information Administration, Independent Statistics & Analysis, “Petroleum & Other Liquids,” www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrfpus2&f=a, accessed November 2014.

2 U.S. Energy Information Administration, *Annual Energy Review 2011*, September 2012, Table 6.2. <http://www.eia.gov/totalenergy/data/annual/pdf/aer.pdf>.

3 Association of Oil Pipe Lines, “About Pipelines,” <http://www.aopl.org/pipeline-basics/about-pipelines/>, accessed November 2014.

- Natural gas pipeline capacity will need to increase by approximately 40 billion cubic feet per day between 2014 and 2035, with the greatest increase over the next 5 to 10 years.
- Natural gas liquids pipeline capacity will need to increase by 3.1 million barrels per day between 2014 and 2035, with the greatest increase over the next 5 to 10 years.⁴

The oil and gas industry has been moving away from the integrated business model that includes crude oil production through to retail, to more specialization. Retail stations were spun off from most companies a number of years ago. About 50% of fueling stations in the country carry the brand of a major oil company,⁵ but only 6% of these fueling stations are actually owned and operated by the oil company whose name they bear. Some companies have separated their distribution and storage businesses into separate master limited partnerships, or sold them to other midstream companies. Additionally, several integrated companies have split their production business from their refining.

Today some oil and natural gas companies participate in only certain segments of the supply chain, such as an oil or natural gas producer, a pipeline company, a petroleum refiner, or a products terminal operator. In sum, the operation of the industry as a whole is the result of the aggregated efforts of all of these individual participants in the supply chain. This diversity creates options for how companies may respond when components of the system are disrupted.

INSIGHTS FROM RECENT EVENTS

This study focused on understanding the factors affecting preparation for and response to major disruptions to the energy supply chains from natural disasters. Analysis of each of the potential vulnerabilities noted below yielded insight into systemic issues that warrant consideration.

4 INGAA Foundation Report, Prepared by ICF International, “North American Midstream Infrastructure through 2035: Capitalizing on Our Energy Abundance,” March 18, 2014.

5 2013 NACS Retail Fuels Report, “Consumer Research: What Do Consumers Think about Fuels Retailers and the Future?” http://www.nacsonline.com/YourBusiness/FuelsReports/GasPrices_2013/Pages/What-Do-Consumers-Think.aspx.

Understanding the Complex and Dynamic Nature of the Oil and Gas Supply Chain

Expansion of the oil and natural gas supply chain infrastructure, diversification of asset ownership, and increasingly complex market structures can create a challenge when developing and understanding situational awareness and recovery plans/efforts during a crisis. Federal, state, and local government understanding of ownership across assets and commodities is essential to support response to events while providing for the needs of the communities. Individual companies are typically effective at addressing their respective local issues and generally communicate well to local responders and with emergency service providers (fire, police, etc.). At the national level, however, a strong link has not been established between impacted companies and governments to communicate the status of their supply system, damage reports, outage durations, expected restart, and assistance needs. Due to changing industry segmentation (along both key components and geographies of the supply chains), and a reduction in the number of fully integrated companies who can provide unique, aggregate insights, state and federal government response centers cannot rely on interpersonal relationships to collect, aggregate, and analyze data used for response collaboration and decision-making.

Understanding supply chain interconnectivity is also an important area for consideration. The U.S. Gulf Coast, with its heavy concentration of refining capacity, supplies fuel not only within its region, but all along the U.S. East Coast and even into the Midwest. Numerous product terminals in New York Harbor rely on receipt of product largely via pipeline from the Gulf Coast, as Northeast refiners do not produce enough supply for the region. The impact of storm damage on areas with a high density of refineries or product terminals on the supply chain in distant areas of high population density was exhibited during hurricanes in 2005 and 2008. In those situations, storm damage on the Gulf Coast disrupted local fuel supply to the East Coast. In 2012, storm damage from Superstorm Sandy reduced product demand along the East Coast and created product containment concerns for the Gulf

Coast refiners as there was not enough storage for the finished products in the Gulf Coast. Other regions are likewise vulnerable to supply disruptions due to natural disaster impacts in distant locations, such as Mount Belvieu, Texas, with its concentration of natural gas and natural gas liquids processing, and Los Angeles, California, with its refining density, unique logistics, and product specification requirements. By developing a better understanding of such dependencies within the energy sectors that supply fuels to other areas, emergency response managers are better equipped to establish appropriate restoration priorities and resource allocation. A comprehensive understanding of this interconnectivity is essential to anticipating the cascading impacts from an event.

Situation Assessment Development

During times of emergency, DOE is responsible for collecting, evaluating, and sharing information on energy system damage and estimations on the impact of an energy system outage within affected areas. Additionally, DOE is expected to provide information concerning the energy restoration process and to establish a situation assessment to expedite regulatory relief through other agencies with legal authorities. Companies throughout the oil and gas industry work with the government to provide information about fuel availability, back-up supplies, and estimates on system restoration. Companies may also work with the government to request assistance or to secure temporary relief from regulatory restrictions in order to expedite the restoration of fuel supplies.

The development of accurate area-wide supply assessments is hindered, and response times can be lengthened by the absence of well-established communications processes. Development of accurate and timely situation assessments require a strong understanding of the fuel supply chain, in particular the difference of commodity/product ownership vs. asset ownership. That understanding combined with standard, aligned communication paths and clear organizational authority will better position the DOE as it coordinates federal efforts related to energy restoration.

Communication and Collaboration

The National Response Framework (NRF) is a guide to how the nation responds to all types of disasters and emergencies. It is built on scalable, flexible, and adaptable concepts identified in the National Incident Management System (NIMS) to align key roles and responsibilities across the nation. The purpose of NIMS is to provide a common approach for managing incidents. Although incidents typically begin and end locally, there are instances where success depends on the involvement of multiple jurisdictions, levels of government, functional agencies, and/or emergency-responder disciplines. These instances necessitate effective and efficient coordination across multiple organizations and activities. NIMS improves the effectiveness of emergency management regardless of size or complexity of the threat or hazard.

Although NRF describes how government and industry should respond to emergencies at a national level, it does not provide guidance on formal mechanisms for communication and collaboration between federal agencies and the oil and natural gas industry. ICS is the all-hazard incident management system that is adopted by NIMS to provide a common organizational structure and communication channels to enable an efficient and effective response. Inconsistent application of ICS within DOE has hampered communication between and within government agencies and industry.

Response Organization Capability

As industry dynamics change and as organizations and personnel turn over, processes and mechanisms need to be in place to maintain organizational readiness. Maintaining trained, competent response organizations within governments (i.e., staff who are knowledgeable in supply chains/complexities, preparedness, response processes, and industry contacts/capabilities/resiliency initiatives) is challenging and complicated by:

- High turnover of government officials across the multiple agencies involved with emergency response

- Relative infrequency of natural disasters and lack of first-hand experience in crisis response
- Lack of understanding of supply chains
- Need for education, training, drills/exercises in areas of strategic importance.

Without an understanding of supply chains and markets and the primary factors that impact their functioning, effective communication and coordination between responding entities is subject to confusion, misunderstanding, and potentially misdirected or ineffective actions. Some recommendations identified in individual after-action reports (and reflected in Appendix C, After-Action Report Summary) point to a varied level of understanding of oil and natural gas supply chains in particular.

As a case in point, during Superstorm Sandy, some government agencies were frustrated by terminal operators' inability to communicate inventory levels to government or to allocate product. These requests were misdirected to the terminal operator, who was not the product owner and was unable to supply the requested information or make product allocations due to legal constraints. While a company may own and operate a terminal, it does not necessarily own the product that is stored in its storage tanks. The terminal owner may only have custody of the product but not ownership. Thus, as with the common carrier pipelines, the owner/operator of the terminals may not have decision-making authority with regard to the disposition of the products held in its storage tanks. The terminal operators are also not permitted, by regulation, to divulge the identity of the parties that own the product stored at the terminal. Not understanding this constraint resulted in unnecessary frustration and delay. Trained, knowledgeable response staff should be aware of these legal constraints and understand what information they need to perform their duty and the proper way to ascertain this information.

When the impact of natural disasters on the whole supply chain is not well understood, this can also cause delays in product specification regulatory relief. During previous Gulf Coast hurricanes, the granting of product specification

regulatory relief lagged the effective window for industry action to supply alternate product along the Atlantic Coast. Because government agencies did not immediately understand the subsequent impact of a fuel disruption in the Gulf Coast on their region, they were slow to react. Government officials who experienced these earlier events were able to appropriately address situations like this in a more timely fashion in Superstorm Sandy. It is critical for emergency response managers to understand the fuel supply chains that service their states so they are prepared to remove regulatory limitations that interfere with the supply of fuels to consumers. Not understanding the interconnectivity of the supply chain can lead to insufficient preparation and delay in response efforts.

Continuous Improvement and Lessons Learned

Each supply disruption presents unique challenges to emergency response, which are best handled through a disciplined approach. Lessons learned from each event need to be assessed

and incorporated into continuous improvement activities, as appropriate. This ability to learn and improve from each event is especially important given the limited number of actual events or even drills and the potential loss of institutional memory between events. A disciplined approach to continuous improvement and utilization of lessons learned has become a widespread industry practice, and there is an opportunity for similar advances to be made by state and federal government agencies.

Leadership plays an important role in embedding the culture of continuous improvement. It is an ongoing process requiring effort, commitment, and resources. Leaders should be active in the planning and preparation activities to ensure that the emergency response and recovery effort can be effectively and efficiently executed if ever needed. Supportive leadership that promotes ongoing advance planning along with preparation and incorporation of lessons learned will enable emergency response teams to better manage situations they had not previously encountered.



Chapter 2

EMERGENCY RESPONSE OPERATIONAL FRAMEWORKS

A disciplined approach to emergency and crisis management implemented prior to, and executed rigorously during an event provides the most efficient and effective response and speeds recovery. The establishment and rigorous implementation of clear communications protocols are critical to a disciplined approach. The National Response Framework (NRF) provides the communication flow structure between industry and government at the local, state, and federal levels, and the Incident Command System (ICS) provides the organizational command structure and processes implemented within each participating entity that enables coordination between entities. ICS is a well-established organizational framework and is widely used in emergency response communities across the country, internationally, and at all levels of government. ICS, when adopted without modification by all organizations, aids effective response and recovery. The NRF and ICS are applicable and effective for incidents both small and large, regardless of location.

The operational work of responding to an incident is managed at the local level and is called *incident management*. The work of responding to

The *Incident Command System* (ICS) is a management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure.

the larger impacts of an incident is typically managed at the regional or national level, and is called *issues management*. Incident management typically deals with tactical operations of response while issues management is concerned with deploying supplemental resources and aggregating information to understand and deal with the broader and cascading impacts of an event.

The recommendations in this chapter focus at the level of issues management and they address:

- Aligning proven operational models for emergency response
- Leveraging existing skills and competencies in DOE’s Energy Response Team (ERT) structure to improve situational analysis and response
- Strengthening communication interfaces
- Expediting recovery through streamlining temporary regulatory relief.

DOE, based on its remit and capabilities, should focus on *issues management*, and therefore should interface with industry at the top levels of the response model as depicted in Figure 2-1.

NATIONAL RESPONSE FRAMEWORK AND THE NATIONAL INCIDENT MANAGEMENT SYSTEM

The National Response Framework is part of the National Preparedness System, as established by Presidential Policy Directive 8: National Preparedness (PPD-8). The goal of PPD-8 is “strengthening the security and resilience of the United States through systematic

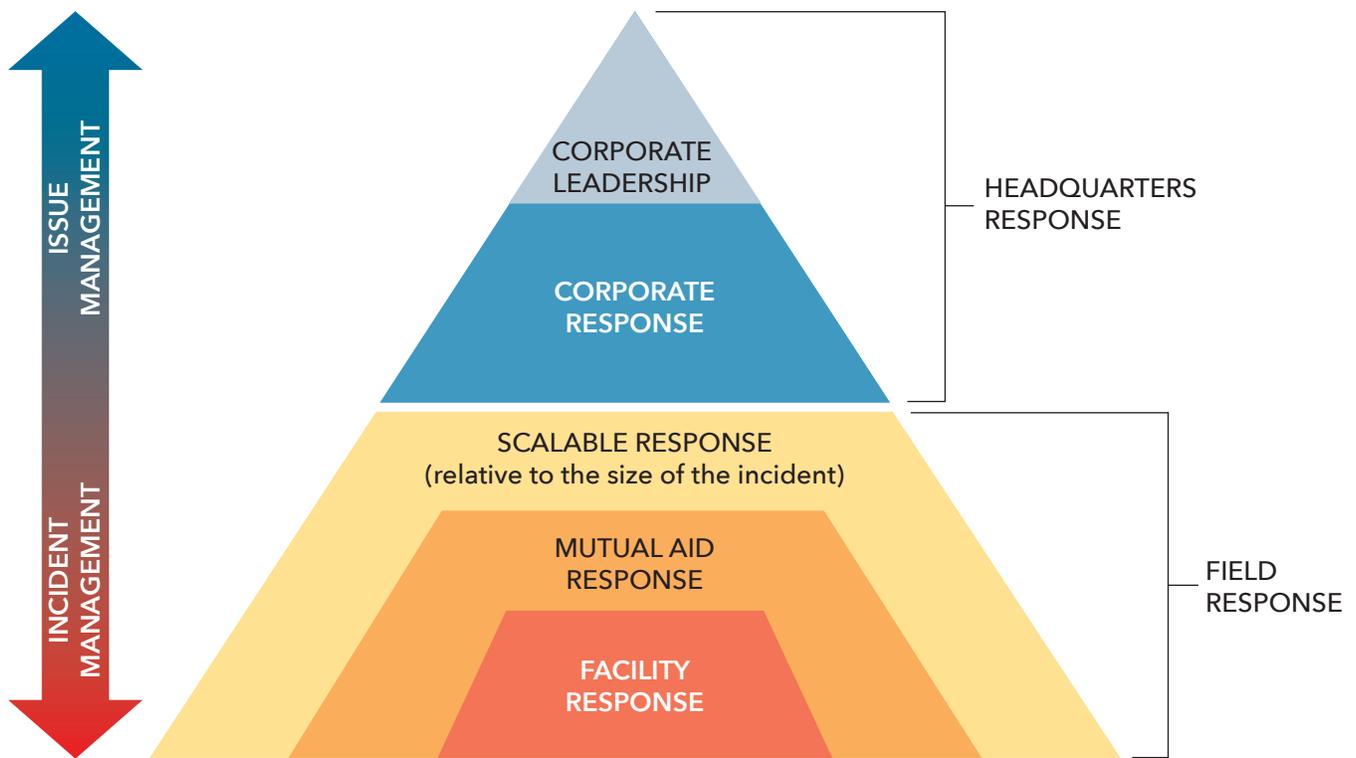


Figure 2-1. *Company Incident Response Model*

preparation for the threats that pose the greatest risk to the security of the Nation.”¹ The NRF is the framework under which government agencies, departments, and responders at the local, state, and federal levels interact with industry to respond to all types of disasters and emergencies. It establishes an organizational structure whereby information is exchanged between the local, state, and federal levels to enable decision-making and resource distribution to respond to large nationally significant incidents. It is built on scalable, flexible, and adaptable concepts identified in the National Incident Management System (NIMS) to align key roles and responsibilities across responding organizations through the use of the ICS within each organization. Where NIMS is a systematic approach to managing an incident, including resource management, communications, and command, ICS provides the organizational

structure necessary to implement the NIMS approach.

Figure 2-2 illustrates the three levels of government (federal, state, and local) and the two levels of industry (corporate and facility) potentially involved in a response and how information is shared between organizations. Incident management occurs at the local/field level and is typically carried out by the impacted company in coordination with the local Emergency Operations Center (EOC). Information and requests for further assistance flow up to the state and corporate levels and then on to the federal level, if appropriate, to enable federal and corporate teams to carry out issues management.

The Emergency Support Functions (ESFs) established under the NRF “provide the structure for coordinating federal interagency support for a federal response to an incident. They are mechanisms for grouping functions most frequently used to provide federal support to states and federal-to-federal support, both for declared disasters and emergencies

¹ U.S. Department of Homeland Security, *Overview of the National Planning Frameworks*, July 2014. http://www.fema.gov/media-library-data/1406718145199-838ef5bed6355171a1f2d934c25f8ado/FINAL_Overview_of_National_Planning_Frameworks_20140729.pdf

under the Stafford Act and for non-Stafford Act incidents.”² DOE is the ESF coordinator for ESF-12 – Energy. DOE is also the primary agency for ESF-12, with responsibility to maintain continuous and reliable energy supplies for the United States through preventive measures and restoration and recovery actions. Specifically, the scope of responsibilities for ESF-12 includes the following:

- Collects, evaluates, and shares information on energy system damage and estimations on the impact of energy system outages within affected areas
- Provides information concerning the energy restoration process such as projected schedules, percent completion of restoration, and geographic information on the restoration
- Provides technical expertise to the utilities, conducts field assessments, and assists government and private-sector stakeholders to

² Federal Emergency Management Agency, “Emergency Support Function Annexes: Introduction,” January 2008. <http://www.fema.gov/pdf/emergency/nrf/nrf-esf-intro.pdf>.

overcome challenges in restoring the energy system.³

The discipline of ICS, utilizing the systematic approach laid out in NIMS, should provide the structure for DOE to act as the coordinating, primary agency for energy infrastructure assessment, repair, and restoration within the federal government as part of the NRF. The implementation of ICS requires that response team members are thoroughly trained on ICS management principles, roles, responsibilities, and common terminology. Implementing ICS as designed includes the following benefits:

- Standardized organization structure with clearly defined roles and responsibilities
- Integrated communications that facilitate escalation of issues, situation assessment, common operating picture, and coordination of response across agencies and sectors

³ Federal Emergency Management Agency, “Emergency Support Function #12 – Energy Annex,” January 2008. <http://www.fema.gov/pdf/emergency/nrf/nrf-esf-12.pdf>.

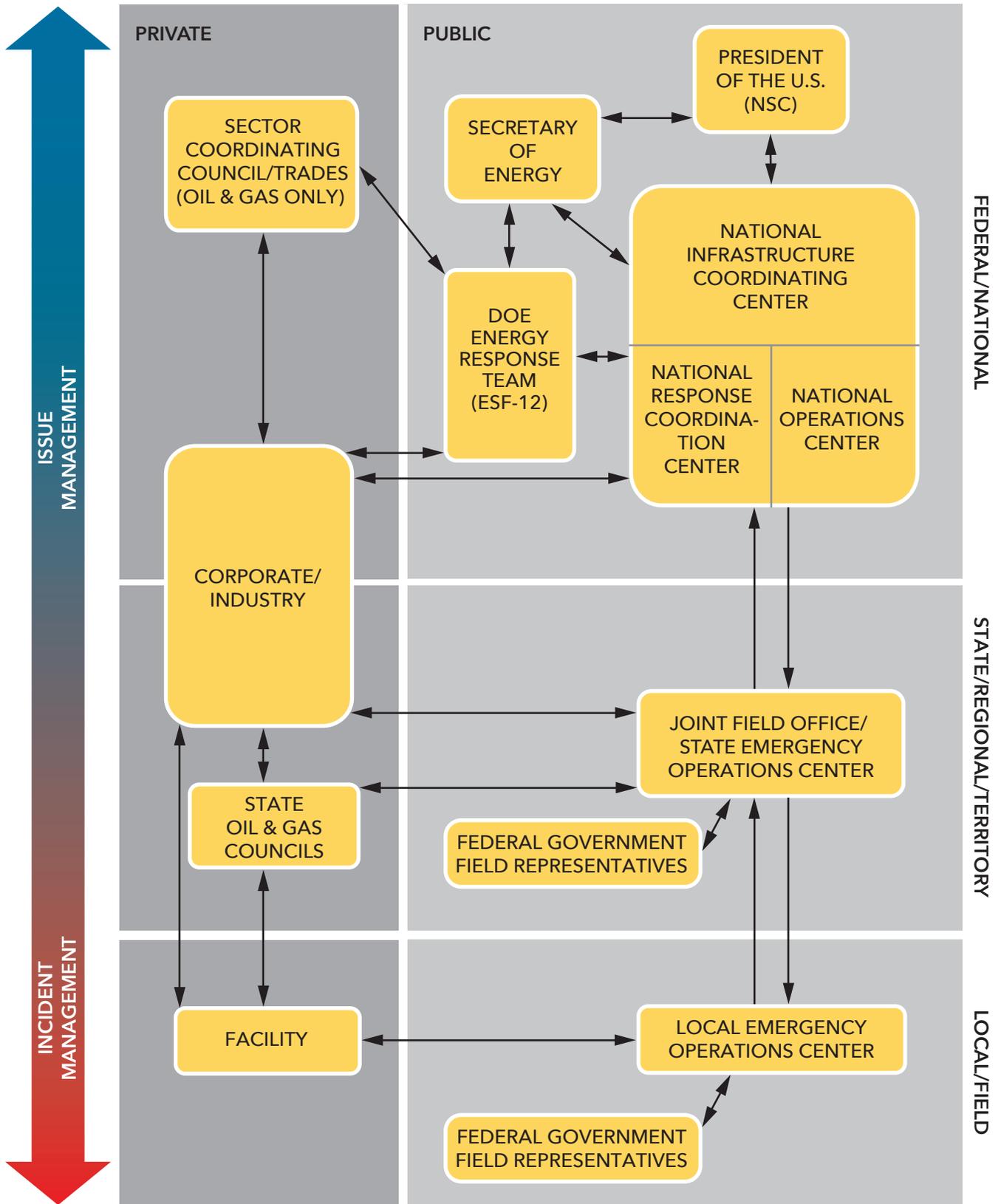
NIMS ICS

The Incident Command System (ICS) was originally developed in the 1970s by fire services in California in the wake of devastating wildfires where 16 lives were lost, 700 structures were destroyed, and one-half million acres were burned. Responding agencies cooperated to the best of their ability, but faced numerous problems with communication and coordination. After the fires, Congress mandated the design of a system that would “make a quantum jump... to effectively coordinate interagency action and allocate...resources.” ICS was developed as a management method to clarify command relationships and use of mutual aid for large-scale incidents. Although originally developed to address fires, ICS is now applied to many other types of incidents, including those faced by the energy sector. The overarching goal of ICS is to enable cooperation and inter-operability among responding

private and public organizations (such as company emergency response teams, fire departments, and the Coast Guard) with maximum flexibility for achieving strategic goals.

The National Incident Management System (NIMS) adopted ICS as its command and control system, delineating job responsibilities and organizational structure for the purpose of managing day-to-day operations for all types of emergency incidents. The ICS structure may be small initially, but the flexibility of the system allows the structure to expand and adapt to the evolving needs of the response. NIMS provides a consistent, flexible, and adjustable national framework and standardized organizational structures, within which government and private entities at all levels can work together to manage domestic incidents, regardless of their cause, size, location, or complexity.

NATIONAL RESPONSE FRAMEWORK



Incident Management: Management of/response to a single event
Issue Management: Management of the cascading effects resulting from a single event

Figure 2-2. National Response Framework

ERT Energy Response Team

The Energy Response Team is a scalable entity designed to respond to an event based on size and potential impact. By leveraging information sharing and coordination mechanisms across all stakeholders, the ERT allows DOE to support and assist in the response and recovery efforts of a coordinated response at the national, regional, and local levels.

ESF Emergency Support Function

ESFs provide the structure for coordinating federal interagency support to an incident. They are mechanisms for grouping functions most frequently used to provide federal support to states, both for declared disasters and emergencies under Stafford Act and non-Stafford Act incidents.

EOC Emergency Operations Center

A central command and control facility responsible for carrying out the principles of emergency preparedness and emergency management functions. EOCs integrate into the Incident Command System (ICS) during large-scale events. EOCs operate at the local, state, and federal levels.

Federal Government Field Representatives

Federal Government Field Representatives include those individuals from the various federal agencies (e.g., DHS, FEMA, USCG, USACE, etc.) that are deployed throughout the impacted area to contribute to the response and recovery efforts. These individuals typically have specific responsibilities for their agency, but during the course of the response they are often in a position to provide broader support to the state and private sector for management of the incident.

JFO Joint Field Office

A component of the Incident Command System. Federal support to states is generally coordinated through a Joint Field Office (JFO). The JFO provides the means to integrate federal resources and engage the impacted state(s) during an emergency. Senior officials from the state and key federal departments form a Unified Coordination Group within the JFO to achieve shared objectives.

NICC National Infrastructure Coordinating Center

A component of the NOC. The NICC is an information and coordination hub that maintains situational awareness of the nation's essential Critical Infrastructure (CI). The NICC shares threat information, in order to reduce risk, prevent damage, and enable rapid recovery of CI assets from incidents caused

by natural disasters, attacks, or other emergencies.

NOC National Operations Center

The NOC coordinates information sharing to help deter, detect, and prevent terrorist acts and to manage domestic incidents. Information on domestic incident management is shared with Emergency Operations Centers at all levels through the Homeland Security Information Network.

NRCC National Response Coordination Center

A component of the NOC. The NRCC is a multi-agency center that coordinates the overall federal support for major disasters and emergencies, in support of operations at the regional-level. The FEMA Administrator, or his/her delegate, activates the NRCC in anticipation of, or in response to, an incident. The NRCC activates and manages the appropriate Emergency Support Functions during an incident.

NRF National Response Framework

The National Response Framework, a component of the National Strategy for Homeland Security, guides the nation in how all-hazards responses are coordinated and conducted by providing the structure and mechanisms for incident response in a national level policy. The NRF builds upon the scalable, flexible, and adaptable Incident Command System (ICS) structure, to align key roles and responsibilities across the nation, linking all levels of government, nongovernment organizations, and the private sector. ICS provides the template for managing incidents regardless of size, scope, or cause.

NSC National Security Council

The National Security Council is the President's principal forum for considering national security and foreign policy matters with his senior national security advisors and cabinet officials. The Council also serves as the President's principal arm for coordinating these policies among various government agencies.

SCC Sector Coordinating Council

SCCs are self-organized and self-governed bodies that serve as principal sector policy coordination and planning entities. Membership composition varies from sector to sector; however, membership is representative of a broad base of owners, operators, associations, and other entities. The SCCs enable owners and operators of critical infrastructure to interact with the government on a wide range of sector-specific strategies, policies, activities, and issues.

- Common terminology essential to any emergency management system, especially when diverse or other than first-response agencies are involved in the response
- Unified command structure that facilitates alignment across jurisdictions
- Consolidated Incident Action Plans that provide measurable objectives and coordinated response
- A manageable span of control that promotes organizational effectiveness
- Comprehensive resource management for efficient allocation of resources.

Critical to effective response is a standardized, rehearsed approach to expand and escalate response support and communications as the event unfolds. As mentioned earlier in this report, the National Response Framework and National Incident Management System provide the frameworks to coordinate communications and collaboration across multiple levels of governments and industry participants using a well-established, disciplined, standardized approach.

Implementation of the ICS, under NIMS, however, is not consistent across organizations and first responders at all levels of government. Although many agencies at local, state, and federal levels use ICS, the variability in application undermines the efficiencies sought through standardization—a notable example is the different organization structure and processes adopted by DOE’s ERT. A consistent, disciplined process, for communication between federal agencies and with industry can lead to more timely and quality information to support situational awareness and decision-making during natural disasters.

Recommendation: Harmonize DOE’s energy response team structure with NIMS Incident Command System (ICS).

The ICS organizational structure is composed of modular components so that personnel and equipment are deployed only as needed, maintaining a manageable span of control and minimizing disruptions to the normal operations of responding organizations. The ICS organization is built

out under the Incident Commander through five major components:

- Command Staff
- Operations Section
- Planning Section
- Finance/Administration Section
- Logistics Section.

Depending on the mission and authority of the organization, an Intelligence/Investigation Section may be added to the General Staff (made up of Operations, Planning, Finance, and Logistics).

Certain ICS roles are pivotal to ensuring DOE’s success in fulfilling its mission as lead agency for ESF-12, discussed earlier. This study and its recommendations focus on the roles shown in yellow in Figure 2-3. These roles are responsible for the collection, analysis, display, and communication of the information related to the situational status of the energy supply chain during the scenarios considered in this study. The roles and short descriptions of each are as follows:

- **Incident Commander**

The Incident Commander is responsible for all aspects of an emergency response, including quickly developing incident objectives, managing all incident operations, application of resources, and responsibility for all persons involved. The incident commander sets priorities and defines the organization of the incident response teams and the overall incident action plan. The role of incident commander may be assumed by senior or higher qualified officers upon their arrival or as the situation dictates. Even if subordinate positions are not assigned, the incident commander position will always be designated or assumed. The incident commander may, at his/her own discretion, assign individuals, who may be from the same agency or from assisting agencies, to subordinate or specific positions for the duration of the emergency.

Specific to the DOE ERT, the Incident Commander would have overall responsibility for the DOE ERT including all the duties listed above during response to supply chain disruptions.

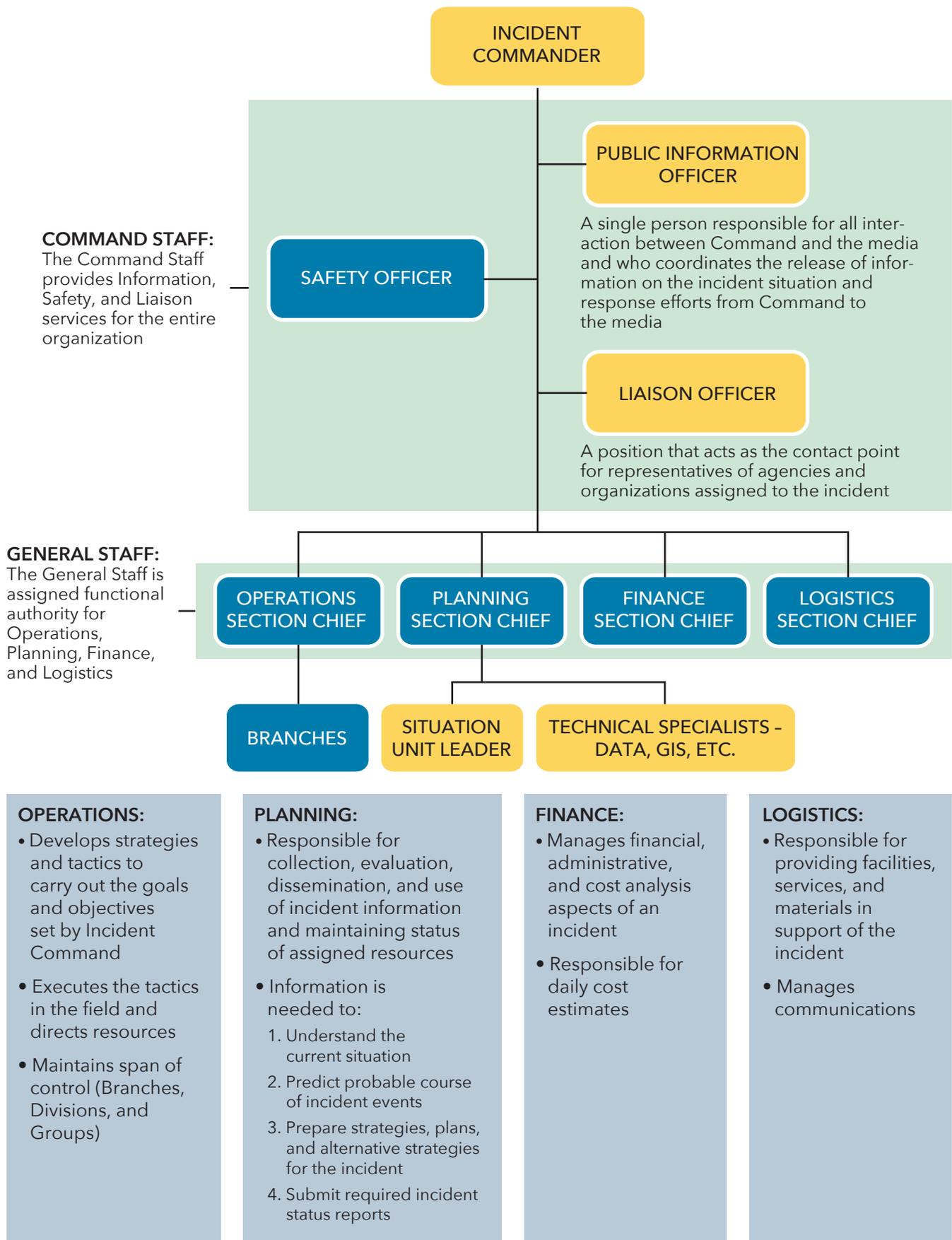


Figure 2-3. Incident Command System Organizational Structure

- **Public Information Officer**

The Public Information Officer is the communications coordinator or spokesperson of certain government organizations. The primary responsibility of a Public Information Officer is to provide information to the media and public as required by law and according to the standards of their profession.

Specific to the DOE ERT, the Public Information Officer is providing information to the public via press releases or public meetings. The Public Information Officer would also be responsible for the release of the DOE Situation Report (SITREP).

- **Liaison Officer**

A Liaison Officer is a person who liaises between two organizations to communicate and coordinate their activities. Generally, liaison officers are used to achieve the best utilization of resources or employment of services of one organization by another. They also work to achieve mutual understanding or unity of effort among disparate groups. For incident or disaster management, liaison officers serve as the primary contact for agencies responding to the situation.

Specific to the DOE ERT, the Liaison Officer would be the initial point of contact between the DOE ERT and the owner/operators.

- **Situation Unit Leader**

The Situation Unit Leader is a person who is responsible for the collection, processing, and organizing of all incident information within the Situation Unit. The Situation Unit Leader may prepare future projections of incident growth, maps, and intelligence information.

Specific to the DOE ERT, the Situation Unit Leader would be responsible for the collection and analysis provided by the owners and operators. This would include the current situational status and a projection of cascading effects of the incident.

- **Technical Specialists—Data, GIS, etc.**

The various Technical Specialists including, but not limited to, data analysts and Geographic Information Systems (GIS) experts, perform

very important functions specific to their subject matter expertise. The data analysts perform the critical function of taking raw data from multiple sources and analyzing it to develop an overall situational status display.

Specific to the DOE ERT, the GIS experts use their expertise to display current information in a GIS format. These GIS displays can be used for the Incident Command as well as potentially used in communicating with the public.

COMMUNICATION PROTOCOLS AND STAFFING

Effective emergency response requires timely and accurate information about the current state of an incident, incident potential, and the probable impacts of the incident. During the study engagement sessions, the topic of information sharing was widely discussed. The original focus of the engagement was on methods for improving the exchange of data, but most public agencies (federal, state, and local) communicated that the real need was high-level situational status about impacts from supply chain disruptions as well as any cascading effects. The engagement sessions identified a number of good practices for successful information-sharing programs, such as developing industry and government contacts and processes before events occur, determining the appropriate level of information that should be needed for decision-making, and protecting proprietary data through statutes or other mechanisms. A common theme was a need for a direct connection between the agency and industry partners (owners/operators). A summary of feedback from engagement sessions can be found in Appendix D.

Often, the impacts of events can be unpredictable, and even when individuals, communities, organizations, and governments are prepared, there are challenges to recovery. Timely and accurate communication is one of the most difficult challenges during an incident. The unpredictability of events and their impacts present a challenge for the government, in particular, to identify the impacted services, responsible parties, owners, operators, and suppliers. In the oil

and natural gas sector, identifying the impacted owner or operators can be especially challenging for those unfamiliar with the supply chain. The market is no longer composed of large integrated companies, and the party having custody of a product is not often the owner of the product. The diversity of the supply chain and the dependencies within the supply chain create many challenges that do not exist in other industries. These challenges make it critical that DOE has the expertise to understand the supply chains and the ability to communicate with the supply chain experts of the owners and operators.

The most effective process for industry owners/operators to share information with federal, state, and local agencies (including DOE) is through one-on-one discussions between individual liaisons from oil and natural gas owners/operators and DOE. The communication would occur prior to and during supply chain disruptions in accordance with ICS. During these one-on-one communications, owners/operators can legally provide the government with information and provide clarity about supplies, delivery issues, and support needs as well as situation assessment (status, potential cascading events, and response activities). A formal process that does not rely on relationships, but instead identifies a liaison role will ensure a continuity of communication between industry and government. These liaison roles provide the linkage to the industry's ICS organization at the proper level. The liaison contacts can facilitate the improvement of situation assessments by establishing direct communication between a relevant company's supply chain subject matter experts and the subject matter experts in DOE's ICS structure.

Leveraging EIA

Under Emergency Support Function 12 (ESF-12), DOE "collects, evaluates, and shares information on energy system damage and estimations on the impact of energy system outages within affected areas."⁴ DOE has many resources at its disposal for the development of a comprehensive analysis of the energy sector that can be inval-

able during a state, regional, or national response. The Energy Information Administration (EIA), an independent statistical and analytic agency within DOE, has many of the skills and abilities that can aid DOE's assessment of impacts to the energy sector during a response. EIA has the ability to take information specific to the industry's supply chains and provide context and relevance such that it is useful to broader state, regional, and national level responses.

Recommendation: Leverage EIA's subject matter expertise within DOE's energy response team to improve supply chain situation assessments.

The Situation Unit is responsible for providing the analytical picture of the impacts of an event, and needs to have personnel with supply chain knowledge and analytical capability to enhance situation assessment during supply chain disruptions. Individuals considered for these roles should have broad knowledge of the oil and gas supply chains, sensitivity to business proprietary and company confidential data, and understanding of supply markets.

Equally important to the process of developing accurate situational awareness information sharing is the ability of those both providing and receiving the information to properly interpret the information being shared. As part of DOE's implementation of ICS, this study recommends that DOE utilize the skills and abilities of EIA personnel in the "Planning Section" of the ICS structure to build the competencies of the "Situation Unit." The use of EIA personnel and their expertise will improve the quality of the analytics produced by DOE.

The Situation Unit personnel in government need to have an understanding of fuel supply chains and the potential impacts from supply disruptions to enable informed decision-making and the proper application of information. This process can function in times of national-level incidents or during smaller scale energy disruptions.

The direct communication between DOE and industry supply chain experts can provide

⁴ Federal Emergency Management Agency, "Emergency Support Function #12 – Energy Annex," January 2008. <https://www.fema.gov/pdf/emergency/nrf/nrf-esf-12.pdf>.

information exchange at a more appropriate level of detail than would be handled at the state or local level, and facilitate a more informed discussion between knowledgeable parties. The process provides a means to develop an aggregated view of the supply chain through communications aligned with antitrust laws.

In past incidents, DOE used an ad hoc mechanism to reach out to industry for gaining intelligence on the status of the supply chain. The use of EIA expertise will be more efficient because EIA already has an understanding of the supply chain and which companies are the key players in the area experiencing supply chain disruption. This knowledge will allow DOE to focus its attention on those key players instead of the industry in general.

Strengthen Industry Interface

To strengthen the communication interface between DOE and individual companies, this study recommends establishing formal, direct communication links between the DOE ERT and company supply chain experts through the ICS structure via the Liaison Officer positions. To strengthen this interface, a Liaison Officer or response operations center contact number will be provided by owners/operators to the DOE ERT to facilitate timely communications.

This industry interface role is a critical component of the common process proposed in this study. This role will ensure that communication flows occur vertically, to and from the local and national levels as needed, as well as horizontally between the public and private sectors (see Figure 2-4). Filling these roles will enable individuals to complete the appropriate level of training to ensure that they can fulfill their mission. During an actual response, these individuals will be well established in their role, thus allowing for the development of well-understood communication pathways to facilitate the flow of information.

The Oil and Natural Gas Sector Coordinating Council (ONG SCC) will, as deemed appropriate, expand its charter, strategic plan, or sector-specific plan to include the following: (1) support DOE's role in the annual updating of the emergency contact list and (2) in event of a disruption,

aid DOE in identifying owners and operators whose systems may have been impacted.

Recommendation: Establish company liaisons and direct communication with DOE's energy response team to improve situation assessments.

This enhanced and direct communication link works in alignment with the NRF, operates through defined ICS roles and responsibilities, and enables DOE to fulfill its ESF-12 mission through inter-agency information-sharing and coordination. This information flow relies on:

- Bottom-up communications, reinforcing the communications between local, state, and federal ICS structures
- Institutionalizing the ICS, including the use of a common terms and defined inter-organization interface to enhance public-private communications

These direct channels of communication are established between each company's subject matter experts and the subject matter experts in DOE's ICS Situation Unit and will enable improved overall situation assessment during times of emergency. Establishing these direct links and developing an enhanced situation assessment include the following benefits:

- DOE will have the most accurate and timely company information
- DOE will have more productive and informed discussions with individual companies
- DOE will have a venue to validate their aggregated view of supply chain situation assessments
- Elimination of the inherent inefficiency of multiple government personnel making similar requests for information to each individual owner/operators
- A legally supportive mechanism for critical information exchange that does not violate antitrust law, protects confidentiality of proprietary information, and is aligned with FERC requirements governing the sharing of non-public information.

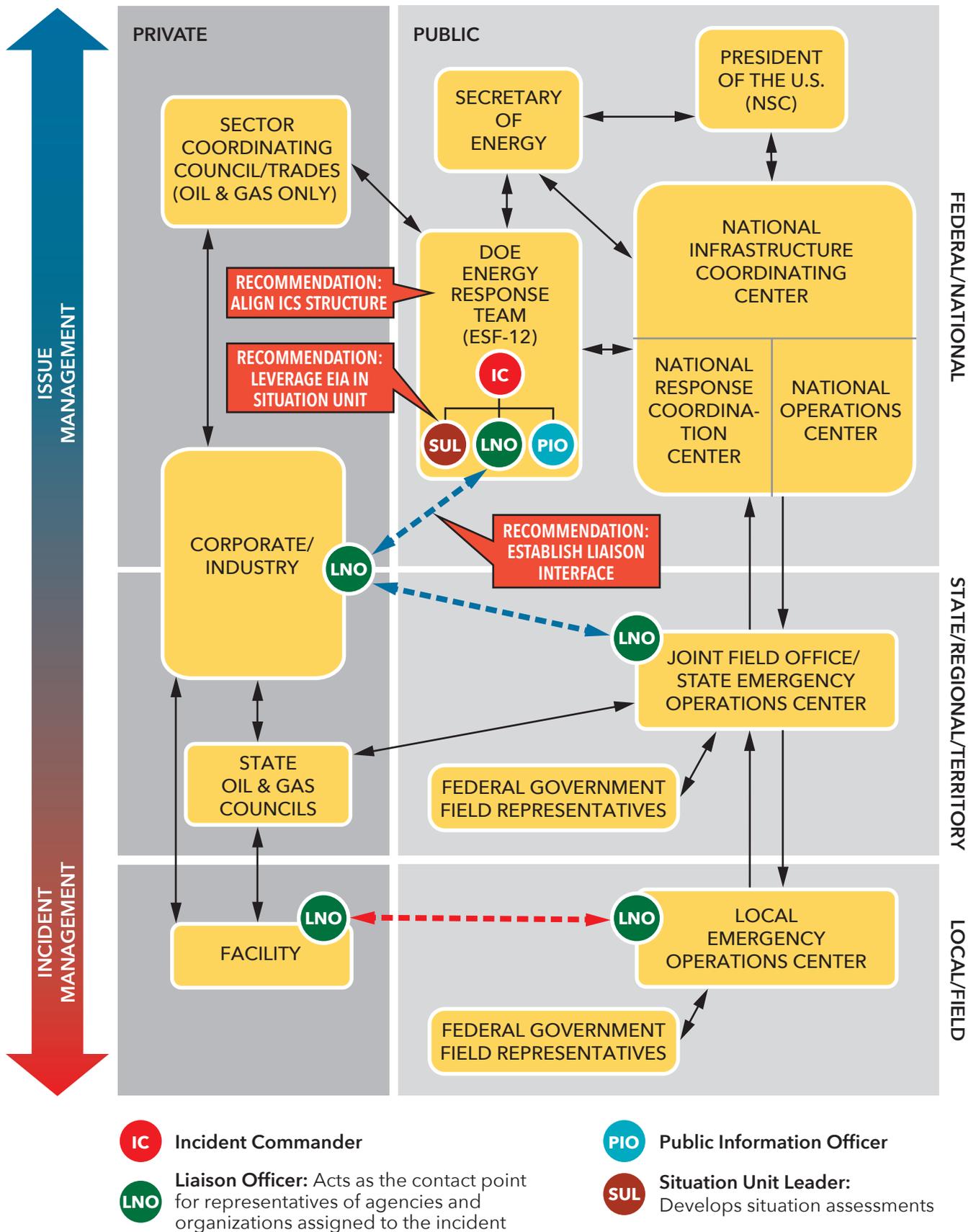


Figure 2-4. Role of Liaison Officer and Situation Unit Leader in the National Response Framework

Establishing the role of liaison officers in industry and DOE, and providing a communication mechanism between them, helps to ensure that the proper level and accuracy of information sharing will occur.

In anticipation of or during the course of a major event, the Secretary of Energy has in the past, and may in the future, request leaders of companies with operations that are directly or indirectly impacted by the event, to participate in group emergency meetings on short notice. Recommendations in this study for improving the flow of situational awareness information to the Department of Energy are expected to reduce the need for such meetings in the future. However, in order to ensure that the Secretary has ready access to the appropriate leaders in unusual and rare situations where the escalation to such a meeting is deemed appropriate, the industry will also undertake to secure and update at least annually an emergency leadership contact list for the Secretary's use of the top executive and/or senior officers at the entities in each of the U.S. upstream, midstream, and downstream oil, natural gas, and petrochemical sectors; industry, with DOE's support, will develop the mechanism to execute this process as part of the study implementation plan. Such leaders should possess the authority to execute or cause to be executed critical operating decisions in an emergency situation where time is of the essence and should be apprised of the importance of their timely participation when called upon to participate in such meetings.

DOE and company officials participating in these meetings would be expected to understand the importance of avoiding discussing or asking about actions or proprietary company information that might create potential antitrust concerns. The Secretary of Energy should make every effort to ensure that discussions are limited to issues related to normalizing operations on an expeditious basis and do not result in inappropriate coordination among competing market participants.

Communication Channels

By establishing and following a well-understood and commonly agreed upon structured com-

munications process, individuals involved in preparedness activities as well as those activities during an actual response will have a clear understanding of their roles and responsibilities. Figure 2-4 shows how information would flow between industry and government through the direct communication links and industry/government subject matter experts. The process proposed in this report follows the organizational structure of the National Response Framework, uses defined ICS roles, and includes response organizations working at the local level.

Any response activity should be driven down to the most local level possible. Here, there is a clear understanding both with the impacted facilities and the local emergency response center with regard to the status of the response and those actions that need to take place for the most rapid recovery possible. In those instances where the local resources are overwhelmed or are limited in their capability, requests for assistance are elevated to the state Emergency Operations Center, then to the Joint Field Office, and then to the federal government. The recommendations provided in this study provide a mechanism whereby impacted operators will provide their facility-specific data and information to DOE, who can in turn aggregate the data and provide high-level assessments by knowledgeable supply chain experts. Additionally, DOE can deliver information to the broader national or regional level response activities that can aid in the more rapid recovery of the energy sector. It is important to note that wherever resources or activities are identified, they should be allocated at the most local level possible for implementation.

This process is designed to facilitate the development of an accurate and timely situation assessment by DOE and the communication of that assessment to other agencies for purposes such as setting response priorities, filling requests for assistance, and expediting the issuance of regulatory relief on behalf of industry.

REQUESTS FOR ASSISTANCE

There are times when the private sector may seek assistance or relief from various levels of government to more effectively restore the

supply chains. In those instances, the government, either at the local, state, or federal levels can play a supporting role. The resources of the government can be brought to bear to assist with restoration of private-sector operations when it will benefit the public and the economy. For example, industry has sometimes needed help in getting employees back to facilities to begin restoration, whether due to blocked transportation routes or lack of fuel. When this is the case, the private sector needs to understand and utilize the process to request assistance.

In the majority of cases, the federal government’s response to a major incident will take the form of assistance to state and local authorities to mitigate immediate threats to public health and safety. More accurate and timely information and situational awareness will enable responding organizations to make more informed and timely decisions, including those related to requests for assistance.

Mechanisms are in place through the NRF for owners and operators to request assistance from

the government if additional support is needed. The NRF was designed to facilitate communication, including requests for assistance, progressively from the local to state and then to the federal levels of government. Requests for assistance should (by design) enter the NRF process and be addressed at the lowest level of government as possible. The Request for Assistance (RFA) process, as shown in Figure 2-5, can follow one of three paths:

- As a request to the local or state EOC/Joint Field Office
- As a request to the National Infrastructure Coordinating Center at the federal level
- As a request through an ESF (e.g., energy, transportation, etc.)

DOE and the Department of Homeland Security should prioritize government support and assistance when requested. Accordingly, RFAs from private-sector Critical Infrastructure and Key Resource entities must be directed through the appropriate channels to the federal, state, and local level decision-makers who can appropriately

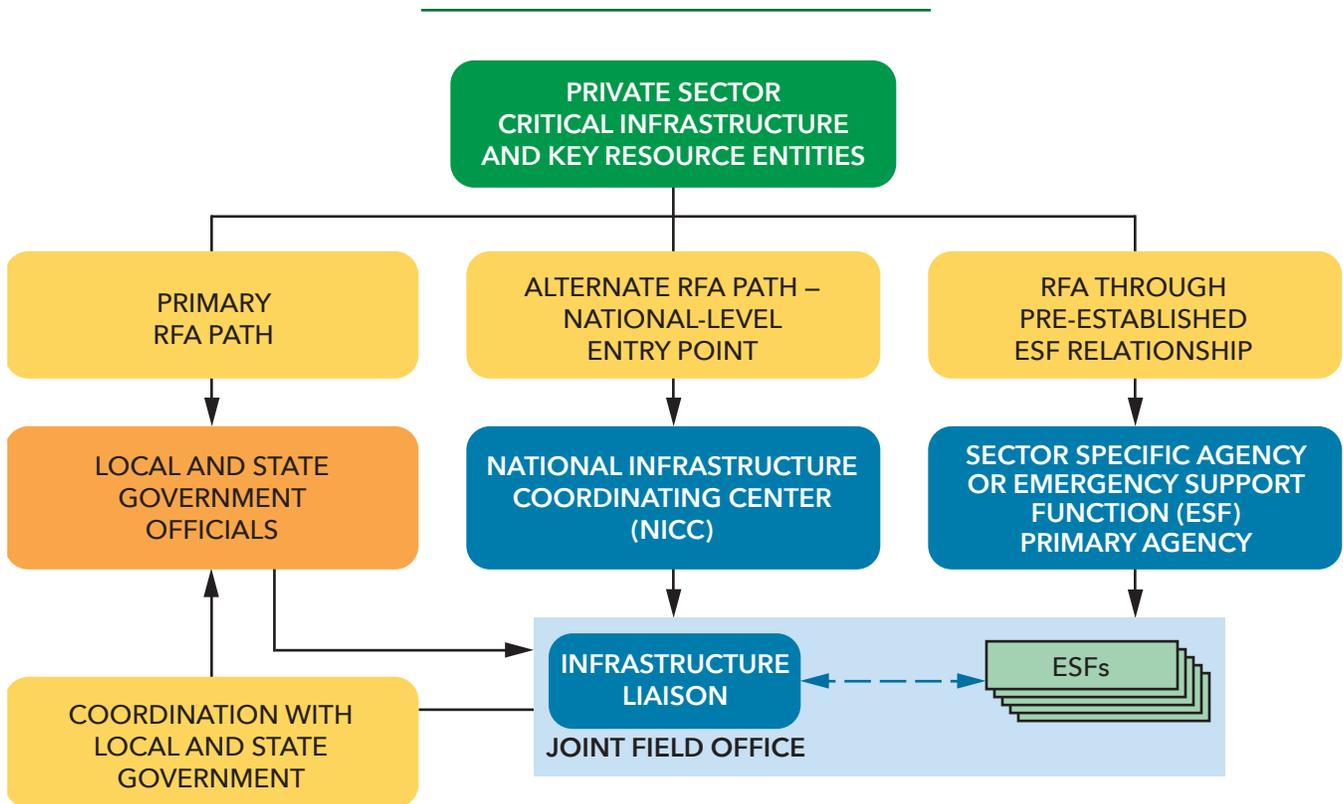


Figure 2-5. Request for Assistance (RFA) Process

consider and adjudicate them in the context of competing needs and priorities.

RFAs are acted upon within the multi-agency coordination centers in the affected area. The Joint Field Office (JFO) is the federal focal point for resolving and acting upon RFAs. The JFO is a temporary federal multi-agency coordination center established locally to facilitate field-level domestic incident management activities related to prevention, preparedness, response, and recovery when activated by the Secretary of Homeland Security. The JFO provides a central location for coordination of federal, state, local, tribal, non-governmental, and private-sector organizations with primary responsibility for activities associated with threat response and incident support.⁵

The JFO is led by the Unified Coordination Group, which is typically comprised of the Federal Coordinating Officer, who is appointed by the President to execute Stafford Act authorities; the State Coordinating Officer, who is appointed by the Governor to coordinate state disaster assistance efforts; and others, such as the Senior Health Official, Department of Defense representative, or Senior Federal Law Enforcement Official.

The JFO uses established processes to ensure that action on each RFA is properly coordinated with state and local officials and acted upon in accordance with legal requirements, available resources, and the overall response and restoration priorities of the JFO. Examples of typical requests for assistance include debris removal to open roads or ports, temporary generators, and access for personnel into restricted areas.

ACCELERATING RECOVERY THROUGH REGULATORY RELIEF

The oil and natural gas industry operates under a myriad of regulations that dictate product quality and contribute to safe operations and environmental performance. The industry has a deep commitment to complying with all regulations, all of the time—this includes during emergency

situations. The industry bears the responsibility for delivering fuels to consumers and is adept at making adjustments to supply chains within the limits of applicable regulations to overcome day to day operational issues or issues that arise from natural disasters. Temporary relaxation of certain regulatory requirements can allow for expedited response and recovery from natural disasters. Prudently issued regulatory relief that appropriately balances competing concerns, allows the government to temporarily suspend certain regulatory requirements so that companies can accelerate recovery that will help alleviate the emergency and restore normal operating conditions to best serve the public interest.

This section starts with an explanation of when regulatory relief may be appropriate and the primary types of relief that may be needed to speed up response and recovery. It then discusses areas for improvement in the existing regulatory relief processes.

Types of Temporary Regulatory Relief Needed During Emergency Situations

Response efforts to the impacts of natural disasters may be augmented by the temporary relaxation of some legal requirements to allow the use of alternative supplies, modes of transportation, and facilities in non-routine ways.

Alternative Supplies—Working with Fuel Specifications

Many states and regions of the country have regulatory specifications that require the use of fuels that meet certain environmental performance standards. (See Appendix G, Hydrocarbon Liquids Supply Chain, for more detail.) Under most conditions, these fuels are readily available, and are delivered to the consumer in the most efficient way possible. Following natural disasters, supplies of these fuels may be limited, and suppliers may seek to switch to alternative supplies in order to meet consumer needs. Government waivers of regulatory requirements can help facilitate this because temporarily relaxing regional fuel specifications effectively expands the pool of available fuel within the affected region. Multiple layers of regulation often apply, and it is not unusual for

⁵ U.S. Department of Homeland Security, Joint Field Office Activation and Operations: Interagency Integrated Standard Operating Procedure, Version 8.3, Interim Approval April 2006. http://www.fema.gov/pdf/emergency/nims/jfo_sop.pdf.

the U.S. Environmental Protection Agency (EPA) and two different state agencies to regulate fuel specifications. Thus, regulatory relief from several government agencies may be needed.

For purposes of emergency preparedness and response, it is important to understand that even though there are a wide variety of gasoline specifications across the United States, many of those that are related to the environmental performance of the fuels, such as summertime volatility specifications, are not related to vehicle performance. Regulatory relief is useful in situations where supplies of specified fuel for an area are limited and a suitable alternative fuel is available. An insufficient supply of a particular gasoline can be supplemented with a different gasoline, provided that the substitute gasoline is available and it is legal to use. This is why regulatory relief for gasoline specifications can be helpful to expedite response to an event. As a good example, on June 6, 2014, in response to a local fuel supply disruption, EPA waived the 7.8 psi RVP (Reid Vapor Pressure) gasoline requirements for Shelby County, Tennessee, temporarily allowing 9.0 psi RVP gasoline in Shelby County. EPA's waiver letter can be found in Appendix E.

Not all fuels are interchangeable. In contrast to gasoline, regulatory relief for diesel fuel sulfur specifications are of limited use because on-highway diesel engines are designed to use ultra-low sulfur diesel (ULSD) 15 ppm sulfur level fuel; higher levels of sulfur can damage the emission control devices on such vehicles. The only places where regulatory relief for diesel fuel could be helpful are California and Texas. Texas Low Emission Diesel and California diesel fuel differ from federal diesel fuel due to additional emissions requirements to reduce NOx emissions. Similar to the situation with gasoline RVP requirements, however, federal diesel fuel can be substituted for Texas Low Emission Diesel or California diesel fuel. Regulatory relief allowing the use of federal diesel fuel in the event of temporary shortages in Texas or California could expedite restoration of diesel fuel supplies in those two states. Regulatory relief allowing higher sulfur for heating oil in states that mandate lower sulfur heating oil may also be useful if there are available supplies of higher sulfur heating oil.

Regulatory relief does not apply to jet fuel because there is a single nationwide specification that is based on aircraft performance and safety consideration. Therefore, there are no readily available suitable alternatives.

Similarly, regulatory relief does not apply to natural gas specifications. There is some variability in natural gas pipeline specifications, but if necessary the pipeline operators have the ability to adjust the specifications without need for regulatory relief.

Changing Distribution Mode

Hurricanes and other natural disasters may require fuel suppliers to change normal distribution modes. For example, a major hurricane that makes landfall in Texas or Louisiana would likely result in a temporary reduction in refining capacity and reduced flows of fuel on the Colonial and Plantation pipelines, which supply the majority of the southeast and eastern United States. To compensate, Jones Act waivers may be needed from the Department of Homeland Security to provide more marine shipping capacity, facilitating increased fuel supply to an impacted area by allowing non-Jones Act ships to transport fuel between U.S. ports.⁶ There is seldom a surplus of Jones Act ships at the ready to absorb a short-term surge in demand. This is particularly true for gasoline, diesel, and other products like ethanol in light of recent increases in shipments of crude oil by Jones Act ships. Thus, in order to expand movement of fuel by ship, Jones Act waivers will likely be helpful to expedite restoration of fuel supplies.

Suppliers may also need to acquire fuels from more distant terminals to supply retail fuel stations in an area affected by a natural disaster. Driver hour restrictions and truck weight

⁶ The Merchant Marine Act of 1920, also known as the Jones Act, is a U.S. federal statute that provides for the promotion and maintenance of the American merchant marine. The law regulates maritime commerce in U.S. waters and between U.S. ports. Section 27 of the Jones Act deals with coastal shipping and requires that all goods transported by water between U.S. ports be carried on U.S.-flag ships, constructed in the United States, owned by U.S. citizens, and crewed by U.S. citizens and U.S. permanent residents. In contrast, non-Jones Act ships, such as foreign-flagged ships, can be used to transport goods between foreign ports and U.S. ports.

restrictions are often relieved to facilitate trucks traveling to more distant terminals to bring fuels to affected areas to speed recovery.

Using Facilities in Non-Routine Ways

As the distribution system shifts to accommodate temporary dislocations, resulting from a natural disaster, it may be possible to expedite recovery by using facilities in non-routine ways. This may require relief from state and federal Clean Air Act restrictions. For example, in the event of a disruption of rail shipments of ethanol, it may be helpful to transport ethanol by barge to compensate for reduced rail deliveries. Clean Air Act permit requirements may need to be relieved at terminals to allow this. Vapor recovery requirements were temporarily relieved at terminals in the aftermath of Superstorm Sandy in 2012 to enable this type of activity.

Regulatory relief may also be useful in the event of natural gas disruptions that would be alleviated by using facilities in non-routine ways. Shortages of natural gas may require electric utilities, for example, to switch to alternative energy sources to restore operation.

The recommendation below addresses two overarching themes related to expediting the restoration of fuel supplies in the aftermath of a natural disaster—speed and certainty of government action to temporarily relax regulatory limitations. Quick and predictable action by the government to issue federal fuel specification waivers, extend previously issued fuel specification waivers, waive state fuel requirements, issue Jones Act relief, stationary source Clean Air Act relief, driver hours relief, and road weight restrictions, as necessary, can help speed recovery by expediting restoration of fuel supplies. Government agencies generally recognize the need for quick action. EPA, for example, typically works with states in advance of events like hurricanes. EPA can, however, sometimes find it difficult to quickly gather necessary information from industry, which slows down the issuance of fuels waivers and other regulatory relief. The communications process discussed throughout this report should expedite communications between industry and the government and allow the government to make decisions more quickly.

There are additional areas where the process can be improved to expedite the issuance of regulatory relief as described below.

To be most effective, regulatory relief needs to provide certainty through the use of clear language aligned across jurisdictions so that the industry is able to reasonably predict and thus plan based on what will be allowed. Uncertainty in regulatory relief can result in missed opportunities to mitigate supply disruptions caused by a natural disaster.

Expediting Regulatory Relief

Improving the Timeliness of Government Action to Remove Regulatory Limitations

Recommendation: Streamline and enhance processes for obtaining temporary regulatory relief to speed up recovery.

Other than regulatory relief from driver hour and truck weight restrictions to enable tanker trucks to acquire fuel from more distant terminals, the most commonly needed regulatory relief in the aftermath of natural disasters are fuel specification waivers for gasoline. These temporarily lift environmental regulations to allow the distribution, storage, and sale of fuels that would otherwise be legally prohibited.

EPA has authority to issue such waivers under section 211(c)(4)(C) of the Clean Air Act in the event that “extreme and unusual fuel or fuel additive supply circumstances exist in a State or region of the Nation which prevent the distribution of an adequate supply of the fuel or fuel additive to consumers,” provided that “the waiver applies to the smallest geographic area necessary to address the extreme and unusual fuel and fuel additive supply circumstances” and “the waiver is effective for a period of 20 calendar days or, if the Administrator determines that a shorter waiver period is adequate, for the shortest practicable time period necessary to permit the correction of the extreme and unusual fuel and fuel additive supply circumstances and to mitigate impact on air quality...” While EPA is

the agency with authority to issue fuel waivers under the Clean Air Act, the law requires that the EPA Administrator consult with the Secretary of Energy. DOE conducts due diligence to determine whether there is a generalized supply shortage to enable the Administrator to make a decision concerning the issuance of a waiver.

As described above, the Clean Air Act places restrictions on EPA's authority to grant waivers and requires EPA to make determinations in order to grant waivers. EPA must determine whether there is a generalized supply problem, the appropriate length of time for the waiver, and the appropriate geographic scope of the waiver. Several things can potentially be done to help expedite this process and help ensure that waivers are issued for appropriate lengths of time for the appropriate geographic area consistent with the needs of the supply chain.

- DOE should work with EPA to clearly identify information needs to determine whether there is a generalized supply shortage and communicate the information needs to industry to help companies respond more quickly to expedite EPA's ability to issue waivers.
- As part of ongoing education efforts, industry and DOE should provide information to other federal agencies, and the states regarding the supply chain to help ensure that waivers are expeditiously issued for the appropriate length of time and for the appropriate geographic area. For example, it is important to understand that a Gulf Coast hurricane that adversely impacts refineries and the Plantation and Colonial pipelines will most likely have adverse impacts on fuel supplies from the Gulf Coast to New England.
- Whenever EPA issues waivers, to the extent permitted by the Clean Air Act, the duration and geographic reach of the waivers should be consistent with the needs of the supply chain as provided by industry. In major disruptions that most likely affect several states, multi-state waivers of sufficient length should be issued.

- Industry and DOE should work with EPA to identify and share information about the needs of the supply chain when issuing and extending waivers. EPA often extends waivers within 2-4 days of their expiration. Depending on the length of the supply chain, however, that may not provide the industry with sufficient lead time to respond effectively. This study recommends that at a minimum, where conditions for issuing a waiver continue to exist, extension be granted 5 days or more ahead of expiration. In the case of major events such as Hurricanes Katrina and Rita, for example, where it is clear that 20 days will not be sufficient duration, EPA should renew the waivers on a rolling 7-day basis to provide 14 to 20 days of forward certainty.
- EPA along with DOE and industry should work with the states to improve the process for state waivers. It is often necessary to secure waivers from two state agencies within a state to implement an EPA waiver, and the states often do not have clearly defined authority to issue waivers. The lack of clear authority and the need to secure multiple waivers can slow down implementation of an EPA fuel waiver. At a minimum, the conditions for state waivers and their duration should be consistent with EPA waivers.

Other Types of Regulatory Relief—Clean Air Act and Jones Act

Clean Air Act

In contrast to fuel requirements, there is no specific authority under the Clean Air Act authorizing states and EPA to waive stationary source Clean Air Act requirements (e.g., Point Source Discharge, New Source Review, Title V permits). Such temporary regulatory relief may be helpful to respond to a hurricane or other major disasters to enable facilities to expedite return to service or to change service. For example, after Superstorm Sandy in October 2012, it was necessary to off-load ethanol at some terminals to supply

ethanol to areas that were directly impacted by the storm. Because that was not a normal function at the terminals, however, the terminals were not equipped with vapor recovery devices for such off-loading. In order to allow the off-loading, states and EPA provided regulatory relief. To provide such regulatory relief, EPA and the states rely on enforcement discretion. Enforcement discretion is an acknowledgement that the activity violates the law, but a statement that the government does not intend to enforce the law. Unfortunately, such enforcement discretion provides no protection from citizen suits under section 304(b) of the Clean Air Act. Under that provision of law, any citizen can bring suit against an alleged violator if the Administrator is not enforcing the law. This was most recently recognized by the Supreme Court in the recent *Utility Air Regulatory Group v. EPA* case:

EPA itself has recently affirmed that the “independent enforcement authority” furnished by the citizen-suit provision cannot be displaced by a permitting authority’s decision not to pursue enforcement. 78 Fed. Reg. 12477, 12486-12487 (2013). The Solicitor General is therefore quite right to acknowledge that the availability of citizen suits made it necessary for EPA, in seeking to mitigate the unreasonableness of its greenhouse-gas-inclusion interpretation, to go beyond merely exercising its enforcement discretion.⁷

While enforcement discretion is the current mechanism for regulatory relief of stationary source Clean Air Act requirements, it introduces legal exposure.

Given the possibility of citizen suits, the use of enforcement discretion to provide regulatory relief introduces legal exposure that reduces its effectiveness for expediting recovery from natural disasters. This issue is described here to inform and educate all stakeholders on this issue. Moving beyond the use of enforcement discretion to remove the legal exposure would require legislative action to expressly allow EPA to issue waivers.

⁷ *Utility Air Regulatory Group v. Environmental Protection Agency*, 134 S. Ct. 2427, 2445 (2014).

Jones Act

Similar to Clean Air Act stationary source regulatory relief, there is no clearly defined process for industry-wide Jones Act waivers. The federal Merchant Marine Act of 1920, also called the Jones Act, requires that only U.S.-built and -flagged vessels carry goods from U.S. ports to other U.S. ports. Requests for relief from certain provisions of the Jones Act are reviewed by the U.S. Department of Homeland Security (DHS) on a case-by-case basis. Coastline relief can be granted in two ways: (1) automatically on request of the Secretary of Defense to the extent considered necessary in the interest of national defense, and (2) when the “head of an agency responsible for the administration of the navigation or vessel-inspection laws” (in this case the Secretary of Homeland Security) considers it necessary in the interest of national defense if the Maritime Administrator determines that no U.S.-flagged vessels are available. There is no clear, publicly known, process for DHS to issue industry-wide regulatory relief, although such relief has been issued in the past. The lack of a clear process and defined criteria is likely one of the reasons for delays in issuance of needed regulatory relief. For example, it took DHS four days to issue regulatory relief from the Jones Act after Superstorm Sandy in 2012.

Given the current inventory of Jones Act vessels for clean products, such as gasoline, and the importance of marine deliveries in most of the recovery efforts after a natural disaster, DHS should establish a clear process to enable the department to grant Jones Act waivers in advance of the event, on an industry-wide basis.

A clear process should be established to enable DHS to grant Jones Act waivers in advance of an event, on an industry-wide basis.

Improving Regulatory Certainty for Temporary Relief

In addition to the timely issuance and extension of regulatory relief, it is critical that the waivers provide fuel suppliers with sufficient certainty regarding the regulations being waived and the extent of the waiver so that

industry can take decisive action to restore disrupted systems. Uncertainty likely results in delay and missed opportunities to mitigate the problem. There are several things that can be done to improve certainty:

- DOE and industry should work with EPA, states, and other government agencies to ensure that waivers use uniform language and remove ambiguity. The EPA “Fuel Waiver Concerning Shelby County, TN,” issued on June 6, 2014, had clear language and should be used as a template for future waivers (see Appendix E).
- State waiver language should align with federal waivers.
- As part of ongoing education efforts, EPA along with DOE and industry should provide information to state and federal agencies that the time required to revert back to normal specifications can impede the full utilization of a waiver. In general, it takes about 15 days to convert a terminal tank back to summer RVP (Reid Vapor Pressure); depending on terminal location, it can take up to 3 weeks to get product to a terminal. Seasonal changes in RVP requirements occur on September 15th, often in the middle of the hurricane season.
- Waiver durations should be valid for both the response and recovery periods. When issuing fuel waivers, EPA should extend summer RVP waivers granted in August until September 15th to maximize the industry’s ability to supply fuels. Absent this, the need to convert terminal tanks back to summer RVP can reduce supply of gasoline in the affected area.
- EPA’s regulations and the Clean Air Act allow gasoline/ethanol blends to exceed the RVP requirements that apply to gasoline by 1 psi, provided that the blend contains 9–10% ethanol. EPA-issued RVP waivers should include a provision to extend the 1.0 psi allowance to ethanol blends below 9%. In emergency situa-

tions, ethanol delivery, the availability of blending equipment, or tankage may be interrupted. The 9% lower limit of applicability of the RVP allowance may impede the ability to provide additional supply. For example, under EPA’s RVP regulations during the summer, 7.8 RVP gasoline with addition of 9–10% ethanol is allowed to have 8.8 psi RVP. In an emergency situation, if there is not sufficient ethanol available, it might be helpful to supply an area with ethanol-free gasoline for a limited period of time to meet consumer needs. If the ethanol-blended gasoline is commingled with the ethanol-free gasoline, the RVP would continue to be 8.8 psi even if the ethanol percent in the mixture is as low as 2%. Waiving the 9–10% requirement in 40 C.F.R. § 80.27(d) would allow suppliers to temporarily commingle the ethanol blend and non-blended gasoline.

LEGAL CONSIDERATIONS— SHERMAN ANTITRUST ACT AND THE DEFENSE PRODUCTION ACT

The Secretary of Energy’s study request identified as a key topic of interest any “legal, procedural or physical challenges to emergency response and restoration.” This section examines some of the collaborative options and legal considerations evaluated in this study.

Sherman Antitrust Act

Prior NPC studies have noted that the antitrust laws impose constraints on the ability of industry participants to respond collectively to a supply disruption resulting from a catastrophic event.

Antitrust laws are designed to prevent collusion and promote competition among rival firms. Although the antitrust laws limit collective action by the petroleum industry following a disaster, experience shows that petroleum companies can and do respond independently to supply disruptions—usually in reaction to market signals and in healthy competition with each other to restore supply to an affected region. Experience further

shows that, during disasters, petroleum companies can and do individually share competitively sensitive information with responsible government officials to provide them adequate information on supply conditions. These separate efforts by independent, competing companies are fully consistent with the antitrust laws and, in practice, have resolved past supply disruptions quickly and efficiently.

Federal antitrust statutes prohibit extensive coordination among competitors—even during times of emergency. Court decisions make clear that the antitrust laws apply fully in emergency situations.⁸ Executive branch officials do not have the authority to confer antitrust immunity. Absent a specific Congressional exemption, the Sherman Act applies.⁹ That competitors reached an agreement at the request of the Executive Branch in response to a disaster does not change this. Thus, even when there would be overwhelming social benefits to industry collaboration, companies are bound to comply with the antitrust laws. Consequently, in order to encourage companies to participate in such efforts, Congress must provide antitrust immunity.

Absent antitrust immunity, petroleum companies would take on significant legal risk by closely collaborating on supply, distribution, and customer issues in the wake of an emergency. Sherman Act Section 1—the antitrust provision most pertinent to this issue—prohibits “every” agreement that unreasonably restrains trade. Under existing precedent, some agreements—including agreements among competitors to allocate resources to specific geographic areas or customers—are *per se* illegal without regard to any other societal or economic justification. Even under the “rule of reason” standard applied to some types of agreements among competitors, coordinated conduct can be justified only to the extent that its pro-competitive benefits outweigh its potential anticompetitive harm; public policy consid-

erations, such as restoring fuel supply after a disaster, generally are not taken into account in this analysis. Further, whether a particular agreement among the petroleum companies was “reasonable” under the circumstances likely would be judged long after the fact by a jury—meaning that, during the disaster, petroleum companies would face significant uncertainty over whether their real-time decisions would later be condemned as anticompetitive.

Even if their conduct were eventually vindicated, petroleum companies would risk incurring significant litigation and reputational costs if they failed to comply with antitrust laws during an emergency. The Supreme Court has recognized that pre-trial discovery in antitrust cases is usually “expensive” and that “judicial supervision in checking discovery abuse has been modest.”¹⁰ Petroleum companies have proven themselves willing to help federal and state governments respond to disasters and overcome supply disruptions. However, it would be unfair for the federal government to ask petroleum companies to help government to respond to disasters and then suffer the costs of time and money in defending subsequent expensive court proceedings where their actions are second guessed. Unless there is a statute exempting petroleum industry coordination from the antitrust laws during an emergency, a government enforcer or private plaintiff could be tempted to challenge such conduct.

Finally, a company may have business concerns about revealing its non-public, proprietary, operating information to competitors who may be in a position to take advantage of that information to the company’s detriment, whether in the immediate crisis or over the long term.

The Competitive Process Works Well During Disruptions

Market forces have served to quickly and adequately address emergencies in the past, even those caused by severe disasters. In the Federal Trade Commission’s (FTC) 2006 “Investigation of Gasoline Price Manipulation and Post-Katrina Gasoline Price Increases,” for example, the FTC concluded that “suppliers responded quickly to

8 United States v. General Inst. Corp., 87 F. Supp. 157, 163-4 (D. N.J. 1949) (rejecting as “without merit” the argument that “in the emergency of war, the war power of the Federal Government and military authorities takes precedence over the civil law and nullified the Sherman Act during the emergency”).

9 Otter Tail Power Co. v. United States, 410 U.S. 366, 378-79 (1973) (absent authorization from Congress, federal officials “do not have the power to grant immunity from the Sherman Act”).

10 *Bell Atlantic Corp. v. Twombly*, 550 U.S. 544, 546 (2007).

the supply disruptions caused by the hurricanes” and there was “no evidence suggesting that the recovery should have occurred in a shorter time-frame.”

Voluntary Agreements under the Defense Production Act

The Defense Production Act of 1950 (DPA), 50 U.S.C. App. sec. 2061 et seq., was enacted upon the commencement of the Korean War, to provide the President with a broad set of authorities for assuring that adequate productive capacity and supply existed to meet national defense needs. The Act, which was recently reauthorized for five years, has been amended numerous times, and contains authorities that could be invoked in responding to an energy emergency. Among these are the Act’s sec. 101(a) contract priorities and allocation authority, and its sec. 101(c), which specifically authorizes the President to allocate and prioritize contracts for materials, equipment, and services to maximize domestic energy supplies in certain circumstances. Another relevant provision is sec. 708, 50 U.S.C. App. sec. 2158, concerning the formation and carrying out of voluntary agreements and plans of action. The DPA’s authorities have been delegated by Executive Order 13603, issued March 16, 2012, and the Secretary of Energy is among the officials delegated DPA authority.

Section 708 of the DPA authorizes the President (or a qualified designee of the President), upon finding that certain conditions exist (including various disasters and national defense threats), to solicit the participation of industry represen-

tatives in national defense programs. Under the Act, industry representatives are authorized to enter into potentially anticompetitive “voluntary agreements” to help provide for the defense of the United States through the development of preparedness programs and the expansion of productive capacity and supply. See id. § 2158(c)(1). Although sec. 708 requires that all federal agencies sponsoring voluntary agreements promulgate implementing regulations, and Executive Order 13603 directs the Secretary of Homeland Security to promulgate implementing regulations, no such regulations have in fact been promulgated.

It may be possible to envision a “worst case” circumstance with very extensive damage that would benefit from suspension of the competitive process in favor of collaborative activity at the direction of the federal government. As part of this study, the NPC has considered whether DPA sec. 708 would provide a legal vehicle to effect the displacement of market forces by a government-directed collaborative process.

In the rare circumstances in which explicit industry coordination potentially would help petroleum companies more effectively remedy a supply disruption, the DPA sec. 708’s inherent legal, structural, and procedural complexity limit its utility for emergency response coordination. It also fails to address, in that context, a company’s legitimate business concerns about exposing its non-public and proprietary operating information to competitors who may be in a position to take advantage of that information to the company’s detriment. (More information on the DPA can be found in Appendix F.)

Chapter 3

PLANNING, PREPARATION, AND SUSTAINING MECHANISMS

Supply Chain emergencies, like many other emergency situations, are best managed through ongoing planning, preparedness, and private and public sector collaboration. This chapter provides recommendations and supporting information for improving and sustaining the public and private sector emergency preparedness and communication frameworks and protocols discussed in Chapter 2.

Sustaining emergency preparedness requires leadership commitment to maintain both a ready, capable workforce and funding between emergency events. Specifically, it requires a commitment to update plans, maintain communications contacts and systems, conduct drills and exercises, and administer effective ongoing education and training programs. The states and DOE would benefit from assistance by the industry to support their efforts to enhance and sustain their preparedness activities and communications channels. The Oil and Natural Gas Sector Coordinating Council (ONG SCC), consisting of national oil and gas trade associations, will expand its role to provide this assistance and support.

ENHANCING EMERGENCY PREPAREDNESS THROUGH PLANNING

Preparing for oil and gas supply emergencies requires an understanding of oil and gas supply chains and effective planning by both government and industry. The oil and natural gas industries have extremely complex production and delivery systems made up of many components, processes, and owners. A proper understanding of these systems and how they interrelate is critical to anyone

who might be responsible for making decisions that could impact operations during the preparation for, response to, and recovery from an event. Understanding the oil and natural gas supply chains, how events can impact supplies and delivery and how the industry responds will mean the difference between a well-coordinated, rapid, and focused response and a confused, slow, reactionary response.

State energy assurance plans and industry business continuity plans/emergency response plans should be carefully crafted to address vulnerabilities and interdependencies, and to provide action plans for potential energy supply emergencies.

State Energy Assurance Plans

Energy assurance plans are the mechanism for states to plan for and respond to incidents involving the energy sector. Under the American Recovery and Reinvestment Act of 2009, DOE funded the development of new or improved energy assurance plans by 47 states, the District of Columbia, and 43 municipalities that participated. The plans are owned by the states and localities and they incorporate approaches, tools, and other “best practices,” as well as the creation of a nationwide network of government, energy industry, and other representatives of organizations interested in sharing information to foster energy assurance and resilience.

To sustain this preparedness initiative and expand this capability, it is imperative that programs be staffed and resourced at requisite levels, in order to achieve a robust and lasting energy infrastructure resilience program for state

and local energy assurance. These plans should include an identification and mitigation of infrastructure interdependencies for supply chains across multiple states and industries. Plans should also clearly define the accountability of stakeholders, fuel supply, and distribution points for first responders.

Understanding and planning for interdependencies are fundamental steps for achieving energy assurance and regional resilience, and are instrumental to the effectiveness of states, local governments, owners and operators, and communities in preparing for, responding to, and recovering from disasters. The ability to identify and understand these interdependencies requires ongoing coordination, collaboration, information sharing, and adherence to a systematic and risk-based process to prioritize mitigation and recovery activities.

Recommendation: States should increase engagement with the oil and natural gas industry in their energy assurance plans, and industry members should assist the state in such efforts.

As the owners and operators of energy infrastructure, industry is best positioned to provide expertise to state and local governments to assist in the development of their state energy assurance plans. It is also in the best interest of owners and operators to partner with their local and state officials to create the relationships and avenues of communication that will assist them with restoration and prioritization if an event occurs.

Through a systematic engagement process, the owners and operators of energy infrastructure can provide information on the dependencies or interdependencies that they have already identified. The coordination will improve the assessment process and inform decision-making related to the prioritization of mitigation and recovery actions. The ONG SCC can assist states in coordinating industry participation.

The energy assurance plans should be integrated into other emergency response plans where applicable and exercised in concert with industry,

on a regular basis. Industry should participate in planning, training, and exercises at the local, state, regional, and national levels.

Reviews of energy assurance plans should confirm that responses to interdependency disruptions include appropriate priorities and sequences for restoration of critical infrastructure prior to an emergency. Owners and operators could also validate the appropriate state and local protocols for “first responder” access credentials to expedite their access to impacted areas.

DOE should continue to work with the states and the National Association of State Energy Officials to refine and enhance their State Energy Assurance Plans to include:

- Clearly defined accountability of stakeholders
- Assessment of vulnerabilities and risk assessments of supply chains
- Local, cross-regional, and cross-industry dependencies and interdependencies
- Fuel supply and distribution points for first responders
- Consideration for impacts to resiliency in state and local policy decisions.

Business Continuity Planning

The oil and gas industry has a vested interest in resuming operations as quickly as possible after a disruption. There are financial obligations to shareholders and contractual commitments to customers that have promoted the establishment of existing processes to limit disruptions, mitigate impacts, and reduce restoration times. As previously mentioned, the industry has a long history of emergency response planning and preparedness, which the industry strives to continuously improve on through drills, exercises, lessons learned, and sharing experiences within industry associations. The August 2010 DOE study, *Hardening and Resiliency: U.S. Energy Industry Response to Recent Hurricane Seasons*, provides examples of the readiness activities the industry has deployed to prepare refineries, pipelines, terminals, and retail outlets to recover quickly from damage from flooding, extreme winds,

and other impacts from storms. Some examples are listed below.

- Conducting hurricane preparedness planning and training
- Complying with inspection protocols
- Improving employee communications and tracking
- Installing redundant communications
- Procuring mobile command vehicles
- Purchasing/leasing portable generators
- Pre-positioning and pre-wiring portable generators
- Securing alternate sources of gas supplies.

Companies should ensure that critical dependencies and interdependencies are addressed in Industry Business Continuity Plans and/or Emergency Response Plans.

Business continuity planning is an important emergency preparedness activity for oil and natural gas companies, and should include planning for interdependencies identified in the State Energy Assurance Plans. Plans can take many forms depending on the focus area of the business and the need and risk profile of an operation/asset. Three common business continuity planning standards are available to industry:

- ISO 22301 – “Societal security — Business continuity management systems”
- NFPA 1600 – “Standard on Disaster/Emergency Management and Business Continuity Programs”
- ASIS SPC.1:2009 – *Business Continuity Management Systems: Requirements with Guidance for Use*.

All of these standards include a business impact analysis including interdependencies, identification of critical business processes, and guidance for preparing a comprehensive business continuity plan. Business continuity planning may be integrated into existing emergency response plans, but should provide the risk-based efforts for identifying critical processes, key dependen-

cies, and contingencies. Fundamental to the business continuity planning process is identifying and developing mitigating actions for key dependencies and interdependencies.

A good practice that was noted by the oil and gas industry and endorsed by electric utilities is the coordination with the electric utilities that provide power to key oil and natural gas assets. Owners and operators should explain the relative importance of the asset to the local or regional supply chain to assist the utility in planning restoration priorities. This process in conjunction with energy assurance planning engagement should further clarify where the oil and natural gas assets rank in power restoration priorities during an event. Outreach to the utility should be conducted on a regular basis at the local level to ensure coordinated planning and effective communications during incidents.

Identifying and understanding interdependencies, coordinating with state energy assurance planning activities, and incorporating the knowledge from the collaboration into business continuity planning processes will better enable the oil and natural gas companies and the government to mitigate the risks posed by interdependencies. These concepts are consistent with the aspirations of the Energy Sector-Specific Plan:

Goal: Understand key sector interdependencies and cooperate with other sectors to address them, and incorporate that knowledge in planning and operations.

Coordination and cooperation are essential to planning and executing security programs and response and recovery activities. Security programs and emergency response planning are most effective when stakeholders clearly understand their respective roles and responsibilities and plan to integrate their independently executed roles to achieve a common set of infrastructure protection outcomes.

The Energy Sector depends on other sectors to help provide its services, and it provides energy services upon which numerous other sectors depend. Interdependencies also exist within the sector itself. Comprehensively

understanding such interdependencies enables the sector to mitigate potential vulnerabilities and helps ensure the Nation's economy can continue to deliver goods and services during extraordinary events. DOE continues to work with sector partners to help identify program gaps and improve the effectiveness of sector infrastructure and resilience programs.¹

Addressing Dependencies/ Interdependencies

The oil and gas infrastructure provides essential fuels to other critical infrastructures, and in turn depends on the nation's electric, transportation, information technology (IT), communications, finance, and government infrastructures. To varying degrees, prolonged disruption to a single infrastructure has the potential to generate disturbances within other infrastructures locally and across regions. Energy interdependencies vary by state and by region and are a function of several primary factors: the types of natural disasters, the supply chain infrastructure, regional regulatory limitations, local production capacities, etc.

During a widespread event, such as a hurricane, the primary dependency for oil and gas infrastructure is to electric power infrastructure. The loss of electrical service can significantly degrade or completely disrupt movements of fuel. Backup or emergency power generating equipment may be used so that some functions of a facility can continue operations. However, larger facilities cannot fully function by generator power alone. Therefore, electric power restoration is critical to recovery efforts for most oil and natural gas infrastructure, and a key consideration in contingency planning.

The thinking behind emergency response and recovery planning has broadened from lessons learned by both government and the oil and natural gas industry since September 11 and Hurricane Katrina. Prior to these events, contingency-planning efforts focused on emergency response (e.g., fire, spill, security), not a broader all-

hazards continuity of operations approach. More recently, greater consideration has been given to developing plans that strive to ensure continuity of operations during and after an incident or crisis, including risk-based efforts for identifying key dependencies, resiliency, crisis communication, and speedy recovery.

The increased awareness of interdependencies and resilience, in both the private and public sectors, has been enhanced through:

- Lessons learned about destruction and disruption of infrastructure assets and systems from disasters and incidents
- Engagement of stakeholders by DOE, DHS, and other federal agencies on the importance of infrastructure interdependencies for energy assurance and resilience
- Workshops, exercises, and other activities at the company, local, and state levels, and by industry associations and partnerships
- Adoption by the federal government of resilience as a national priority, stakeholder collaboration, public-private partnerships, and cross-sector/multi-jurisdiction coordination and information sharing.

DOE has been engaged in efforts to identify dependencies and interdependencies, and has worked collaboratively with the states, other federal agencies, and the oil and natural gas sector to include these dependencies in planning. DOE has engaged in the development and exercise programs with the states on energy assurance planning, which is discussed in the previous section. Recently, DOE has brought together the ONG SCC, the Electricity Sector Coordinating Council, the Financial Services Sector Coordinating Council, and the Communications Sector Coordinating Council to discuss cross-sector issues including interdependencies.

Utilize existing frameworks of the Oil and Natural Gas Sector Coordinating Council/ Government Coordinating Council to enhance the identification and response planning for dependencies and interdependencies at the local, state, federal, and industry levels.

¹ U.S. Department of Homeland Security and U.S. Department of Energy, *Energy Sector-Specific Plan—An Annex to the National Infrastructure Protection Plan*, 2010, Section 5.3.3.

The ONG SCC through its members has worked with DOE and DHS on interdependency studies, initiatives, and discussions between industry and government. Examples of some of these efforts are listed below:

- Development of “The Oil and Natural Gas Sub-sector Pandemic Influenza Guideline” with the Department of Homeland Security
- Engagement in National Infrastructure Advisory Council studies
- Engagement with Critical Infrastructure Cross-Sector Council and their interdependency reviews
- Participation in national level exercises (e.g., TOPOFF, NLE, DOE exercises, etc.)
- Participation in cross-sector emergency management workshops.

The ONG SCC framework, which has been extensively used by DOE and industry, provides a demonstrated process for engagement with other sectors, and can be further used to advance coordination on interdependency activities on the federal level. The *Energy Sector-Specific Plan* references DOE’s and the oil and gas industry’s risk methodologies and activities related to interdependencies.

Many of the (risk) methodologies used in the Energy Sector include dependencies and interdependencies among infrastructures. The energy industry sponsors and participates in regional and national planning activities. Such activities are designed to identify and analyze system and interdependency considerations that transcend individual companies, considerations that may also be used by DHS to prioritize efforts during national emergencies. Through the NIPP partnership, Energy Sector participants have been actively engaged in exercises to develop response strategies involving multiple sectors, agencies, companies, and governmental entities. The sector will continue to develop ties to other sectors and to explore the extent and importance of interdependencies.

The broad range of methods used by the Energy Sector to assess risk is also a func-

tion of the international scope of the sector’s assets, supply chains, and products. Many energy companies are global and have extensive experience in dealing with a wide variety of natural and manmade threats. This experience has resulted in effective ways to prioritize infrastructure protection and resilience investments based on risk. It has also highlighted the importance of interdependencies within the sector as well as among the other CIKR sectors.²

In addition to continuing the engagement through the ONG SCC, the **industry should expand the *Oil and Natural Gas Industry Preparedness Handbook* to include considerations and examples of interdependencies.** This effort could facilitate further evaluations, communication, and awareness of the interdependencies of the industry.

ENHANCING EMERGENCY PREPAREDNESS THROUGH TRAINING AND EXERCISE PROGRAMS

To ensure sustainment and continuous improvement of emergency preparedness and response, training and exercise programs must be established and supported through leadership by a process owner.

Process Owner inside DOE

A designated role, a process owner, must be identified, resourced, staffed, and funded appropriately to fulfill the following responsibilities:

- Ensure harmonization of the Incident Command System (ICS) within the emergency response team
- Clarify DOE-wide roles and responsibilities for individuals outside the response team
- Ensure that ICS members have appropriate skill, knowledge, and training
- Create and maintain training and education programs
- Coordinate drills and exercises

² U.S. Department of Homeland Security and U.S. Department of Energy, *Energy Sector-Specific Plan—An Annex to the National Infrastructure Protection Plan*, 2010, Section 3.1.

- Continuously assess the maturity of DOE’s preparedness and response program, and make recommendations for improvement.

To ensure sustainment, DOE’s emergency preparedness program needs to have an assigned process owner.

Private and public resources are available to assist DOE to build a preparedness program. One of the best examples is the U.S. Coast Guard’s Incident Command System Mandated Training Requirements established and maintained by the U.S. Coast Guard’s Office of Response Policy. The program clearly lays out the purpose, scope, and training requirements for all staff at all levels. DOE is encouraged to consult with those agencies that currently utilize ICS to share best practices and lessons learned.

Management of Change, Education, and Training for Key Positions

Routine education and training of key leadership positions and individuals transitioning into critical emergency management roles at DOE, states, and industry is crucial to emergency preparedness and effective decision-making during emergency response. Education and training programs, as with other programs, need strong leadership for long-term success. DOE, as the lead for ESF-12 and the sector-specific agency for energy, as well as state, local, and industry response organizations have the responsibility to establish management of change processes and effective education and training programs which ensure staff is prepared to respond to emergencies and coordinate with stakeholders across the public and private sectors.

Recommendation: Both DOE and states should establish routine education and training programs for key government emergency response positions.

To enhance competency, both DOE and states should identify the key positions in their organizations that are responsible for coordinating

response to energy emergencies. New, existing, and incoming personnel filling those roles should be required to complete in-depth training on oil and natural gas supply chains and emergency plans and emergency response frameworks. Establishing a management of change process for key positions will facilitate emergency preparedness sustainment by identifying minimum training requirements for each position, and ensure that appropriate training and job handover are effectively managed as people move into and out of positions.

Within DOE and states, all levels of staff, including senior leadership, should receive mandatory education and training commensurate with their role in a response. DOE and states should identify the levels of staff that need to be educated about the oil and natural gas supply chains, the National Response Framework, the Incident Command System, and the communications protocols between public and private sectors. Staff should have the background knowledge and experience to understand the many intricacies of operations, regulations, and authorities that can impact how the various stakeholders operate. Industry, through the ONG SCC, should continue to provide support for education and training where needed.

Drills and Exercises

The study supports FEMA’s position that drills and exercises are critical to sustaining the emergency preparedness processes.

Exercises enable entities to identify strengths and incorporate them within best practices to sustain and enhance existing capabilities. They also provide an objective assessment of gaps and shortfalls within plans, policies and procedures to address areas for improvement prior to a real-world incident. Exercises help clarify roles and responsibilities among different entities, improve interagency coordination and communications and identify needed resources and opportunities for improvement.³

³ Federal Emergency Management Agency, “Exercises.” www.fema.gov/exercise.

Recommendation: Both DOE and states should improve their comprehensive drill and exercise programs and include industry participation. Reciprocal invitations extended by companies to DOE and states are recommended.

The objective of a drill and exercise program is to ensure that a response organization is continuously testing and improving the overall preparedness program, including the testing of plans, organizational structure, roles, and training. To accomplish this, both DOE and the states should improve their comprehensive drill and exercise programs. Drills and exercises should include staff, leadership, and key stakeholders who will have a role in response activities, as well as industry participation. To ensure that these processes undergo continual improvement, it is recommended that a DOE process owner take responsibility for the drills and exercises process. Having a specific office or division responsible for the drill and exercise program, will help to ensure the drill/exercise program is comprehensive in nature.

The drill/exercise program must work in concert with an overall education and training program to ensure that responders are adequately prepared to respond to an actual incident.

A good drill/exercise program will challenge the response team at the correct level of existing capabilities to develop consistency in a team concept, but must also challenge the team members beyond their existing capability to ensure continual improvement and a more capable team. Outside evaluators could be used during drills/exercises to ensure an independent assessment of the teams capability is provided as feedback. An after-action assessment must be completed after each drill/exercise that includes the identification of needed improvement areas and assigned tasks to address those improvement areas. Outside evaluators can also provide input to the process owner for design of the next drill/exercise to test identified improvement areas.

A comprehensive drill/exercise program must include both announced and un-announced sce-

narios. DOE should review and consider how it could utilize the National Preparedness Response Exercise Program (NPREP) as a model for an exercise program. NPREP is used throughout the federal government and the oil and natural gas industry.

Exercises and drills should be designed to replicate real-world scenarios as closely as possible in both the simulated event and the staffing for the response. Specifically, the individuals that participate in exercises, including senior leadership, emergency managers, and industry personnel, should be those that will have responsibilities in an actual event. Injects (additional pieces of scenario information that drive the event story line), requests for assistance, and competing priorities should all be designed into the process. DOE's ability to cope with and learn from challenging situations presented during exercises will strengthen their capabilities during an actual event.

DOE must continue participation in federal government exercises/drills. DOE participants should be the members of the DOE ERT or DOE senior leaders with a role in the response.

Industry should invite DOE to participate in industry-led drills and exercises.

The oil and natural gas industry is committed to inviting DOE and other federal agencies, as appropriate, to participate in industry-led drills and exercises. In many instances, DOE may have opportunities to help plan or provide inputs to these industry led drills. The industry's requirements to conduct drills and exercises utilizing both ICS and NPREP, means that DOE can leverage scenarios, challenges, and best practices used in industry programs in the development and refinement of their own program.

EDUCATION ON SUPPLY CHAINS

Preparing for oil and gas emergencies requires an understanding of oil and gas supply chains. Updates to the education and training curriculum should include inputs from both industry

and government to ensure balance and to facilitate mutual understanding and appreciation of each other's issues and concerns.

Annual Refresher Education in Advance of Hurricane Season

DOE and FEMA, working with states, should conduct annual refresher education for stakeholders across the energy sector, including industry, state, local, tribal, and territorial governments, and the public. The purpose of the training is to build an understanding of potential impacts from events, such as hurricanes, and the preparedness actions and behaviors that can mitigate some of those impacts. The oil and natural gas industry is committed to working with DOE to educate energy sector stakeholders. Where possible and appropriate, companies, working through their trade associations, will share educational materials and resources, which can aid DOE and state efforts.

DOE and FEMA, working with applicable states, should conduct annual hurricane preparedness education for stakeholders across the energy sector, and the public.

Utilize the Oil and Natural Gas Industry Preparedness Handbook

The ONG SCC adopted the *Oil and Natural Gas Industry Preparedness Handbook* (the Handbook) and associated electronic application as a key training reference to help communicate to and educate stakeholders across the public and private sectors about the oil and natural gas systems and how their complexities influence preparedness for and response to an incident.⁴ The Handbook includes additional components that address preparedness and response strategy, the National Response Framework, ESF-12 communications model, strategies for preparing at the

⁴ American Petroleum Institute, *Oil and Natural Gas Industry Preparedness Handbook*, October 2013. The Handbook can be downloaded at <http://www.api.org/policy-and-issues/policy-items/safety/oil-and-natural-gas-industry-preparedness-handbook>. The associated iPad application, "Energy Well to Wheels (W2W)," is also available for download from api.org.

state and local levels, and potential regulatory relief.

The oil and natural gas industry, through the American Petroleum Institute (API), worked with the ONG SCC members as well as individuals across ten government agencies to identify the key strategies that can assist industry and government response to events. The Handbook is a succinct and effective resource to educate response communities on the National Response Framework, the complexities of the oil and natural gas supply chain, the importance of preparing locally, and the importance of regulatory relief during a response. DOE and industry should commit to using the Handbook as a common reference tool to explain the supply chains, elements of planning and preparedness, and collaboration between the industry and government.

Overviews and descriptions of the hydrocarbon liquids, natural gas, and natural gas liquids (NGL) supply chains can be found in Appendices G and H.

Use the *Oil and Natural Gas Industry Preparedness Handbook* as a common reference tool to explain the supply chains, elements of planning and preparedness, and collaboration between the industry and government.

Maintaining and Enhancing the Oil and Natural Gas Industry Preparedness Handbook

The oil and natural gas industry, through the ONG SCC, will review the Handbook on a regular basis and issue updates as appropriate. At the time of this report, the suggested updates to the Handbook include expanded discussions on supply chain complexities, interdependencies, and roles and responsibilities. Specifically, these updates include topics that are important to preparedness and response:

- *Nuances of regional supply chain flexibilities and resiliencies.* Domestic growth in oil and natural gas production over the past 5-6 years have led to increased resiliency throughout both the oil and natural gas supply chains.

- *Intricacies of commodity ownership.* As developments in domestic production have changed, so has the ownership of assets across the industry. Diversification of ownership, coupled with increasingly complex market structures, has created confusion outside of the industry because often the owner of the asset is not the same entity as the owner of the product within that same asset. For example, terminals typically hold product but do not own the product; a retail gas station can be branded with the name of a large oil company, but can be independently owned and operated by an individual with a commercial contract with that company. Understanding ownership across assets and commodities is critical to federal, state, and local governments as they attempt to respond to events while providing for the needs of their communities.
- *Ethanol and NGL supply chains.* Both of these supply chains are integral to the liquids oil and gas supply chains necessitating a broader description of interdependencies.
- *Seasonality of threats and potential cross-regional consequences.* The impact of a natural disaster in one region may have cascading impacts on fuel supplies in another region. Additionally, response activities may require collaboration and waivers across multiple states.
- *Mutual assistance practices in the oil and gas sector.* The Handbook will describe the cooperative and mutual aid agreements in place to support response.
- *ICS and the communication interface of the response framework.*
- *Updating the list of potential regulatory relief.*
- *Interdependency between natural gas and electricity generation.* As the electricity market shifts towards an increase in natural gas fired power generation, a greater awareness of the interdependency between natural gas and electricity generation is needed.

The Oil and Natural Gas Sector Coordinating Council will maintain and enhance the *Oil and Natural Gas Industry Preparedness Handbook*.

Education on the Hydrocarbon Liquids Supply Chain

As noted several times above, it is critical that both industry and government personnel involved in emergency preparedness understand the supply chains, so that during emergencies DOE can quickly establish situational awareness and make informed decisions. The following provides a high level summary of the supply chains. More detailed descriptions are in Appendices G and H.

The hydrocarbon liquids supply chain is a complex, highly efficient, resilient, and robust network of feedstock producers, manufacturing plants, and modes of distribution. Much of the system's resiliency and robustness arises from diversity of sources of supply. Multiple sources of crude oil both domestically and internationally are transported from point of production to refineries by pipelines, ships, barges, and rail. Refineries are dispersed throughout the country, although for logistical reasons tend to be located along the coast and major waterways. From refineries, products can be delivered via rail, barge, ship, or pipelines, although most fuels are transported by pipelines.

Product Fungibility and Diverse Sources of Supply Result in Efficiency, Resiliency, and Robustness

An important factor in the efficiency, resiliency and robustness of the supply chain is the fungibility⁵ of fuels within the distribution system. Refiners produce products that meet strict specifications, so that gasoline blendstocks⁶ are interchangeable. The gasoline produced by multiple refineries can then be commingled and shipped in

5 Fungibility means that something is interchangeable although not identical. For example, dollar bills are fungible. If someone deposits a dollar bill in a bank, they can later go to the same bank office or a different branch and withdraw a dollar. The dollar withdrawn is not the exact same dollar deposited, but that is irrelevant because it is functionally interchangeable. Fuels travel through the distribution system much like dollar bills through the banking system. It is only when proprietary additives are added to fuel that they become unique and are no longer interchangeable. In the case of gasoline that happens when the fuel is put in to the tanker truck at a terminal for delivery to a retail fueling station.

6 Reformulated blendstock for oxygenate blending (RBOB) and conventional blendstock for oxygenate blending (CBOB) is gasoline blendstock that is not yet fit for purpose. It needs to be blended with ethanol to meet octane requirements.

large batches over long distances in common carrier pipelines. Along the pipeline, fuel is diverted from the main flow and stored at distribution terminals located near consumer markets (terminals can also be supplied by rail, barge, and ship). The last leg of the journey from distribution terminal to the retail site is typically by tanker truck. It is during the step of loading fuel into the tanker truck that ethanol is introduced along with the proprietary additives that make the fuel unique to a brand.

The increased use of biofuels, particularly ethanol, has complicated the distribution system to some extent. Biofuels are typically produced in the Midwest, close to the sources of feedstock, and transported to distribution terminals by rail, although some is also distributed by barge, ship, and tanker truck. Gasoline is not typically finished gasoline suitable for consumer use until ethanol is added to the gasoline at the distribution terminal as the gasoline and ethanol are put in to the tanker truck for final delivery to the retail site. Proliferation of regional fuel specifications has further compounded this complexity. These constraints can generally be relaxed through regulatory relief. Ethanol blending on the other hand impacts the suitability of the fuel for consumption. Figure 3-1 provides an overview of the hydrocarbon liquids supply chain.

Fungibility and Diversity of Supply Allows the Industry to Rapidly Adapt to Temporary Disruptions

During normal operations, the oil and gas industry manages the supply chain by making routine adjustments to supply lines and distribution routes to account for outages, supply variations, and market demand. When normal operations are not possible, industry operators seek out the next best efficient and cost-effective option. For example, if one terminal becomes inoperable, suppliers will typically divert tanker trucks to the next closest terminal to acquire fuel for retail sites. Similar adjustments occur when a refinery or a pipeline is inoperable. The market also plays a key role in readjusting supply and demand. Market mechanisms work through the adjustment of pricing at both the wholesale and retail levels providing incentive for consumers to use less, and for

suppliers to seek out more distant sources of supply to meet consumer demand.

In the aftermath of a natural disaster such as Hurricanes Katrina, Rita, Gustav and Ike, or Superstorm Sandy, which disrupt the supply chain infrastructure, the industry manages the supply chain in much the same way, but on a larger scale. In response to extreme events where supplies are disrupted, industry will most likely shift sources of supply for the affected area (e.g., industry may secure supplies from terminals further from the affected area), change fuel distribution modes (e.g., use barges and ships rather than pipelines), and use facilities in non-routine ways (e.g., if rail transport of ethanol is disrupted, ethanol may need to be shipped from a terminal that does not typically ship ethanol). Government regulators may be called upon to temporarily relax regulations to enable the industry to make such shifts to expedite the restoration of fuel supplies.

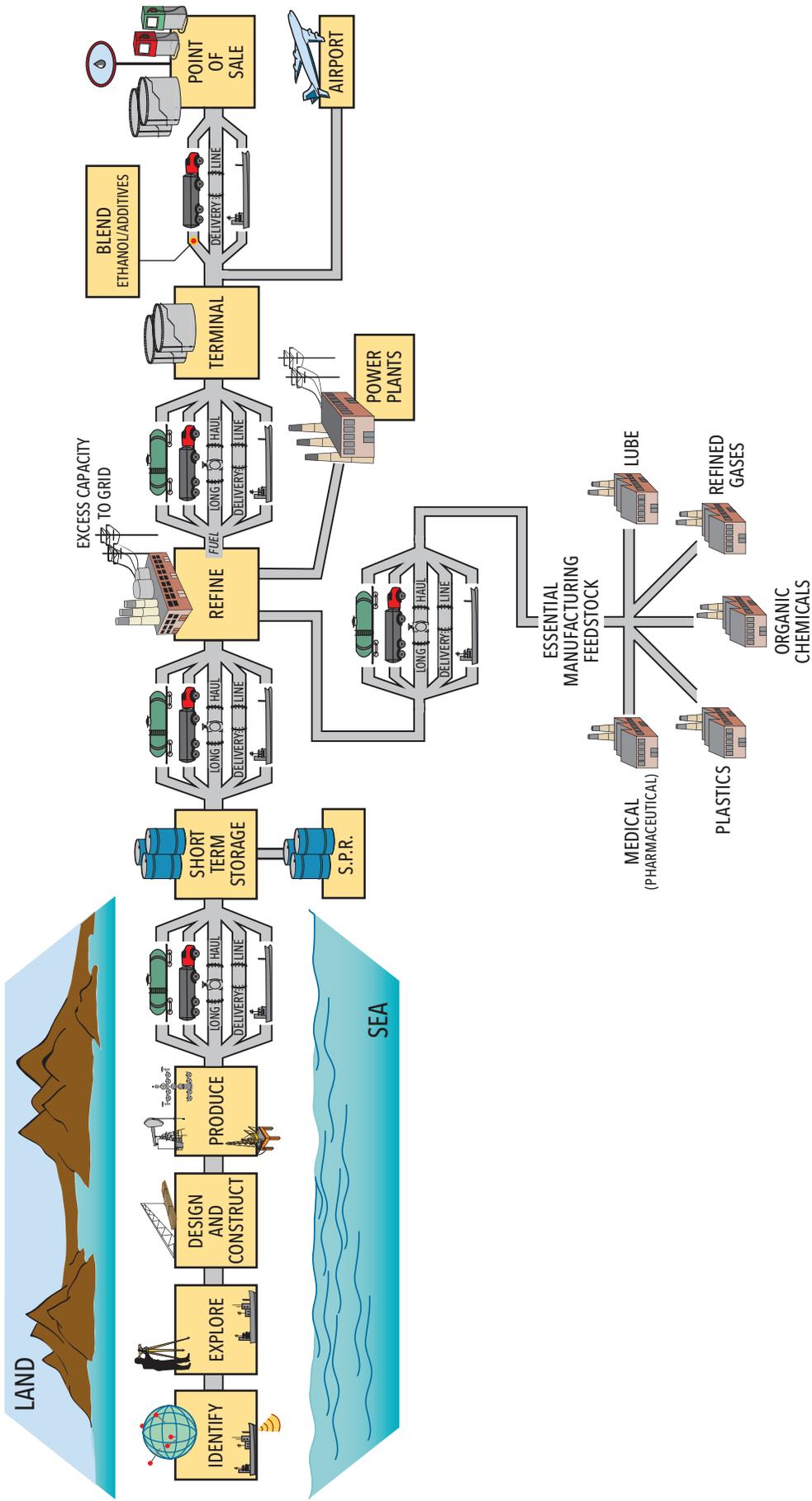
Education on the Natural Gas Supply Chains

The natural gas and natural gas liquids supply chains are complex, but very efficient, resilient, and robust. Fungible product specifications and diversity of supply sources are key reasons for these favorable aspects of the system. Figure 3-2 provides a high-level summary of the natural gas supply chains, and a high-level description. More detailed descriptions of the supply chains can be found in Appendix H.

Natural gas gathering systems collect supplies from well sites and transport the natural gas to processing facilities. The processing facilities remove contaminants. Midstream processing plants are designed and operated to render products that meet defined quality specifications for transmission through intrastate or interstate pipelines which deliver gas to distribution lines which deliver to end users.

The movement of the natural gas through the pipeline system is managed by a well-designed and controlled series of compressor and metering stations, valves, and further equipment to monitor and control the system.

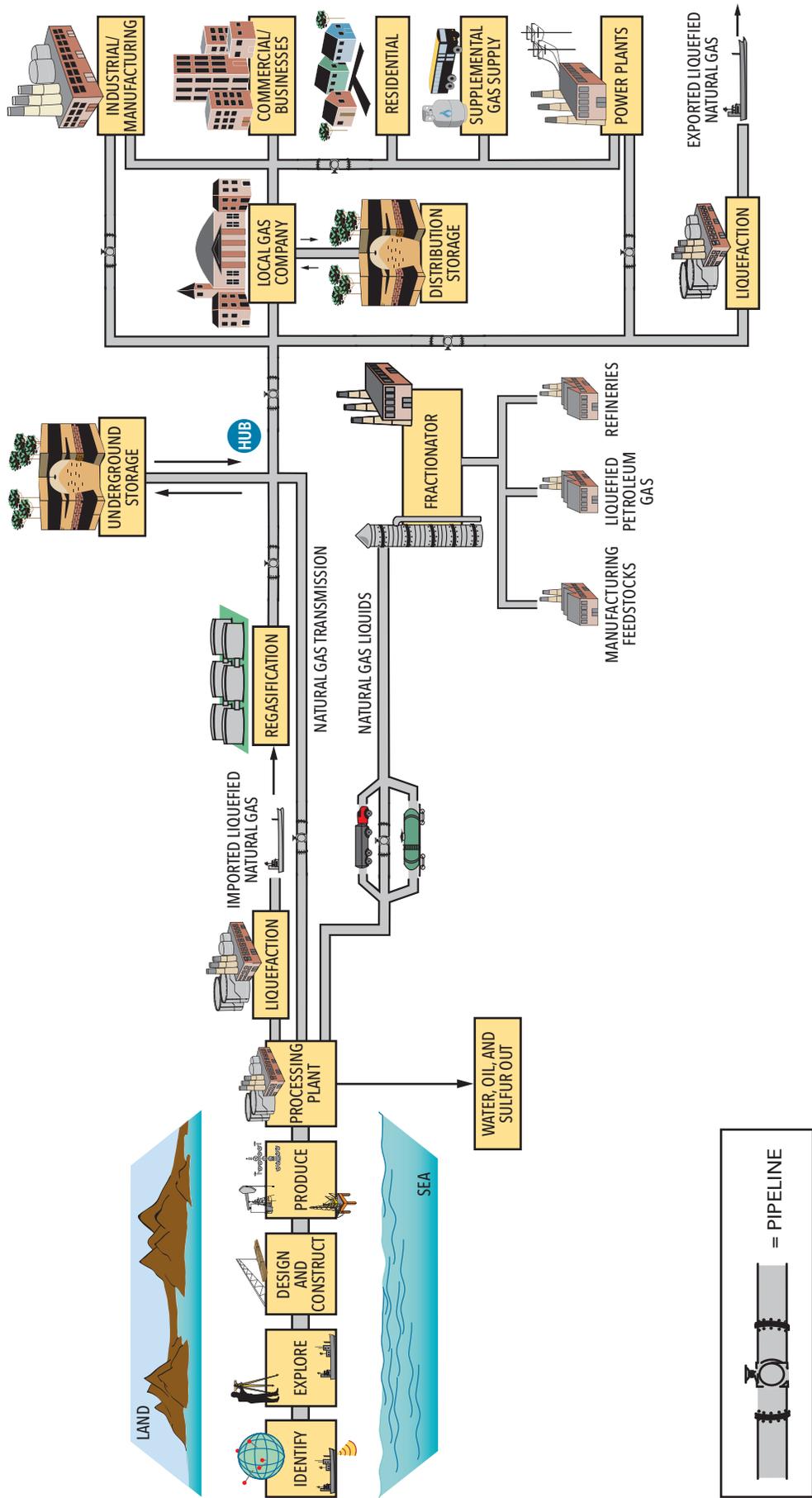
The national natural gas delivery network is intricate and expansive, but most of the major



Source: American Petroleum Institute, *Oil and Natural Gas Industry Preparedness Handbook*, October 2013.

Figure 3-1. Hydrocarbon Liquids Supply Chain

(Source: American Petroleum Institute, *Oil and Natural Gas Industry Preparedness Handbook*, October 2013.
<http://www.api.org/~media/Files/Policy/Safety/ONG-Industry-Preparedness-Handbook-v2.pdf>)



Source: American Petroleum Institute, *Oil and Natural Gas Industry Preparedness Handbook*, October 2013.

Figure 3-2. Natural Gas and Natural Gas Liquids Supply Chains
 (Source: American Petroleum Institute, *Oil and Natural Gas Industry Preparedness Handbook*, October 2013.
<http://www.api.org/~media/Files/Policy/Safety/ONG-Industry-Preparedness-Handbook-v2.pdf>)

 = PIPELINE

transportation routes can be broadly categorized into eleven distinct corridors or flow patterns: five major routes extend from the producing areas of the Southwest; four routes enter the United States from Canada; and two originate in the Rocky Mountain area. The interconnection of two or more pipelines is called a hub and there are nearly three dozen hubs in the United States' natural gas pipeline network. Hubs provide great flexibility in moving natural gas from supply areas to consumption markets. (For more information, see Appendix H.)

Natural gas can be produced at a fairly steady rate, and can be transmitted at a consistent rate. However, demand for natural gas may have normal peaks or lulls dependent on factors such as seasons or weather. Temporarily placing natural gas into storage for later withdrawal helps provide a valuable tool for systemic balance between supply and demand forces.

The seasonal pattern in the United States is relatively predictable, with higher demand for natural gas coinciding with colder weather. So, typically, natural gas is injected into storage facilities from the spring and through summer. In the

LIQUEFIED NATURAL GAS (LNG)

LNG is natural gas that has been super-cooled to approximately -260°F. At such low temperatures the product transforms from its gaseous state into a liquid. This also greatly reduces the volume so that LNG is about 600 times smaller than natural gas at normal ambient temperatures. Due to this compactness, it may be preferable at times to store or transport the product as LNG rather than as natural gas. For instance, some areas in the United States lack proper underground formations for conversion to natural gas storage. In such cases, specialized above-ground LNG tanks are employed for peaking facilities. Peaking facilities are needed for use during peak periods of natural gas demand—in the coldest weather for heating and in hot weather for fueling electric power generators.

event of short-term, volatile demand swings that call for a quicker response than standard storage facilities are equipped to manage, peaking facilities can supplement supplies. Peaking facilities are capable of liquefying natural gas during off-peak periods, storing it in above-ground tanks, and then regasifying the product for injection into the transmission or distribution system.

The interstate pipeline network delivers natural gas to distribution lines, which in turn make deliveries to end users. Some large industrial facility customers or power generators may connect directly to an interstate natural gas pipeline, but the majority of consumers receive their natural gas from Local Distribution Companies, or LDCs. Many storage facilities are owned and operated by large LDCs to provide natural gas delivery security for their customers' needs.

Education on the Natural Gas Liquids Supply Chains

Natural gas liquids refers to five purity products: ethane, propane, normal butane, isobutane, and natural gasoline (also known as pentanes plus) produced primarily as a by-product of natural gas processing, but also as a by-product of some refinery processes.

The NGL supply chain begins at exactly the same place as the natural gas supply chain, since NGLs are comingled in the natural gas stream. Natural gas production that is rich in NGLs, or "wet," must be processed to remove the NGLs from the natural gas stream. After the processing plant, NGLs are usually piped, but sometimes trucked or railed, to a fractionator for further processing into the five discrete products mentioned above, while natural gas enters the distribution system for delivery to end users. NGLs can be transported by pipe, rail, truck, or ship for petrochemical feedstocks, home heating fuel, agricultural uses, gasoline blending, or export.

Most NGLs are not consumed at the time of production or fractionation for a variety of reasons including seasonality. This necessitates storage facilities. Storage plays a key role in managing variable demand and responding to temporary outages at production, processing, and fractionation plants. The Transmission and

Distribution sectors of NGLs also rely on storage and other assets to minimize impact to end users and consumers in the event of supply disruptions. Storage also plays an important role in the resiliency and robustness of the NGL supply chain. Product storage capacity assists in making deliveries to the industrial customers generally reliable even after natural disasters have occurred.

In contrast to gasoline and similar to natural gas, NGLs have no alternate non-specification product options that can be used to replace disrupted supplies and no applicable waivers for granting wider product parameters. Natural gas must meet specifications based on performance and safety. Although product specification waivers are not applicable to these products, some types of regulatory relief (i.e., truck driver hours, truck weight restrictions, and truck specification waivers) may be helpful to expedite distribution of these products in the aftermath of a natural disaster.

Just as with hydrocarbon liquids, fungible specifications and diversity of supply sources are key to the efficiency, resiliency, and robustness of the natural gas and natural gas liquids supply chains. The recent “Shale Revolution” and supporting transmission infrastructure projects designed to carry the unconventional onshore production to market, has had the most significant impact in minimizing consequences to end users from a Gulf of Mexico supply disruption. As experienced during Hurricane Ike in 2008 and subsequent offshore disturbances, the offshore supply disruptions had minimal impact to end users and consumers. Similarly, in the event that a supply disruption occurs in the onshore producing regions due to well freeze-offs, the end user may be able to source their gas from Gulf of Mexico production or other onshore production basins not impacted by the cold weather.

EXPANDED ROLE OF THE OIL AND NATURAL GAS SECTOR COORDINATING COUNCIL

The oil and natural gas industry recognizes DOE’s role, as the primary agency for coordinating energy sector disruptions, to assist state and local governments and private-sector stakehold-

ers to overcome many of the challenges associated with the restoration of energy systems. Industry, as the owners and operators of these systems, has the primary responsibility, as well as the skills and experience, to stabilize and restore critical services after an incident occurs. Pre-planning will never identify every challenge, resource, or information need during an actual incident. Therefore, it is in the best interest of both public- and private-sector representatives to communicate before, during, and after an event to ensure access to physical resources, pertinent information, or those responsible for the administration of both. The Oil and Natural Gas Sector Coordinating Council (ONG SCC) provides a means to improve some preparedness and communication process.

The ONG SCC represents the interests of oil and natural gas sector owners and operators with representatives from some 24 industry trade associations. The ONG SCC provides a private forum for effective coordination of oil and gas security strategies and activities, policy, and communication across the entire sector to support the nation’s homeland security mission. The council provides a venue to mutually plan, implement, and execute sufficient and necessary sector-wide security programs, procedures, and processes, and to exchange information and assess accomplishments and progress for protecting the nation’s oil and natural gas critical infrastructure. The ONG SCC is a self-organized, self-run, and self-governed entity. The council selects a representative from the industry to serve as the council chairperson and function as the prime contact and focal point for DOE and DHS. The ONG SCC was established in June 2004 to facilitate DHS’s efforts to protect and secure our nation’s infrastructure through its partnership approach, whereby it engages in partnerships among government and industry stakeholders. The members of the ONG SCC also work on transportation sector pipeline efforts through the Pipeline Working Group that serves as the Pipeline Modal Sector Coordinating Council for the transportation systems sector. Additional working groups are established to manage specific issues such as cyber security, information sharing, and emergency response.

The national infrastructure is divided into 16 sectors, and select federal agencies are

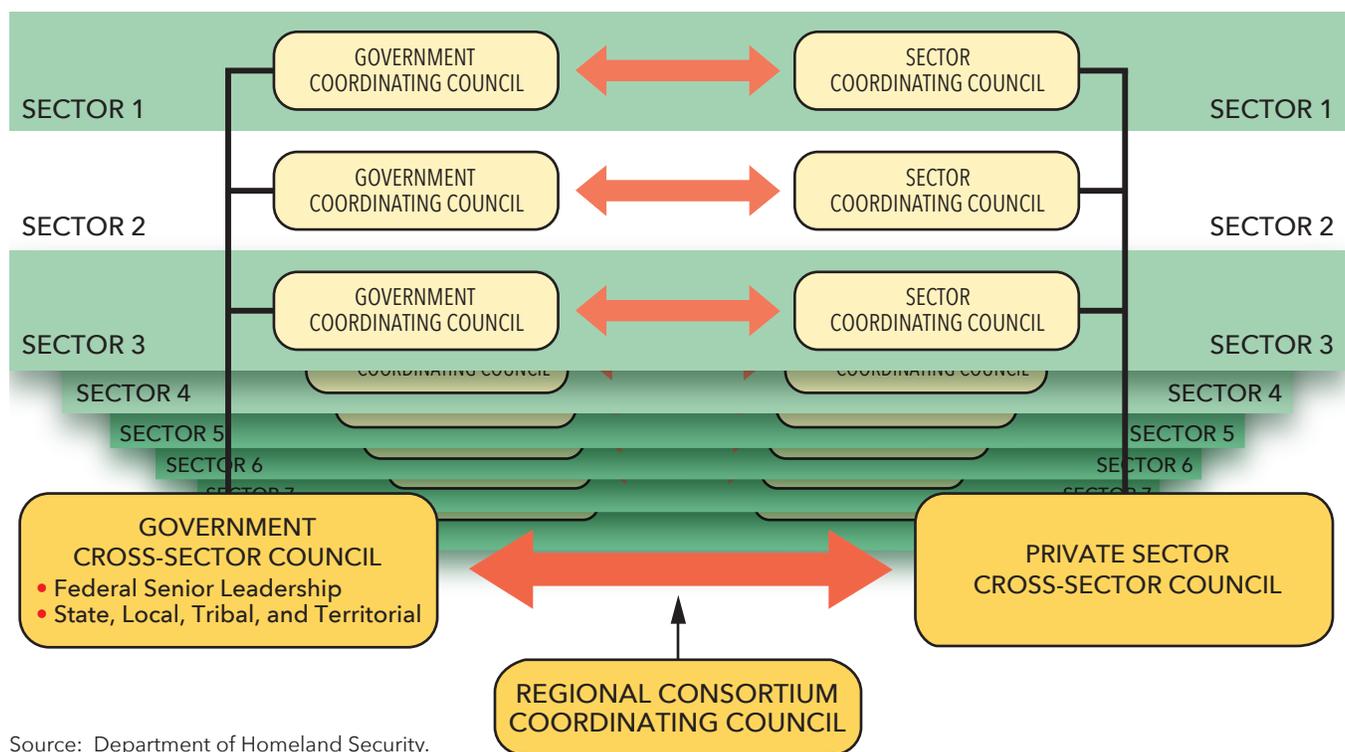
responsible for leading the efforts in each sector as the Sector-Specific Agency. DOE has been designated the Sector-Specific Agency for the oil and natural gas industry. A Government Coordinating Council (GCC), which is the government counterpart for the Sector Coordinating Council (SCC), for the energy sector was established in early 2004. The GCC is co-chaired by the DHS Assistant Secretary for the Office of Infrastructure Protection and the DOE Assistant Secretary for Electricity Delivery and Energy Reliability, and consists of the federal sector energy-related organizations, as well as those representing state and local governments. The GCC is tasked with coordinating strategies, activities, policy, and communications across governmental entities within each sector. The GCC meets regularly with their SCC counterparts to share information and collaborate on efforts. Through the partnership model, shown in Figure 3-3, the GCC maximizes efficiency by collaborating with sector partners at various levels to help develop and prioritize various security programs and initiatives. The partnership between industry's ONG SCC and

government's GCC, shown in Figure 3-4, provides a mechanism to facilitate preparedness and communication improvements.

The framework presented in Chapter 2 lays out a process to be used to get direct information from industry to determine potential impacts to national or regional energy supplies and restoration timelines. To assist DOE, the ONG SCC has agreed to expand its support role in enhancing emergency preparedness. This will include supporting DOE in the annual updating of the industry emergency contact lists, in updating and maintaining the *Oil and Natural Gas Industry Preparedness Handbook*, and facilitating education and participation in drills by the industry. Following is a summary of the expanded role of the ONG SCC along with a summary of limitations.

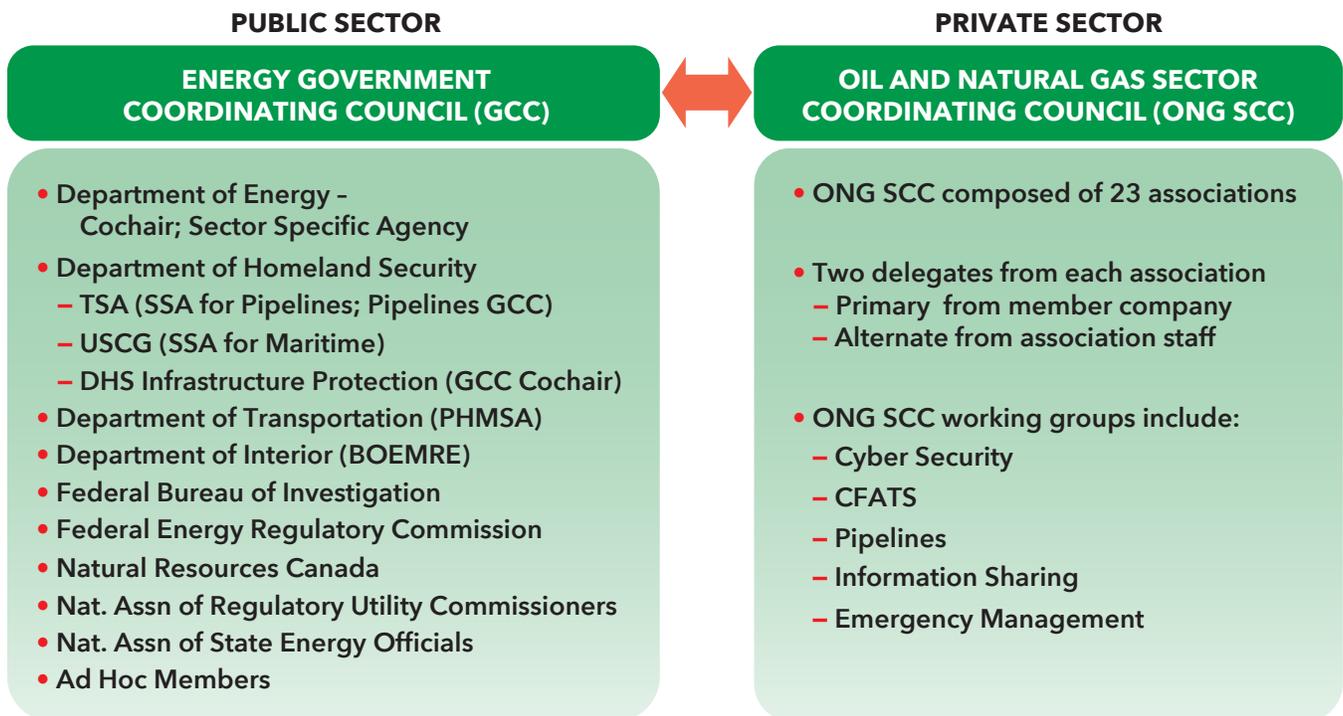
Expanded Role

- Education
 - Maintain/update the *Oil and Natural Gas Industry Preparedness Handbook*
 - Provide context and education when needed



Source: Department of Homeland Security.

Figure 3-3. Sector Partnership Model



Source: Department of Homeland Security.

Figure 3-4. Energy Sector (Oil and Natural Gas)
Public-Private Partnership Framework

• **Information Sharing**

- Support DOE in the annual updating of the industry emergency contact lists
- Serve a liaison role for government to identify and connect with affected member oil and gas owners and operators during significant events
- Provide a feedback mechanism for DOE to validate certain situational status information at a high level

• **Training**

- Share drill/exercise schedules of industry and government when available
- Participate in workshops and conferences

ONG SCC Limitations

• **Company-Specific Information**

- Cannot share company-specific information
 - Supplies

- Restoration timelines
- Market Information

• **Market Analysis**

- Cannot provide analysis of market impacts for certain companies or regions

• **Discussion Topics**

- Cannot engage in discussions involving the following:
 - Pricing
 - Inventory Stocks
 - Contracts
 - Product Movements

• **Collection/Consolidation of Information**

- Cannot collect/consolidate company-specific information, develop aggregate situation assessment, nor speak on behalf of company-specific representatives during events.

POLICY CONSIDERATIONS—RESILIENCY, EFFICIENCY, AND ENVIRONMENTAL REGULATIONS

In addition to the sustaining mechanisms mentioned above, such as training, education, planning and drilling, a critically important component for maintaining and improving emergency response to natural disasters is ensuring that due consideration is given to policy that may potentially impact the infrastructure development decisions made by industry.

Resource Development Requires Infrastructure Build Out

The oil and natural gas industry plays an essential role in the nation's economy: delivering the fuel that powers economic growth and job creation, and drives revenues to government at all levels. Underpinning the industry is the world's largest network of oil and natural gas pipelines, comprising nearly 2.6 million miles, safely carrying more than 14 billion barrels of crude oil each year and all natural gas produced in the United States (more than 25 trillion cubic feet in 2012).⁷ Today, the United States is witnessing meaningful growth in natural gas, natural gas liquids, and crude oil production alongside significant growth in demand. The growth in production and demand has also yielded an increase in direct capital investment in oil and gas infrastructure to meet the requirements of the marketplace.

Natural gas usage has increased dramatically during the past decade, most noticeably in the power generation sector. Natural gas currently fuels about one-third of electric power generation in the United States. In addition, natural gas price stability has led to a resurgence of gas use in industrial applications. Furthermore, growing production of NGLs has encouraged renewed interest in petrochemicals production. NGLs obtained from natural gas and as a refinery by-product are a critical feedstock used

in the petrochemicals industry. Finally, growing oil production from unconventional supply sources has created additional opportunities for North American refineries to take advantage of new crude oil supplies. The increase in supply of domestic oil, natural gas, NGLs, and refined products can provide resiliency during natural disasters. However, additional infrastructure development is first necessary in order for the United States to fully realize the resiliency benefits associated with an abundance of supply.

The resiliency of the U.S. energy delivery system is ultimately enhanced and strengthened through increased robust connections between supply and demand centers.

The value of a resilient and robust energy delivery infrastructure is easy to recognize. Resiliency can temper the magnitude of disruptions by offering the ability to adapt and quickly resume energy deliveries following an outage. However, a less obvious and commonly overlooked aspect of infrastructure resilience is the more slowly moving aspect of adaptability. In the case of the nation's energy infrastructure system, that adaptability is manifested in the ability of the infrastructure system to evolve as supply and demand markets shift locations and change in intensity levels. It is imperative that the system keeps pace with the supply and demand forces to prevent bottlenecks and to create new connections accommodating secure and reliable energy delivery. This necessitates modifying and building out the existing energy infrastructure. Further energy infrastructure development projects are critical for the advancement of new energy resources by supplying new and changing markets with energy supply resiliency. According to a 2014 study conducted by energy analyst ICF International, more than \$640 billion in total midstream capital expenditures are forecasted in the United States and Canada from 2014 to 2035, as shown in Figure 3-5.⁸ This represents about \$30 billion per year in

7 American Petroleum Institute, *The State of American Energy: America's Energy, America's Choice*, January 2014. <http://energytomorrow.org/~media/EnergyTomorrow/pdfs/API-2014-State-of-American-Energy-Report.pdf>.

8 INGAA Foundation Report, *Prepared by ICF International, North American Midstream Infrastructure through 2035: Capitalizing on Our Energy Abundance*, March 18, 2014.

natural gas, NGLs, and oil midstream activity. More specifically, the study projected:

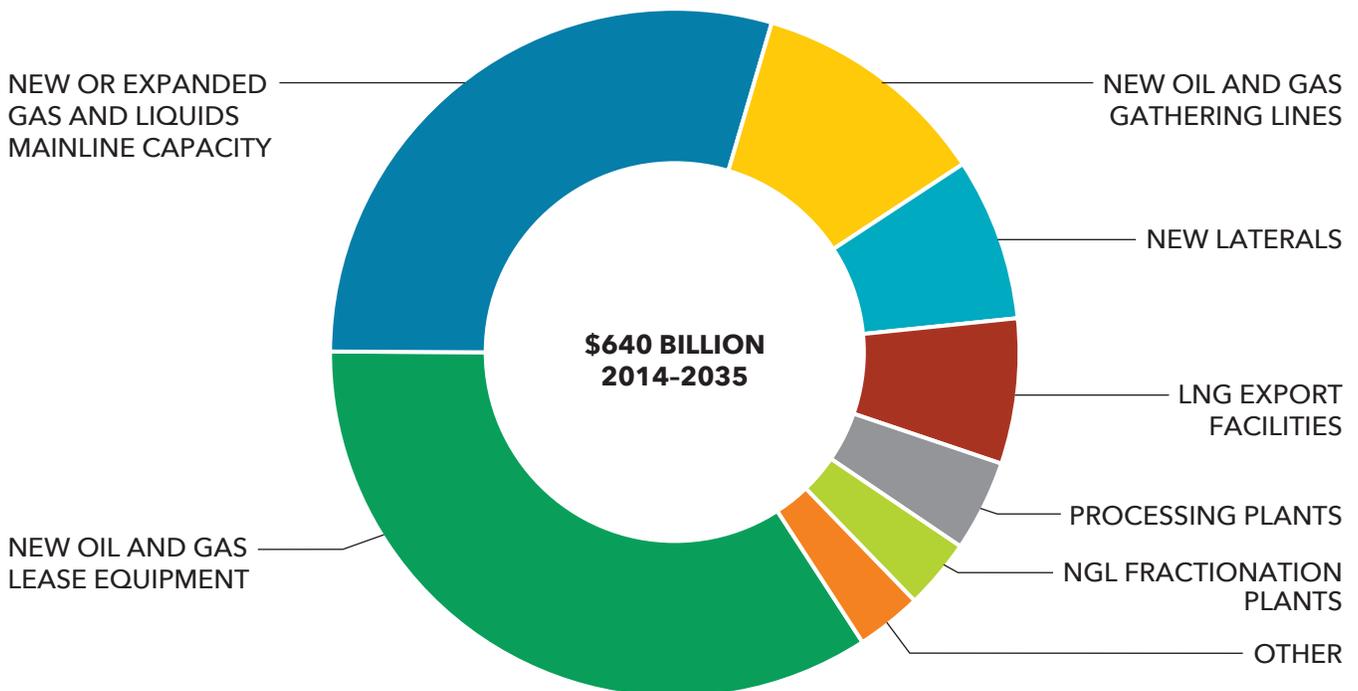
- Annual average natural gas midstream investment of \$14.2 billion per year, or \$313.1 billion through 2035
- NGL infrastructure capital investment of \$2.6 billion per year, or \$56 billion
- Crude oil infrastructure capital investment of \$12.4 billion per year, or \$271.8 billion total of capital investment.

As infrastructure designs are reviewed by state and federal governments, much consideration is given to the infrastructure project’s environmental impact. Along with those environmental considerations, government policy makers and regulators should give equal consideration to the efficiency and resiliency created through the enhancement of increased energy infrastructure.

Sufficient energy infrastructure will enable the United States to develop its vast resources, with far-reaching positive impacts to nearly every sec-

DOE and states should make resiliency consideration part of the permitting process.

tor of the U.S. economy. Impacts from energy infrastructure investments permeate deeply into the national economy by contributing to higher local, state, and federal tax revenues, raising the country’s GDP, yielding new jobs and boosting the nation’s labor income. Indirect and induced benefits occur well beyond the energy industry. Some estimated economic effects from the ICF International study include \$132.9 billion increases in federal tax revenues and a further \$108.5 billion lift in state and local tax revenues over the study period. The value added to the U.S. GDP is assessed to be \$692.2 billion. The projected necessary energy infrastructure build-out equates to nearly 340,000 high paying jobs per year. In fact, ICF International calculates, “every \$100 million of investment in new infrastructure creates an average of about 67 jobs over the projection



Source: INGAA Foundation, International Pipeline Conference 2014.

Figure 3-5. North American Midstream Infrastructure through 2035

NORTHEAST PIPELINE CAPACITY

The Department of Energy, in assessing the adequacy of natural gas pipeline capacity in the Northeast writes:

“The ability of the gas pipeline network in the Northeast to meet ‘essential human needs’ demand during disruptions of pipeline supply has changed in significant ways in the past eight years. In the span of just a few years, the growth of Marcellus Shale gas production has increased regional gas supply and altered the movements of natural gas into and within the Northeast. The growth of production from the Marcellus Shale has added much more flexibility to Northeast gas markets and pipelines such that a disruption on an upstream segment of one of the long-haul pipelines would have less of an impact on the region than it would have in the past.

“This is particularly so for those market areas south and west of the New York City Metro area. The market areas in western, central, and northeastern Pennsylvania now have access to more gas from local production than their markets require, such that a disruption of upstream gas pipeline capacity would not affect their ability to meet ‘essential human needs.’ Nevertheless, outages on individual pipelines could still cause localized gas delivery problems due to limitations on intra-market movements of natural gas.

“New gas supplies from the Marcellus also benefit those markets in Maryland, the District of Columbia, and Northern Virginia, Delaware, southeastern Pennsylva-

nia, New Jersey, and upstate New York. Marcellus supply allows the ‘backhaul’ of gas on pipelines that traditionally moved gas from points farther south and west into the Northeast market, thereby enhancing the supply options for these markets. The ability of Marcellus gas to feed the markets farther downstream in Pennsylvania effectively frees up gas that would have flowed into those regions and increases these markets’ ability to meet ‘essential human needs’ should a disruption occur.

“What remains problematic, however, are those markets ‘at the end of the pipe,’ namely New England and New York City Metro. They remain downstream of their gas supplies and are vulnerable to pipeline disruptions. There are no opportunities for ‘backhauls’ and the amount of pipeline capacity entering these market areas limits the supplies they can receive from any domestic source, including Marcellus. The New York City Metro area appears to be less vulnerable than reported in the 2005-06 study, in part because of the planned expansions on Texas Eastern and Transcontinental pipeline systems into the area (due online in late 2013). These expansions could provide some additional flexibility for the New England by freeing up capacity on the Iroquois pipeline system formerly serving the New York City Metro area.”

(U.S. Department of Energy Office of Electricity Delivery and Energy Reliability Energy Infrastructure Modeling and Analysis Division, “Assessment of the Adequacy of Natural Gas Pipeline Capacity in the Northeast United States,” November 2013.)

period.”⁹ Clearly, growth in the energy infrastructure results in growth in the entire economy.

Complex and duplicative regulations can cause delays in or the cancellation of the development of new infrastructure and thwart investments,

impeding this critical infrastructure development. Consequences of delayed infrastructure investments include a decline in rig counts, cancellation of industrial projects such as petrochemical facilities, associated loss of direct and indirect jobs, less affordable energy, and scarcer energy and fuel sources. Therefore, it is imperative that

⁹ Ibid.

industry collaborate with stakeholders such as DOE to find common-sense opportunities to improve the permitting and regulatory process to allow for improvements to resiliency by supporting and facilitating energy infrastructure investment. Effective and thoughtful collaboration between government and the private sector can enable improvements to the reliability of the entire energy delivery system.

Regulatory Streamlining Needed for Natural Gas Compression Permitting

Natural gas is compressed to move the product through pipelines from supply areas to market. Compressors are driven by either natural gas fired drivers (i.e., engines and turbines) or by electric drivers (i.e., motors). For a specific project, the selection of compressor driver is based on a variety of factors, such as the availability of reliable electric power, equipment efficiencies, required operating flexibility, environmental impacts, and capital/operations and maintenance costs. Some benefits of natural gas driven compression include the ready availability of fuel onsite, non-reliance on the electrical grid, and lower initial capital costs. Where reliable power is available, benefits of electric motor driven compression may include higher efficiencies, wider operating ranges, and lower maintenance costs, as well as reduced noise impacts and less air emissions generated from the facility. Selection of the compressor driver appropriate for a specific project/location is typically based on evaluation of these types of factors.

It is important to note that proposed projects are often subject to state and/or federal air quality regulatory requirements. While the state air permitting process for new natural gas fired compressor drivers can typically take from 12 to 18 months, the federal air permitting process can typically take from 24 to 36 months. Due to the complexity of federal air permitting of natural gas fired sources, especially in ozone non-attainment areas, industry often selects electric motor driven compression as the most expedient solution to getting critical projects into service. However, this increases the interdependency of the natural gas sector to the electric sector, whereby natural gas driven compression would provide a higher level of independence.

Streamlining the air permitting process could potentially help address some of these timing issues. Possible actions could include improved coordination between state and federal agencies during the air permit application review process, improved certainty regarding emission control requirements, and improved tools for use in the project evaluation process (i.e., air dispersion model improvements). For projects subject to FERC regulation, improved coordination of the air permitting process and the FERC regulatory review process could also improve project certainty and timelines.

A more flexible, streamlined air permitting process would allow companies to more fully evaluate both natural gas driven and electric motor driven compression options. Companies could then select the type of equipment best suited for each specific project and location after taking into account factors such as cost, life-cycle emissions, and reliability.

Balanced regulatory policy considerations are needed for infrastructure development and permitting.

Risk assessments must be conducted to account for the region's supply chain vulnerabilities to natural disasters, specifically, exposure introduced by relying solely on the electric grid to power natural gas compression. In the event a natural disaster impacts electricity transmission, natural gas supplies fueling electricity generation may also be impacted, thus potentially curtailing electric power generation. Therefore, the pros and cons of each type of compression system, natural gas-fired or electric-driven, must be considered in totality. A streamlined air permitting and regulatory process placing both compression options on an equal footing allows stakeholders to make better decisions to meet regional resiliency and reliability needs in a timely manner.

NGL Infrastructure Expansion Needed to Support Natural Gas Development

As the United States moves forward with natural gas infrastructure development in emerging

shale supply areas, it is important to not lose sight of the NGL infrastructure needed to strengthen the resiliency of the natural gas supply chain.

The tremendous rise of natural gas production as a result of the shale revolution has brought with it a corresponding surge in NGL production. “Wet” gas supply (natural gas production that is rich in NGLs) from the Marcellus, Utica, Texas, and Oklahoma has been growing rapidly. In fact, the proportion of gas coming from dry gas plays has dropped from a high of 86% in 2010 to a low of 57% of unconventional gas production today. Essentially, production of gas from dry plays has been flat for the past three years, while gas from NGL-rich gas plays has increased significantly.¹⁰

The heavier NGLs (butanes and pentanes) must be removed from the natural gas stream to create marketable natural gas. While NGL recovery is an operational necessity for production of the natural gas, the surge in NGL production and corresponding decrease in natural gas prices have made NGLs an economically important by-product of natural gas drilling operations. NGLs, once considered a nuisance by-product to natural gas, now provide significant value to natural gas producers. The proliferation of wet gas production and its vital role in keeping natural gas production economic requires maintenance and expansion of NGL infrastructure including processing, piping, trucking, railing, shipping, and export facilities to ensure natural gas supplies remain available to meet growing demand. NGL production growth is coming from various plays across the country. Some legacy plays in the South Texas area already have sufficient infrastructure to handle the surge. Other areas, like the Appalachian area, require the development of the full suite of processing, pipeline, fractionation, and transmission assets to continue to bring both natural gas and NGLs to market.

In fact, significant infrastructure additions will be needed to support the rising use of natural gas and NGLs in North America. In a 2014 analysis of energy infrastructure, ICF International estimated a required investment of more than \$369 billion during the next 21 years (\$313 billion for natu-

ral gas and \$56 billion for NGLs).¹¹ The analysis projected that in order to meet our energy needs, North America will require 850 miles of new natural gas transmission pipeline per year and almost 14,000 miles per year in new natural gas gathering lines, in addition to almost 700 miles per year of new NGL transmission lines. Moving product through these pipelines will necessitate more than 580,000 horsepower of natural gas pipeline and gathering compression, and 30,000 horsepower for NGL per year.

The natural gas and NGL supply chains are interdependent. If raw natural gas is not processed and NGLs are not removed, then the natural gas may not be suitable for consumption by consumers. Downstream constraints in the NGL supply market can quickly back up and impact a processing plants’ ability to operate. Without an outlet for the NGLs produced, plants cannot process gas and wells must be shut in. If NGL infrastructure, including storage, is not available to bring these valuable products to market, then investments in processing plants may not occur. As a result, some wet natural gas plays may not be developed, thus inhibiting supply and demand of both NGLs and natural gas.

To avoid this, and ultimately enhance connections between supply and demand centers, NGL infrastructure needs to be equally considered as a valuable component in the natural gas supply chain necessary for the broad development of infrastructure resiliency plans.

Crude Oil and Refined Products Infrastructure Expansion Needs

The tremendous rise of crude oil production as a result of the shale revolution is occurring while domestic demand for motor fuels is flat to declining. But development of crude oil may be hindered without the development of new market infrastructure.

ICF International forecasts the need for significant incremental crude oil infrastructure capacity. This includes oil gathering lines and

¹⁰ Bernstein Research, Bernstein E&Ps, “A Post-Summer’s Gas Deflate – Associated Gas Bringing 2015/16 Gas Price Down to \$4/mcf,” September 10, 2014.

¹¹ INGAA Foundation Report, Prepared by ICF International, *North American Midstream Infrastructure through 2035: Capitalizing on Our Energy Abundance*, March 18, 2014.

further pipeline grid development, as well as new surface equipment such as pumps, valves, manifolds, flowlines, stock tanks, separators, and heater-treaters. It goes on to forecast oil production gains in the United States and Canada between 2014 and 2035 of roughly 8 million barrels per day. This will mandate infrastructure investments averaging \$12.4 billion each year during the next two decades.

Although most U.S. refineries are designed to run a heavier crude oil than is currently being produced from the domestic shale plays, shale oil is a growing component of the refinery's feed slate. As a result of the abundance of Canadian and domestic crude oil, refineries are economically advantaged to utilize North American production where possible, running at maximum rates.

Chapter 4

EMERGENCY RESPONSE IN ACTION

This chapter provides examples of how the response frameworks discussed in Chapter 2 would be applied to emergency situations faced by a single company, an event that impacts many companies and an event with impacts that require an emergency response of very large scale and long duration. Each example provides a scenario for the type of emergency event that might typically be addressed (such as a hurricane), followed by the steps that would typically be followed, by business function, in anticipation of the event, and then a description of how the response would be managed. The scenarios below focus on business continuity plans and the steps that companies throughout the supply chain take to prepare for, respond to, and recover from a natural disaster, and communications between industry participants and the government using the communications process discussed throughout this report.

PRINCIPLES FOR RESPONSE

The recommendations in this study align with the principles applied across the oil and natural gas industry when preparing for and responding to events that could potentially disrupt operations or supplies. The overriding principle is to return the energy system to steady state operations as quickly as possible—a goal shared by both the oil and natural gas industry and the government. Industry has the primary responsibility for restoring liquid fuel and natural gas/natural gas liquid supplies in the wake of a natural disaster. The federal government has an important role in supporting and assisting the preparedness and response efforts of industry as well as local and state governments.

The following are guiding principles for both industry and government, which are essential when restoring supplies:

- Response to supply chain emergencies is best managed when there is advance planning, preparedness, and private and public sector collaboration.
- Industry is responsible for restoring oil and gas supply.
- Collaboration and coordination of activities and resources is enabled through rigorously adhering to established frameworks and management system.
- The restoration of critical electricity infrastructure must take priority.
- Supply chain interdependencies across segments/regions must be identified and planned for.
- Allowing markets to function provides for the quickest and most efficient restoration of supply to impacted areas.
- Operations, even in times of emergency, must be in compliance with the law.
- Regulatory relief for the quick restoration of supplies should be granted, as appropriate.

These principles facilitate communication between companies and government, organize the process through disciplined action, provide efficiency when multiple organizations, operations, and requirements are competing for resources, and expedite the restoration of impacted supplies. The following sections describe how these principles are utilized throughout a typical company's preparation for and response to an event.

SINGLE COMPANY RESPONSE

Many incidents impact single company operations and can be managed individually by the impacted company. The following example provides details of such a response as well as a preparedness and response timeline for an anticipated supply chain disruption caused by an approaching hurricane impacting the Gulf of Mexico coast and a single company operation.

Note: The timelines and actions presented in this example are considered typical of an integrated company's plans, but are strictly for illustrative purposes. Individual companies retain the right to adjust or amend these timelines and actions to meet the specific needs of their operations and locations.

Supply chain recovery planning begins prior to the hurricane making landfall.

Scenario

The scenario allows for planning to occur in phases prior to impact of a hurricane and presents typical preparedness, response, and recovery operations followed through a hurricane response plan (business continuity plan) for a typical integrated company operating in the Gulf of Mexico. The company business units include production, refining, pipelines, terminals, and marine transportation and, for purposes of this example, will be referred to as “the company.”

For other scenarios that occur without warning, the response would be the same in principle, but may not allow for a phased shutdown of operations. The structure under which the company responds (ICS including incident and issue management) would be the same. The company notification, preparedness, and response actions would be no different under the declaration of the Stafford Act or an incident where the Stafford Act is not declared.

Notification

The National Hurricane Center, DOE Energy Response Center, and FEMA issue daily updates

on tropical storm locations, potential for strengthening, and projected tracks. These updates are monitored by the company as a routine practice during hurricane season and are communicated throughout the organization via the Corporate Emergency Preparedness Group when a potential storm impact to operations is identified.

The company's Emergency Preparedness Group initiates communications to the business continuity coordinators in all the operating components and the Supply Chain Recovery Team. The Supply Chain Recovery Team begins preparation by identifying scenarios of supply chain disruptions and plans for these scenarios.

Plan Implementation

The company's hurricane plan has a phased approach for emergency management and describes individual roles and responsibilities for specific units of the company prior to, during, and after the hurricane arrival. This “phased” approach allows for the following:

- Facilities operating as long as safely possible
- Fuel supplies to the market to facilitate evacuation of these areas in advance of the storm
- Fuel supplies to emergency responders
- Safe shutdown of operational facilities to limit damage from the storm (Limiting damage to facilities from an incoming storm can be an important factor in the re-start of the facility and can significantly speed up the re-start.)
- Safe evacuation of operating employees and contractors, and safe return to re-start the facility.

Oil and natural gas companies have multiple objectives when preparing for a natural disaster: (1) protect the personnel and facility from harm, and (2) maintain product supply.

As indicated in Chapter 2, responders at the individual facility will focus on those activities that will need to take place on site to prepare for, respond to, and recover from the hurricane. Individuals involved in the response at the corporate level will focus on impact assessment to

the company's supply chain and any subsequent recovery efforts.

The company's hurricane plan describes the required activities and operations for the facility incident management team. This incident management team will initiate its response to the hurricane under the Incident Command System (ICS). This facility, owned by the company, will manage its own response. However, if the response exceeds the capability of that facility, the team will rely on mutual assistance from internal company resources or external resources. The company's corporate emergency management team will provide support and assistance as needed, or take over the response if required. The local facility is responsible for implementing its response plan. Any additional capabilities and resources needed for response are escalated through requests to the corporate emergency management team or National Response Framework. This process is representative of a tiered response structure used in most companies and is represented in Figure 4-1, in the Incident Management portion of the diagram.

The company has trained response teams in the Incident Command System (ICS).

For this scenario, specific activities of individual business units within the company are listed below. It is important to note that the timelines and actions presented in this example are considered typical of an integrated company's plans, but are strictly for illustrative purposes. Individual companies retain the right to adjust or amend these timelines and actions to meet the specific needs their operations and locations.

Preparedness

The following preparedness activities commence in anticipation of an incoming storm.

Exploration and Production

The company exploration and production (E&P) operations are both offshore and onshore and can be impacted by different hazards in this scenario.

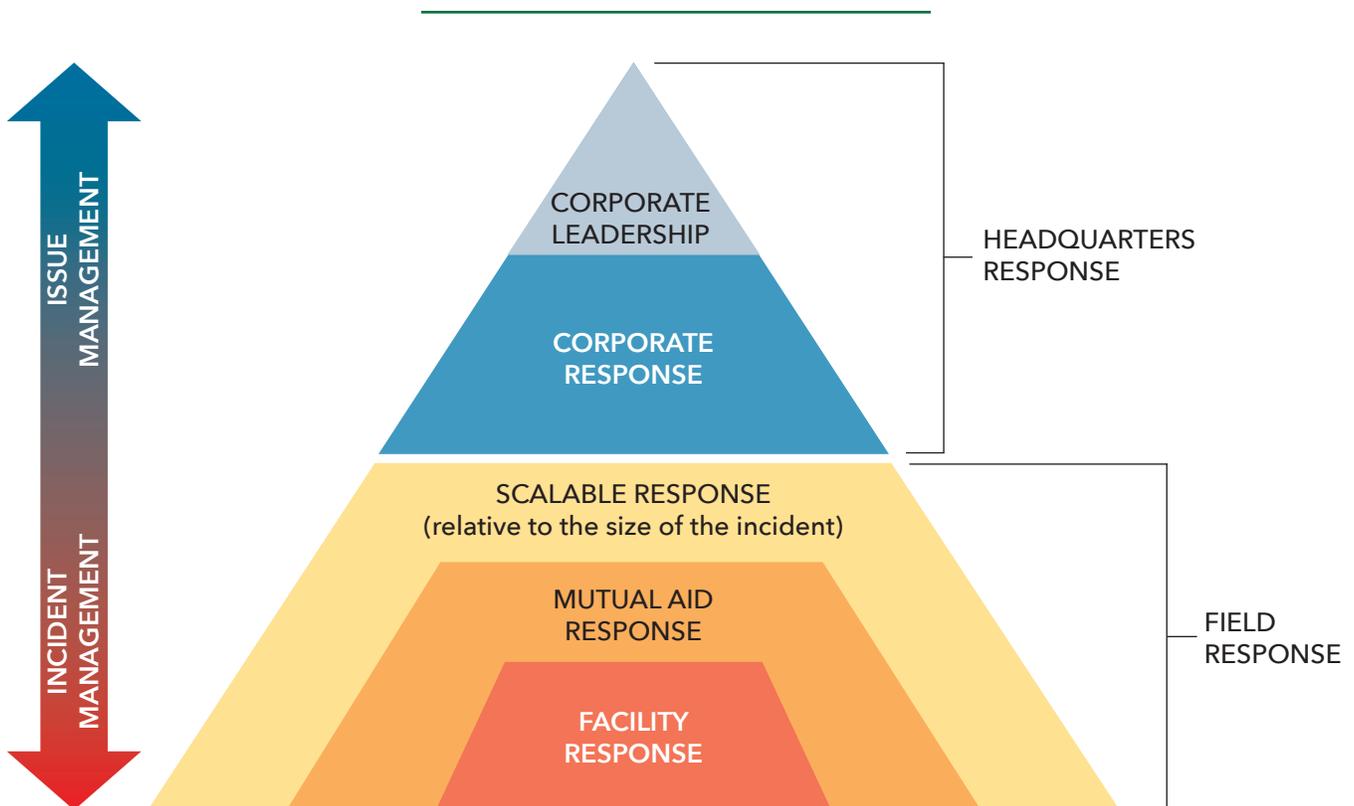


Figure 4-1. Company Incident Response Model

The offshore production areas will need to be evacuated prior to the arrival of the storm for the safety of personnel and to ensure a safe shutdown of the operation. Once the storm arrives in the vicinity of the offshore location, further evacuation is not possible due to very high wind and wave action. The offshore operation implements phased response plans that call for an orderly shutdown of operations commencing days before the storm actually arrives.

Onshore production will face challenges with high wind, rainfall, and potentially flooding conditions. These hazards may also necessitate an orderly shutdown of operations before the storm arrives. Similar to offshore production, the response plans go into effect days before the arrival of the storm.

Table 4-1 provides a typical timeline for a phased approach used by production operations. (Note: These timelines are used for illustrative purposes only and should not be considered as an industry standard.)

Refining

In anticipation of the storm, the refinery begins planning for a potential outage. Following the hurricane plan (business continuity plan), the

team addresses potential dependencies and interdependencies of the refinery operations. The refinery contacts and coordinates with its commercial electrical supplier, feedstock suppliers (crude oil or other feedstock), and crude oil supply transportation operations (pipelines and marine transportation). A ride-out team for the refinery is readied.

The team works closely with their contracted weather service to get very detailed weather projections for their specific plant location. The contract weather service provides projections of very specific wind speeds and rainfall amounts expected at the site. These data are important because safe operating limits of refining process equipment include maximum wind speed. Each hurricane plan contains limits dictating when operations personnel will be allowed outside of a safe structure—safety limits are again based on wind speed issues that may result in flying objects that could severely injure the operations personnel.

Ride-out teams are small teams of refinery personnel that remain in the facility to maintain operations safely. If the storm projections are too severe and exceed the safe engineering operations limits mentioned earlier, the refinery will be shut down in an orderly fashion to allow

Phases	Hours from Outer Band Impact	Strike Probability	Storm Forecast
Phase I: Assessment	169 - 144 hours (6-7) days	Gulf of Mexico track predicted	Initial Predictions
Phase II: Response Planning	143 - 120 hours (5-6) days	Predicted impact 300 miles either side of facility	Category 3 - 5 or Tropical Storm to Category 2 with >20" inches of rainfall predicted
Phase III: Initiate Shut-in of Facility & Employee Evacuation	119 - 96 hours (4-5) days	Predicted impact 150 miles either side of facility	Category 3 - 5 or Tropical Storm to Category 2 with >20" inches of rainfall predicted
Phase IV: Complete Shut-in of Facility & Employee Evacuation	95 - 72 hours (3-4) days	Impact on facility predicted	Category 3 - 5 or Tropical Storm to Category 2 with >20" inches of rainfall predicted

Table 4-1. *Phased Preparedness Activities for Production Operations*

the ride-out team to be evacuated ahead of the storm.

The phased hurricane plan (business continuity plan) provides those timelines at which decisions need to be made for either continued operations of the facility, a partial slowdown, partial shutdown, or total shutdown of the facility, and safe evacuation of company personnel and contractors from the area. Consideration is given to maintaining fuel supply for evacuees and providing a safe work environment at the facility. These objectives can be in conflict with each other, so the phased hurricane response plan (business continuity plan) provides direction to achieve each of these objectives. An illustrated example of a phased preparedness plan for a refinery operation is shown in Table 4-2.

The threat from each impending hurricane will be evaluated and proper response made in accordance with this plan. The final decision for total plant shutdown is made by the Facility Manager. The strength of each hurricane entering the Gulf of Mexico and the probability of it passing through Southeast Louisiana will dictate the extent of the actions that should be taken. The key to proper response is advance preparation and completion of low cost/low risk steps as early as possible. Plans should be executed far enough in advance so that outside work may be completed before sustained winds reach 60 mph. The Hurricane Phase Plans are based on predicted wind speeds at the refinery.

Oil and Products Pipelines

The company's pipeline operations have phased preparedness plans that are similar to the refinery plans described in detail above. The company's pipeline operations are controlled from a central control center, but there are also field personnel available who interface with pipeline operations field valves, pumps, tankage inventory, and electrical supply. Local pipeline personnel are also operating under their hurricane response plan to balance maintaining operations and safety of personnel and contractors. Similar to the refining example above, they are receiving individual weather reports addressing rainfall and wind speed, and have environmental limits of when their personnel can safely operate. Since pipelines

are mostly underground, the majority of pipe is not affected by wind. However, wind issues can affect the pipeline tank farms that are important to maintaining pipeline operations. Excessive rainfall can create issues within the tank farm, inundating the bermed area around the tanks and causing the tanks to float. Each tank has an engineering study completed to identify the safe inventory level in the tank that needs to be maintained to prevent it from floating. The maintenance of this inventory level can create operational issues and must be factored into supply balancing prior to and after the event. The major potential impact to pipelines is loss of commercial electrical power and flooding that can wash out stream or creek crossings and allow the un-buried pipeline to be impacted by flood waters or debris contained in the flood waters.

Depending on the size and nature of the event, resources (e.g., personnel, generators, supplies) from other operating areas may be staged outside the impacted area so that they are ready for the response after the area is deemed safe to return. In addition, emergency access credentials would be issued as necessary for critical responders to facilitate access into impacted areas.

Natural Gas Pipelines

Natural gas pipeline operators have phased preparedness plans that are similar to the refinery plans described in detail above. Employees must be evacuated ahead of the storm to return later to facilitate the re-start of operations. Response plans for natural gas pipeline operations and compressor stations are similar to those for the liquid pipeline operations with a few distinctions. Natural gas locations do not typically have the same above-ground storage tank inventory concerns as liquid operations.

Similar to oil and liquid pipeline operations, natural gas pipeline operators have an emergency management plan that is risk based, tested, and required by the Pipeline Safety Regulations. These plans, which are facility-specific, are intended to deal with facility-specific events and include isolation of facilities, as well as protection of the public and company personnel. Local operating personnel, who are trained on the plan and practice implementation, are responsible for executing the

Preparedness Condition Phase	Hours from & Severity of Impact to Facility	Actions to be Taken
Preparedness Condition Phase I	Hurricane is moving toward the refinery with maximum sustained winds of 60 mph predicted at the refinery in 60-72 hours.	<ol style="list-style-type: none"> 1. All units will operate at normal conditions. 2. Incident Commander meets with Department Managers to review plans and coordinate preliminary activities (e.g., review dock schedules and tank levels, check contractors' status, initiate preliminary tie-down activities). Phase I is primarily a planning activity phase.
Preparedness Condition Phase II	Hurricane is moving toward the refinery and sustained winds greater than 60 mph are predicted at the refinery in 48-60 hours.	<ol style="list-style-type: none"> 1. Communication with the local Emergency Operations Center is initiated concerning the preparedness plans of the facility. 2. Communication with dependent/interdependent suppliers/vendors is initiated (e.g., commercial power, water, etc.). 3. Personnel are assigned to fuel vehicles, obtain emergency generators, and complete activities per the Maintenance Department Hurricane Checklist. 4. Coordination plans are implemented to fill all storage tanks to their minimum operating level and will ensure that all tanks out of service have man-ways removed to prevent flotation during flooding. Monitor U.S. Coast Guard Activity on the status of river traffic and restrictions. 5. Initiate contact with the perishable food supplier(s). 6. Assign personnel to notify employees of refinery plans and verify employees' plans. 7. Initiate departmental plans per departmental Hurricane Preparation checklists. 8. Initiate the actions as dictated by the Operations Unit Hurricane Shutdown Procedure. 9. The Incident Commander alerts the Ride-Out Crew. The size of the Ride-Out Crew will be determined by the forecasted wind speed of the hurricane.
Preparedness Condition Phase III	Hurricane is moving toward the refinery and sustained winds will be more than 60 mph at the refinery in 24-48 hours.	<ol style="list-style-type: none"> 1. Communication with the local Emergency Operations Center is continued concerning the preparedness plans of the facility. 2. Communication with dependent/interdependent company suppliers/vendors is continued. 3. Direction for all critical units to either be cut to minimum throughput or shutdown and all non-critical units shutdown, as outlined in the departmental hurricane procedures. Personnel will be released, if possible, once shutdown activities are completed as directed by Incident Command. 4. Personnel are assigned to close the docks and coordinate plans to open all floating roof tank drains and close tank dike drains for the duration of the storm. 5. Necessary equipment is staged and completes activities per the Maintenance Department Hurricane Checklist. 6. The Incident Commander releases all personnel not required for plant operations and safety. 7. Begin to secure the perishable food items.
Preparedness Condition Phase IV Only the Incident Commander (Division Manager) can initiate Phase IV	Hurricane is moving toward the refinery and sustained winds greater than 60 mph are predicted at the refinery in 12-24 hours.	<ol style="list-style-type: none"> 1. The Ride-Out Crew assumes control of the refinery and all other personnel are released. 2. When the hurricane-force winds are 4 hours from the refinery and sustained winds at the refinery are predicted to be over 60 mph: Incident Command evaluates the need to shut down boilers, wastewater, and potable water units. 3. The Incident Commander orders the evacuation of all Ride-Out Crew personnel to secure buildings.

Table 4-2. Example of Phased Preparedness Plan for a Refinery

plan. These plans are reviewed with local emergency responders and law enforcement agencies in order to ensure timely and effective event response.

Most compressor stations for natural gas pipelines are powered by natural gas, which reduces the dependency on electric power for compression. However, remote measurement and control technologies and other systems are dependent on electric power.

Terminals

Terminals have phased preparedness plans that are similar to the refinery plans described in detail above. The company operates terminals in the predicted path of the hurricane. The terminals face similar impacts to their operations as pipelines. Terminals are supplied by one or two modes of transportation—pipelines and marine operations. If either or both of these transportation modes are impacted, then the terminal inventories and throughput may also be impacted. Flooding and floating tanks are a hazard in the terminals similar to tanks in the pipelines or refineries. Employees must be evacuated ahead of the storm to return later to facilitate the re-start of operations.

Marine Transportation

The company's marine transportation operates in the offshore environment and is impacted in ways similar to offshore production. Tanker operations in the Gulf of Mexico and along transportation supply routes can be interrupted by a hurricane. Supply and distribution experts will be planning ahead of the storm to offload as much product as possible into pipelines and terminals to maintain supply. When tanker operations can no longer continue operating, they move safely out of the path of the storm.

The marine transportation operation is working through the United States Coast Guard (USCG) to ensure the expeditious resumption of trade. The USCG is the lead federal agency for the implementation of the Marine Transportation System recovery process. This process lays out direction and priority for short-term and long-term recovery as well as the transition. A more detailed description of the Marine Transportation System

recovery process can be found in the May 2014 3rd Edition of the USCG Incident Management Handbook.

Fuel Distributors and Marketing

Product from the terminal reaches the retail station by tank truck. These trucks are operated by fuel marketers, also called distributors. The marketers purchase the fuel at the terminal from the product owners, who are typically refiners that have service agreements with the terminal. The marketers may have purchase agreements with the refiners that stipulate pricing, product quality, and quantities availability. Marketers may also be "spot" buyers, meaning they continually seek out the best pricing opportunities without prior agreements. In turn, the marketers sell typically pre-arranged truckload volumes of product to the retail gasoline station.

It is important to understand that the marketer purchases the fuel from the refiner who owns the product. The terminal is often not the product owner and thus is not in a position to decide whether or not to load a particular truck; that decision remains in the purview of the product owner.

During a supply disruption, if supply disruptions result in local outages, the marketers, through their relationships with the refiners/product owners, are able to locate and purchase product from further supply points. This is only effective, however, if (1) interstate commerce laws allow and (2) the market creates the right incentives for distributors and retailers.

Retail

The retail arm of the company assesses the current inventory of fuel and checks with their suppliers for an estimate of when their last shipment of fuel will be received. The retail stations plan for how long they can supply fuel before shutting down or being shut down from the loss of commercial power. The retail stations anticipate an increased need of fuel to supply evacuees leaving the area.

Response

Various levels of response are initiated in the company to facilitate recovery of operations to a

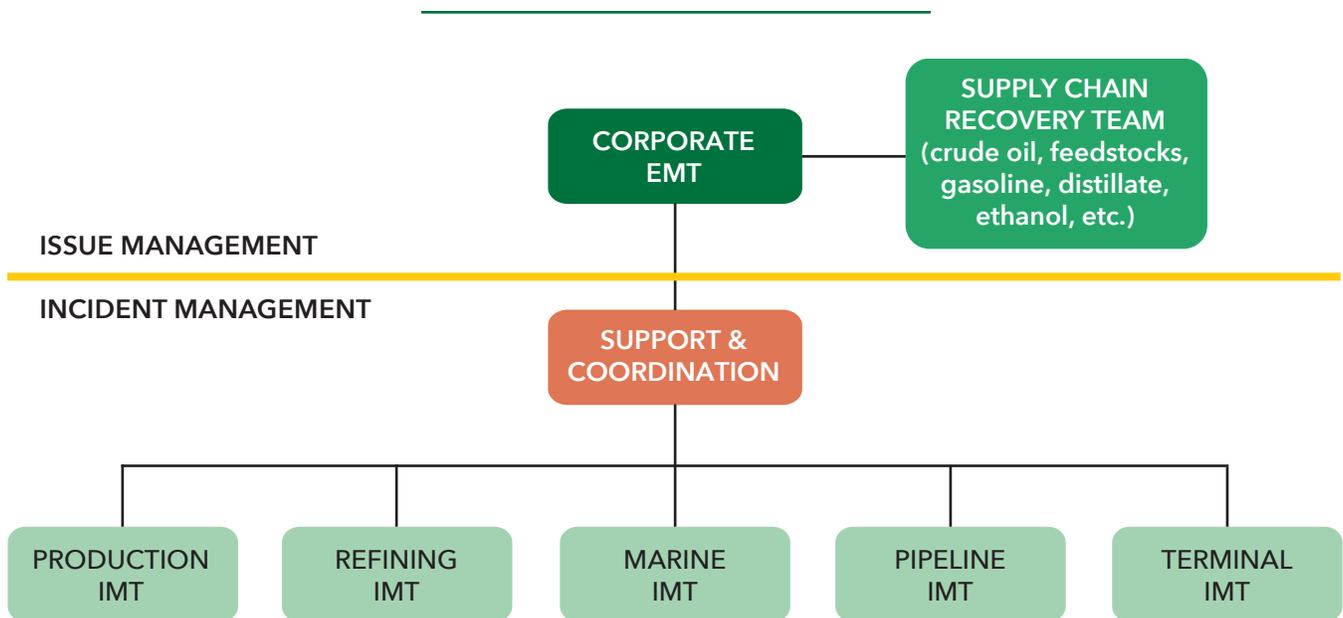
steady state environment as quickly as possible. These levels of response are as follows:

- Each operating facility (operating component) establishes their Incident Management Team (IMT) to facilitate response and recovery. This is represented by the Incident Management portion of Figure 4-2.
- The Corporate Emergency Management Team (EMT) is already activated as the storm approaches to support the individual facility response teams in their effort. This is represented as the Issue Management portion of Figure 4-2. If this EMT is requested to take over the facility response, it operates in the Incident Management portion of Figure 4-2.
- The Corporate level “Supply Chain Recovery Team,” which has been activated and working in the preparedness phase is now in response mode to recover the supply to the marketplace as soon as possible. The Supply Chain Recovery Teams are assessing and, where appropriate, developing alternate supply needs in close coordination with facility operations, with regard to the following issues:
 - Fuel supply to first responders
 - Operational status of suppliers, pipeline operators, terminals, and trucking operators under contract

- Pipeline deliveries
- Marine transportation modes potentially affected by this storm
- Supply of fuel at terminals
- Supply of fuel at retail stations
- Alternate modes of transportation
- Alternate supply sources, which would include internal company sources and supply from other producers
- Cascading effects of the storm outside of the impacted area.

These considerations are represented in the *Issue Management* portion in Figure 4-1, Company Incident Response Model, found earlier in this chapter. An organizational chart of the teams and the response structure is depicted in Figure 4-2.

In the single-company response scenario, the operational/communications model described in Chapter 2 would apply, but would more than likely be resolved at the local level. The local Emergency Operations Center (EOC) would be in contact with each of Company X’s IMTs to provide local support if needed. This communication process would be through the Liaison Officer



Note: EMT = Emergency Management Team; IMT = Incident Management Team.

Figure 4-2. Company Response Organization

of each IMT. If all the issues can be addressed locally, any Request for Assistance would not escalate above the local/state EOC to the Joint Field Office (JFO). It is most likely that the JFO would not have been activated in this scenario.

The company's Supply Chain Recovery Team would resolve the supply chain recovery with each IMT or their representative.

MULTI-COMPANY RESPONSE

Some incidents impact the operations of multiple companies. Each impacted company implements its emergency plans. The following example provides details of such a response and addresses issues related to the prioritization of critical resources, such as generators. The following example provides a preparedness and response sequence for an anticipated supply chain disruption caused by an approaching hurricane making landfall in the northeastern coast of the United States.

Note: The sequence of actions presented in this example is considered typical of terminal and pipeline company plans, but are strictly for illustrative purposes. Individual companies retain the right to adjust or amend these sequence of actions to meet the specific needs their operations and locations.

Scenario

A hurricane makes landfall in the northeastern U.S. and impacts three large terminals and one critical terminal (Companies A, B, C, and D) that distribute fuel and other crude oil products throughout the area, disrupting service and effectively preventing the distribution of fuel throughout the region. In addition to the terminals, the two main pipelines (Companies E and F) that supply fuel to the terminals have already been shut down because of the loss of commercial power from tornados two days before as the tornados were spun off of the hurricane. Three major marine ports have been shut due to the storm and debris in the waterway channels. One major port seems to have less damage than the other two, but has less capability to recover operations. The impact and subsequent damage to

each terminal varies, but all have power disruption issues.

The NRF and ICS provide a disciplined approach for local response as well as an escalation of information and requests for assistance when needed.

The response will be coordinated through the response framework described in Chapter 2 and depicted in Figure 4-3. The numbered steps below correspond to the steps shown in Figure 4-3.

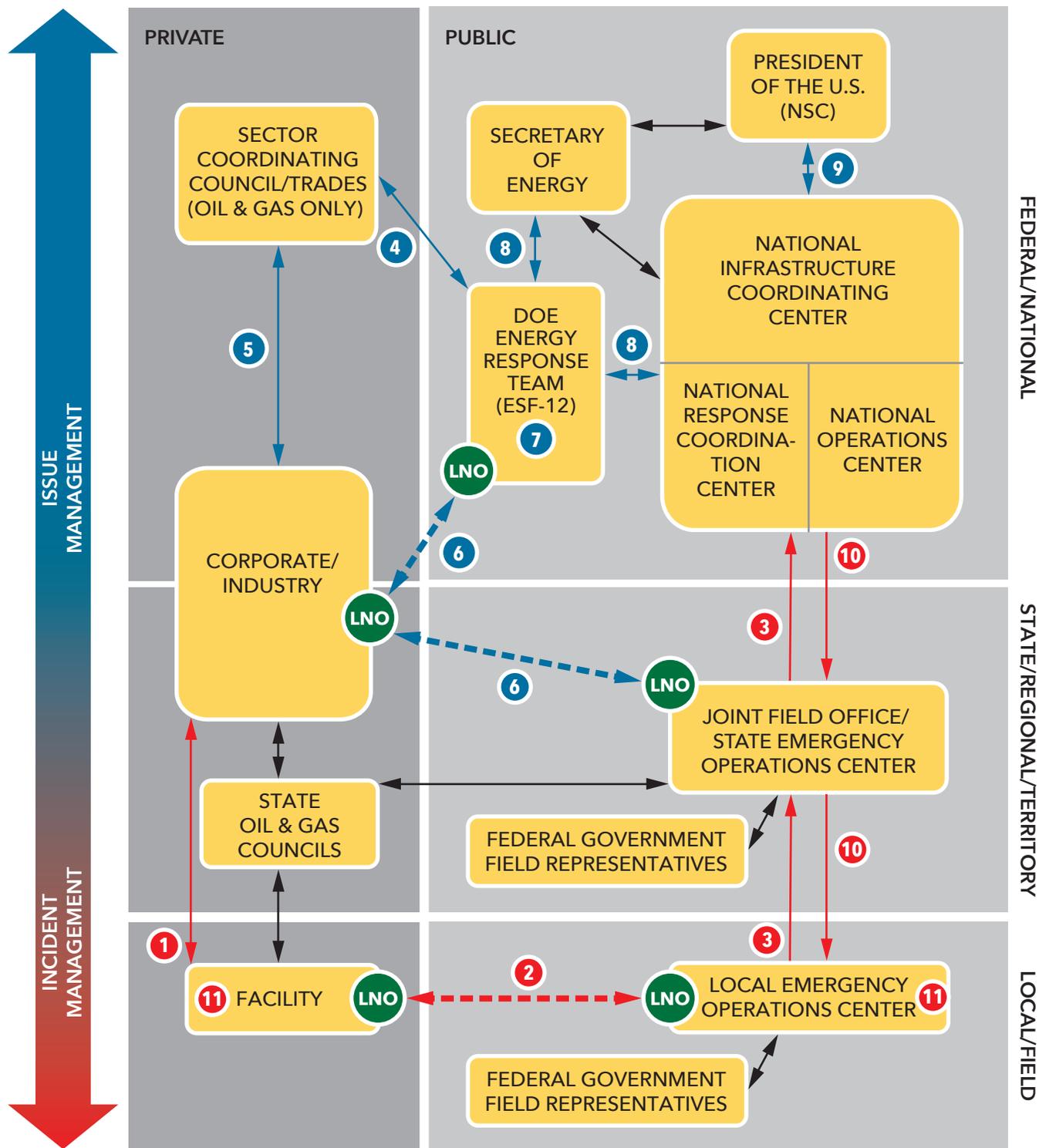
Response

1. Each of the companies sets up its Incident Management Team at the impacted terminals, pipelines, and marine ports to assess the damage and respond and recover from the hurricane using the Incident Command System. Restoration activities include debris removal, repairing/replacing damaged pumps, deploying emergency generators, evaluating systems integrity in preparation to begin operations, removal of excess water, and preparing the site to receive main line power when available. The electric utility has reported that service may not be restored for at least four days. Companies have assessed their facilities and determined the following:

Company A – This terminal is a 3.5 million barrel terminal, receiving product by pipeline, rail, and vessel, and distributing various refined petroleum products. The assessment has determined that in the aftermath of the hurricane, the facility is, in large part, undamaged with minimal wind damage scattered throughout the facility. The facility is confident that this impact can be ameliorated, and within one day, the facility will be operational when power is available.

Company B – This terminal has a storage capacity of 7.8 million barrels and stores and distributes both refined petroleum products and various petrochemicals. The initial assessment identified multiple storage tanks that floated from their foundations during the flooding of the facility. The water has receded,

NATIONAL RESPONSE FRAMEWORK



- | | |
|---|---|
| <ul style="list-style-type: none"> 1 = Owner/operator establishes corporate EMT under ICS 2 = Owner/operator requests resources from local EOC ESF-12 desk 3 = Information and requests for resources that are not filled at the lower level 4 = ONG SCC is notified of DOE Energy Response Team activation 5 = ONG SCC notifies owner/operator of the intent to activate DOE Energy Response Team 6 = Owner/operator and DOE supply chain experts communicate the high-level situational status of the supply chain disruption | <ul style="list-style-type: none"> 7 = DOE situation unit provides analysis and situational assessment to DOE Energy Response Team 8 = DOE provides energy supply status update to U.S. government and requests additional resources to recover supply chain, as appropriate 9 = NICC collates all sector-specific situational assessments into a SITREP 10 = Resources are allocated and provided to responders 11 = Response activities conducted <p>LNO = Liaison Officer</p> |
|---|---|

Figure 4-3. National Response Framework Operational Model

HOW INFORMATION FLOWS IN THE NATIONAL RESPONSE FRAMEWORK (FIGURE 4-3)

Step 1. Company X establishes its Corporate Emergency Management Team (EMT) to support the Incident Management Teams (IMT) at each operating facility. The EMT and IMT are organized under the Incident Command System (ICS). The EMT is responsible for managing any issues, including the activation of the Supply Chain Recovery Team. Companies may stand up IMTs for specific operational functions such as production, refining, pipelines, terminals, and marine.

Step 2. Each of Company X's IMTs will request resources from the local Emergency Operations Center (EOC) as needed. If those resources can be provided by the local EOC, the communication chain stops at that point.

Step 3. If resources cannot be provided by the local EOC, the request progresses up the communication chain to the Joint Field Office and potentially to the National Infrastructure Coordinating Center (NICC) if needed.

Step 4. If the supply chain disruption is significant enough, The Oil and Natural Gas Sector Coordinating Council (ONG SCC) is notified by the Department of Energy (DOE) that the DOE Energy Response Team has been activated.

Step 5. The ONG SCC notifies the owners/operators in the sector that the DOE Energy Response Team has been activated.

Step 6. Company X's Supply Chain Recovery Team experts are contacted by DOE Energy Response Team supply chain experts (Situation Unit) to share the situational status of individual company supply chains.

Step 7. DOE Energy Response Team supply chain experts (Situation Unit) analyze situational status supplied by sector companies to develop an assessment of the sector.

Step 8. The DOE Energy Response Team provides its situation assessment of the supply chain in the Oil and Natural Gas Sector to the U.S. government under its role as lead agency for ESF-12. In addition to this assessment, DOE can request additional resources to assist in recovery of the supply chain, as appropriate.

Step 9. The NICC collates all situation assessments from critical infrastructure sectors and incorporates it into a Situation Report (SITREP).

Step 10. Resources requested by a company through the process described in Step 3 or requested by the DOE in Step 8 are provided through federal or state resources to facilitate recovery.

Step 11. Companies use resources to conduct response and recovery.

but the secondary containment will need to be drained, and the tanks will need to be moved back on their foundation. Additionally, there was a substantial amount of product released when the tanks flooded. While the release was contained within the facility's secondary containment system, it will need to be cleaned up before the tanks can be relocated and put back into service. The amount of product released is unknown, but it is expected to be multiple days before the damaged tanks will be operational. Though 80% of the facility is still capable of operation once power has been restored, the impacted tankage is dedicated to truck rack loading. The facility is working on reconfiguring piping to supply the truck rack. Truck loading capacity will be restricted until completed.

Company C – This terminal is an 800,000 barrel facility that distributes refined products. While a smaller terminal, its location makes it a critical distribution terminal for multiple retail stations in the impacted area. The principal impact from the hurricane was flooding at the loading rack. The flooding subsequently impacted the vapor recovery unit and damaged it beyond repair. Until this unit can be replaced (roughly four days), the loading rack will be inoperable and trucks will not be able to load at the rack.

Company D – This 1.2 million barrel terminal is located in area that makes it a critical distribution point for multiple retail facilities in the impacted area. The assessment determined that there was minimal damage to the

facility. The area surrounding the terminal was severely damaged, and all of the roads to the terminal are blocked with debris or are washed out altogether. Therefore, even when power is restored to the facility, it will continue to remain inoperable until the roads are cleared or repaired and trucks are able to access the loading rack.

Company E – This is a large pipeline operator that supplies 60% of the fuel to the area on a daily basis. The pipeline pumping stations were damaged from flying debris during the tornado and are undergoing repair. It is anticipated that the facility can be mechanically repaired with three days, but it is still awaiting an estimation of commercial power restoration.

Company F – This is a smaller pipeline operator that supplies 20% of the fuel to the area on a daily basis. Similar to Company E, the pumping stations and above-ground manifold were damaged by flying debris during the tornado. It is anticipated that the facility can be mechanically repaired within two days, but the facility is still awaiting an estimation of commercial power restoration.

Company G – This is a marine transportation company that has two tankers of gasoline from a U.S. source that was in transit to Europe to be sold on the spot market. Both ships are about two days from the U.S. Northeast Coast at the current time. They have offered to sell the product at a U.S. port, but they are both non-Jones Act tankers and cannot legally offload at a U.S. port. If they cannot get approval from the U.S. government to offload, they will continue on towards Europe.

Each company has also established its Corporate EMT to support the IMTs at each operating component. The EMT is organized under the ICS. The EMT will include any Issue Management issues identified. This will include the activation of the Supply Chain Recovery Team. The situation report for the terminal has been relayed to the EMT, and a press release is issued to reflect the restoration timeline by the Information Officer. This is represented by Step 1 in Figure 4-3.

The supply chain experts communicate their status with the DOE Energy Response Team.

2. Each company IMT will request resources from the local EOC as needed. If those resources can be provided by the local EOC, the request stops at that point. This is represented by Step 2 in Figure 4-3.

All six companies have reported the status of each facility through their incident management team to the local EOC. Wherever possible, they are working with the EOC to identify and address issues (i.e., access, law enforcement protection, etc.) wherever possible. The facilities will also be communicating directly with the entities responsible for providing commercial power to operate the terminal. The local EOC may help facilitate the dialogue between the terminal and the power company, but in this scenario the EOC is limited in its ability to bring about a solution to this issue. As such, the issues are communicated to the JFO/state EOC. The marine transportation company trading operation has reached out to customers willing to purchase the fuel, but has not heard anything concerning a required waiver from the Jones Act requirement. Companies A and B both have identified alternate sources of fuel, but the alternate source fuel is not allowed to be sold in the impacted area due to EPA Clean Air Act rules.

3. If the requested resources cannot be provided by the local EOC, the request will progress up the communication chain to the JFO and potentially to the National Infrastructure Coordinating Center (NICC) if needed. This is represented by Step 3 in Figure 4-3.

Because the requested resources cannot be provided by the local EOC, the request will progress up the communication chain to the JFO, where it will be routed to the Emergency Support Function #12 (ESF-12) or appropriate supporting ESF representative. At the JFO, the ESF-12 representative assesses the issues supplied by Companies A, B, C, and D and provides solutions wherever possible. In this scenario, the ESF-12 representative is informed

that Company A and B terminals need portable generators and the JFO can fill that order through FEMA. It is determined that Company C has the resources to de-water its facility and no further action is needed. The JFO cannot assist Company D terminal through its resources and forwards the request to the NICC, National Operations Center (NOC), and National Response Coordination Center (NRCC) to address.

Companies E and F only need priority commercial power restoration and have any communicated with their commercial power companies and are working on a priority restoration timeline.

4. DOE activates its Emergency Response Team and notifies the Oil and Natural Gas Sector Coordinating Council (ONG SCC) of the activation. This process would likely occur prior to landfall. This is represented by Step 4 in Figure 4-3.
5. The ONG SCC notifies its membership that the DOE ERT has been activated. This is represented by Step 5 in Figure 4-3.
6. Supply Chain Recovery Team experts from each impacted company are contacted by the DOE Emergency Response Team supply chain experts (Situation Unit) to share the situational status of the supply chains. This is represented by Step 6 in Figure 4-3.

Company A, B, C, D, E, and F supply chain experts individually:

- Share their situation assessment including existing supply status, bottlenecks to recovery, and potential cascading impacts
- Provide their individual assessment of the current supply chain status based on market analysis and on the information obtained while trying to procure alternate supplies, and through contacts with transportation/fuel carriers and customers
- Provide latest recovery information given to them by their commercial power suppliers
- Give status of their ability to procure generators from their contractors to temporarily provide power to the terminals until commercial power can be restored.

Companies A and B have stressed to the DOE ERT their need for a waiver from the Clean Air Act rules to bring alternate fuel to the area.

Company G has communicated through the Multi-Agency Coordination System and eventually to the DOE ERT its availability to supply fuel, but has also stressed its need for a waiver to the Jones Act. It has yet to get any response from the U.S. government.

7. The DOE EMT supply chain experts (Situation Unit) analyze situational status supplied by the companies to develop an assessment of the sector. This assessment is provided to the DOE ERT. This is represented by Step 7 in Figure 4-3.

DOE conducts an analysis/assessment of the information received by each of the six companies to determine the relative importance of each terminal and pipeline. This information is predicated on both the damage to the facility or the surrounding area as well as in the role of each terminal and pipeline to the overall recovery efforts.

8. As the lead agency for ESF-12, the DOE Energy Response Team provides its situation assessment of the supply chain in the Oil and Natural Gas Sector to the U.S. government. In addition to this assessment, DOE can request additional resources to assist in recovery of the supply chain, as appropriate. This is represented by Step 8 in Figure 4-3.

DOE communicates the assessment of the terminal and pipeline issue to the NICC, NOC, and NRCC. Based on the assessment conducted by DOE, the agency is able to provide a recommendation that:

- Company D needs the roads cleared and the NICC, NOC, and NRCC agree with the DOE recommendation that resources from

The DOE ERT provides a status update to the NICC for the Energy Sector and utilizes this information to affect the national level response and expedite recovery efforts within the sector.

the U.S. Army Corps of Engineers and/or National Guard be immediately deployed to clear the roads to the facility.

– The DOE ERT informs the NICC, NOC, and NRCC about the request for a waiver from the Clean Air Act for alternate fuel for Company A and B terminals and the Jones Act Waiver for the two tankers. The NICC, NOC, and NRCC agree that DOE should continue that conversation with EPA and DHS to address the issue. The NICC, NOC, and NRCC ask DOE to ensure the results of those conversations are communicated back to the NICC in case they do not get an update from the agencies themselves.

9. The NICC collates all situation assessments from critical infrastructure sectors and into a SITREP (Situation Report). The situation assessment should provide an appropriate level of detail for decision-makers and leaders to message to the public. This is represented by Step 9 in Figure 4-3.

Information specific to the terminal and pipeline issues is translated into communications materials that can be used at the national level. These materials will demonstrate that (1) the public sector understands the issue and (2) is coordinating activities with the private sector to restore operations as quickly as possible and provide fuel throughout the impacted area.

10. Resources requested by any company through the process described in Step 3 or requested by DOE in Step 8 are provided through federal or state resources to facilitate recovery. This is represented by Step 10 in Figure 4-3.

Activity is communicated back down to the JFO, state EOC, and local EOC, and activities are implemented as appropriate. In the case of Company D, the JFO and state EOC coordinate activities and deploy (or redeploy if they are otherwise engaged) U.S. Army Corps of Engineers and/or National Guard resources to clear the roadways. Local law enforcement is informed to ensure that generators can be transported to the terminals and do not get delayed at roadblocks, or have escorts as appropriate as they are deployed to the terminals.

11. Companies use resources to conduct response and recovery. This is represented by Step 11 in Figure 4-3.

The terminals and pipeline pumping stations companies continue recovery operations. Those terminals receiving generators connect them to the terminal provide temporary power until commercial power can be restored.

LARGE-SCALE, LONG-TERM EVENTS

Major, long-term incidents can impact the operations of multiple companies across multiple sectors, disrupting critical services over several regions. Such an incident can be exacerbated by interdependencies between impacted sectors. The following example provides details of such a scenario and how the response is coordinated through the response frameworks outlined in this report. Such a response will require coordination between impacted companies and government at the local, state, and federal levels. This scenario assumes the natural disaster allows for advance planning and a phased response, such as with an anticipated hurricane. It further assumes that all components of the oil and natural gas supply chain are impacted, including the natural gas liquids supply chain.

For scenarios that occur without warning, the response will be the same in principal, but may not allow for a phased shutdown of operations. The structure under which the company will respond (Incident Command System including Incident and Issues Management) will be the same.

Scenario

This scenario examines the impacts from and response to a Category 5 hurricane entering the Houston Ship Channel and continuing through the Midwest (see Figure 4-4). The hurricane impacts most, if not all, critical infrastructure sectors. A significant portion of the refining capacity is impacted, as well as associated pipelines and marine transportation in the Houston area. Further impacts to the oil and natural gas infrastructure occur as the storm continues north through the Midwest. Commercial electrical power in

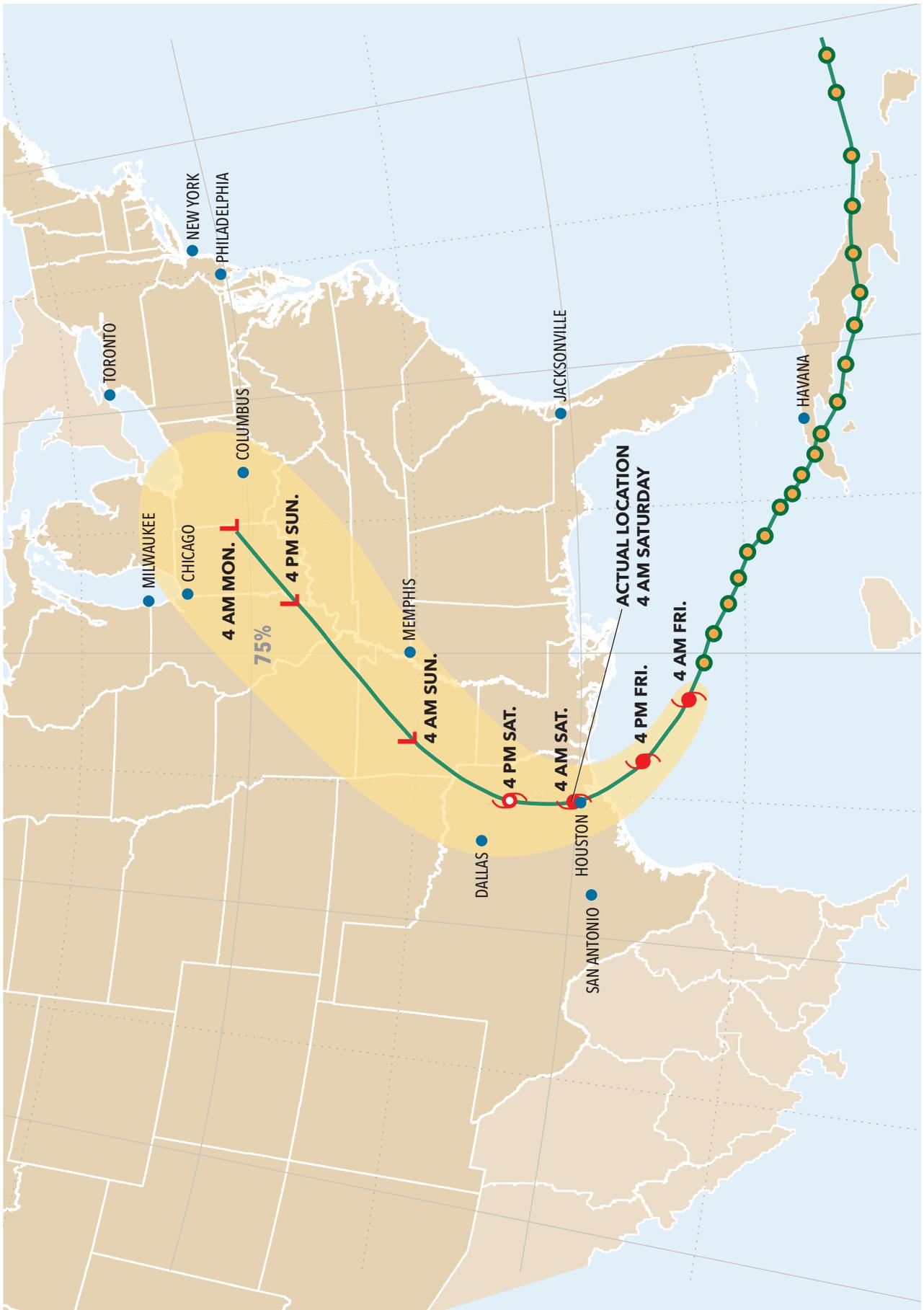


Figure 4-4. Large-Scale, Long-Term Event Scenario Map

the Houston area and the Midwest is severely impacted. Response and recovery assets must be prioritized to address the most critical needs. Consequently, the restoration of the oil and natural gas sector assets will be dependent on the recovery of other critical infrastructure. In turn, other critical infrastructure sectors will be dependent on the oil and natural gas sector for their recovery.

Preparedness

The preparedness functions, issues, actions, and organization will be the same as described in the single company example presented earlier in this chapter. Multiple companies will be implementing their individual preparedness and response activities as opposed to a single company response.

Response

Initial, Short-Term Response

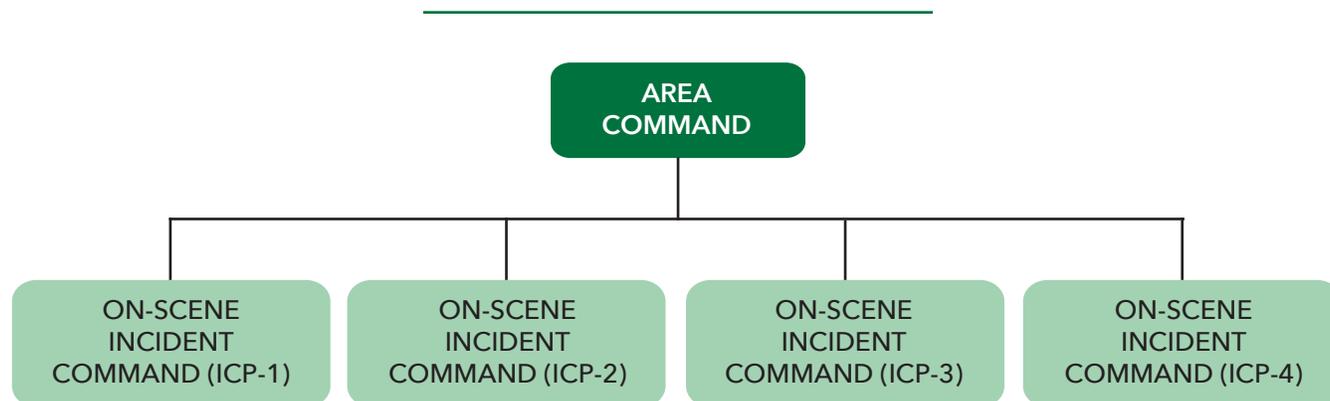
Multiple companies respond using the ICS as their incident response organizational tool. This command and control structure allows appropriate situational information sharing with the federal government through the National Response Framework (NRF). The federal government has declared a Stafford Act incident, and FEMA has directed the lead agencies to assume roles under the Emergency Support Functions defined in the NRF. DOE establishes its role as lead agency for ESF-12.

Using the NRF for the initial incident response, the federal government may choose to set up an Area Command structure to manage this level of incident. The purpose of the Area Command is to provide oversight of the incident management teams, focusing primarily on strategic assistance and direction and resolving competition for critical response resources. Area Command is an expansion of the ICS and is used to oversee the management of:

- Multiple incidents that are being handled by an ICS organization
- A very large incident that has multiple incident management teams assigned to it, as represented in Figure 4-5.

If the federal government sets up an Area Command structure to manage the incident, the oil and natural gas companies are well positioned to interface with the government because of their use and understanding of the Incident Command System.

The government will also deploy the use of multi-agency coordination that is already represented in the NRF diagram in Figure 4-3. The Multi-Agency Coordination System (MACS) is a process that allows all levels of government and all disciplines to work together more efficiently and effectively. Multi-agency coordination occurs across the different disciplines involved in incident management, across jurisdictional lines, or across levels of government. MACS is a system, NOT a facility (see Figure 4-6).



Note: ICP = Incident Command Post.

Figure 4-5. Multiple Incident Management Team Structure

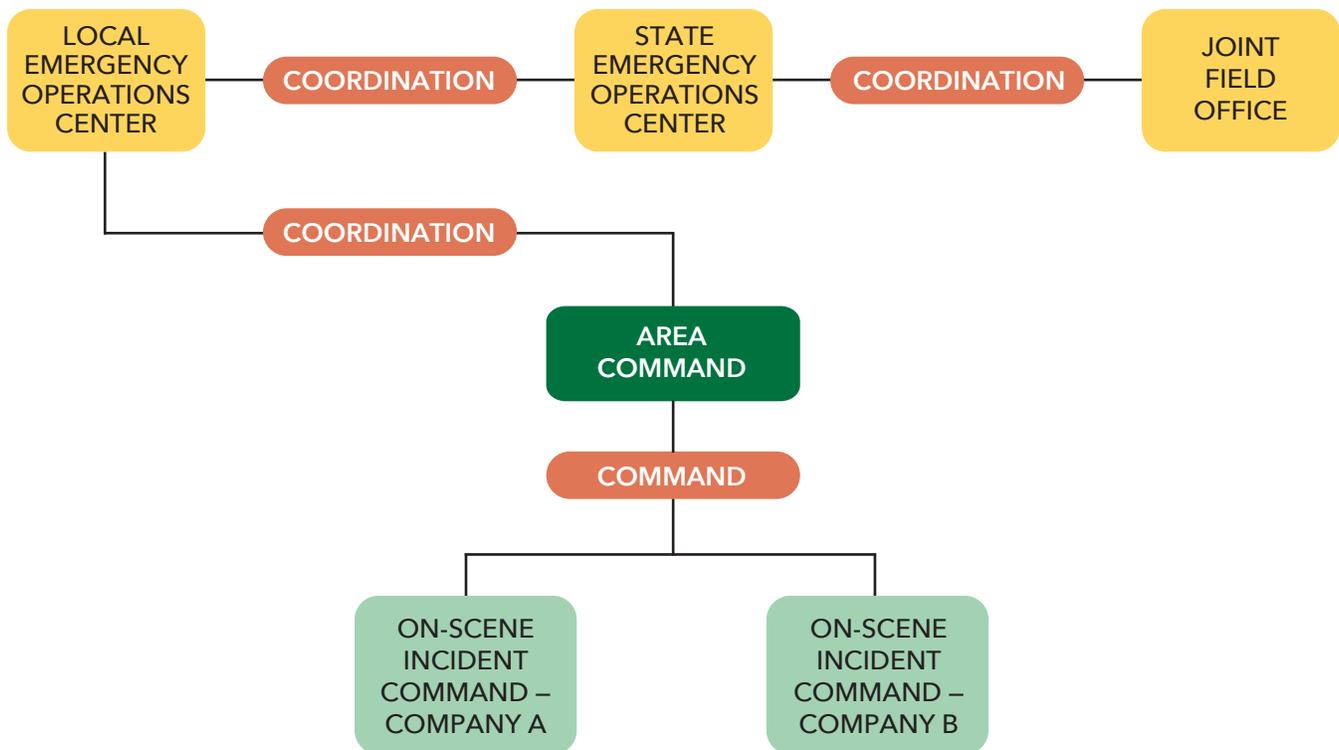


Figure 4-6. Multi-Agency Coordination System with Area Command Structure as Part of the National Response Framework

The various companies will respond as they would in the first two scenarios presented in this chapter. The government process will expand to include all the parties and address all the issues using tools such as Area Command and the Multi-Agency Coordination System. The Supply Chain Recovery Team will function as they did in the earlier scenarios, by assessing the impact and identifying solutions to recover supply.

Long-Term Response

It is highly likely in this scenario that the recovery effort will take an extended time before pre-disaster operations are back to normal. At some point, the federal government will move to a longer-term recovery process described in the National Disaster Recovery Framework (NDRF). While the oil and natural gas companies would migrate their recovery efforts from the NRF process to the NDRF process for assistance (if needed), individual companies are still responsible for the recovery activities of their operations irrespective of the size or impact of the incident.

Relationship of the National Response Framework to the National Disaster Recovery Framework

The focus of the NRF is to support the response actions as well as the short-term recovery activities that immediately follow an incident—such as life saving, life sustaining, property protection, and other measures intended to neutralize the immediate threat to life, environment, and property, as well as to stabilize the community.

As response and short-term and intermediate recovery activities begin to wind down, longer-term recovery efforts gradually need to take on a more central role with the NDRF. The core principles and organizational constructs introduced in the NDRF coexist with the NRF and build upon

The NRF and NIMS allows for a scalable response.

its organizational structure and resources to more effectively address longer-term recovery needs. The NRF fully transitions to the NDRF when the disaster-specific mission objectives of the ESF are met and all ESFs demobilize.

The National Disaster Recovery Framework introduces six new Recovery Support Functions (RSF) that are led by designated federal coordinating agencies at the national level. Recovery Support Functions involve partners in the local, state, and tribal governments and private and nonprofit sectors not typically involved in emergency support functions, but critically needed in disaster recovery. These new partners may include public and private organizations that have experience with permanent housing, financing, economic development, advocacy for underserved populations, and long-term community planning. The processes used for facilitating recovery are more flexible, context-based, and collaborative than the task-oriented approach used during the response phase of an incident.

The National Disaster Recovery Framework is the framework/mechanism that addresses long-term response activities to a major event.

The oil and natural gas critical infrastructure is addressed under the Infrastructure Systems RSF detailed below.

Infrastructure Systems Recovery Support Functions

The coordinating agency for the Infrastructure Systems RSF is the U.S. Army Corps of Engineers. The primary agencies are Department of Homeland Security (Federal Emergency Management Agency/National Preparedness and Protection Directive), U.S. Army Corps of Engineers, Department of Energy, and Department of Transportation. The supporting organizations are Department of Homeland Security, Department of

Commerce, Department of Interior, Education Department, Environmental Protection Agency, Federal Communications Commission, General Services Administration, Health and Human Services, Department of Treasury, and Department of Agriculture.

Mission. The mission of the Infrastructure Systems RSF is to facilitate the integration of the capabilities of the federal government to support local, state, and tribal governments and other infrastructure owners and operators in their efforts to achieve recovery goals relating to the public engineering of the nation's infrastructure systems.

Function. The core recovery capability for infrastructure systems is the ability to efficiently restore the infrastructure systems and services to support a viable, sustainable community and improve resilience to and protection from future hazards.

The Infrastructure Systems RSF serves as a collaborative forum for federal government engagement with local, state, tribal, and private sector representatives to focus on public engineering services that can reduce risks from disasters and expedite recovery. The collaborative efforts of this RSF involve government and private-sector partners with expertise in public engineering services, as appropriate, across the infrastructure sectors identified through the National Infrastructure Protection Plan Partnership Framework. Therefore, the scope of this RSF includes, but is not limited to, the following infrastructure sectors and subsectors: energy, water, dams, communications, transportation systems, food production and delivery, government facilities, utilities, sanitation, engineering, flood control, and other systems that directly support the physical infrastructure of communities; the scope also includes physical facilities that support essential services, such as public safety, emergency services, and public recreation.

Emergency Preparedness

APPENDICES



Appendix A: Request Letter and Description of the NPC

Appendix B: Study Group Rosters

Appendix C: After-Action Report Summary

Appendix D: Stakeholder Engagement Sessions Summary

Appendix E: Waiver Example

Appendix F: The Defense Production Act

Appendix G: Hydrocarbon Liquids Supply Chain

Appendix H: Natural Gas and Natural Gas Liquids Supply Chains



The Secretary of Energy
Washington, DC 20585

October 25, 2013

Mr. James T. Hackett
Chairman
National Petroleum Council
1625 K Street, NW
Washington, DC 20006

Dear Mr. Hackett:

Building the foundation for a clean energy economy will require unprecedented actions by industry and government to strengthen the nation's oil and natural gas infrastructure, tackle the issues of climate change, and protect our environment. To provide useful input into upcoming policy decisions, I request that the National Petroleum Council undertake strategic, short term studies on three topics: *Natural Gas and Oil Infrastructure Resilience*, *Maximizing the Climate Benefits of Natural Gas*, and *Arctic Research*.

Natural Gas and Oil Infrastructure Resilience. Superstorm Sandy, wildfires and floods have underscored the importance of having resilient oil and natural gas infrastructure and effective ways for industry and government to communicate to address energy supply disruptions. Key questions to be addressed on this topic include:

- What vulnerabilities have recent storm activity exposed in US energy infrastructure?
- What legal, procedural, and physical gaps need to be addressed by industry and government to improve response to disruptions?
- What strategies should be pursued to increase energy system resilience to storms and other potential disruptions?
- What actions can be taken to address the interdependencies between oil and natural gas systems and other critical infrastructure?

Maximizing the Climate Benefits of Natural Gas. The vital role that domestic natural gas resources are poised to serve in a clean energy economy will hinge on maximizing the climate benefits of increased natural gas use. Key prerequisites will include gaining a better understanding of the extent of methane leakages in the natural gas value chain from the well head to the consumer, as well as focusing attention on reducing these leakages. Key questions to be addressed on this topic include:

- What technologies and practices can be adopted or further developed to improve the detection and measurement of methane emissions from natural gas systems?
- What technologies and practices can accelerate reductions in methane leakage in natural gas systems?



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Arctic Research. A core component of the Administration's National Strategy for the Arctic Region released in May 2013 includes responsibly developing Arctic oil and gas resources to ensure energy security. In 2015 the United States will assume chairmanship of the multi-nation Arctic Council. The National Petroleum Council's input would be invaluable to assist us as we explore:

- What research should the Department of Energy pursue and what technology constraints must be addressed to ensure prudent development of Arctic oil and gas resources while advancing U.S. energy and economic security and ensuring environmental stewardship?

For the purposes of these studies, I am designating Deputy Secretary Daniel Poneman to represent me. He will provide the necessary coordination between the Department of Energy and the National Petroleum Council and oversee the Department's engagement. Acting Assistant Secretary Christopher Smith is the Designated Federal Official for this advisory committee and he will work with Deputy Secretary Daniel Poneman and the Council staff to identify leads for each of the studies. I understand that dialogue between the Department and the Council may be necessary to further define the scope of the studies.

Sincerely,

A handwritten signature in black ink, appearing to read 'Ernest Moniz', with a stylized, flowing script.

Ernest Moniz

DESCRIPTION OF THE NATIONAL PETROLEUM COUNCIL

In May 1946, the President stated in a letter to the Secretary of the Interior that he had been impressed by the contribution made through government/industry cooperation to the success of the World War II petroleum program. He felt that it would be beneficial if this close relationship were to be continued and suggested that the Secretary of the Interior establish an industry organization to advise the Secretary on oil and natural gas matters. Pursuant to this request, Interior Secretary J. A. Krug established the National Petroleum Council (NPC) on June 18, 1946. In October 1977, the Department of Energy was established and the Council was transferred to the new department.

The purpose of the NPC is solely to advise, inform, and make recommendations to the Secretary of Energy on any matter requested by the Secretary, relating to oil and natural gas or the oil and gas industries. Matters that the Secretary would like to have considered by the Council are submitted in the form of a letter outlining the nature and scope of the study. The Council reserves the right to decide whether it will consider any matter referred to it.

Studies undertaken by the NPC at the request of the Secretary include:

- *Industry Assistance to Government – Methods for Providing Petroleum Industry Expertise During Emergencies* (1991)
- *Petroleum Refining in the 1990s – Meeting the Challenges of the Clean Air Act* (1991)
- *The Potential for Natural Gas in the United States* (1992)
- *U.S. Petroleum Refining – Meeting Requirements for Cleaner Fuels and Refineries* (1993)
- *The Oil Pollution Act of 1990: Issues and Solutions* (1994)
- *Marginal Wells* (1994)
- *Research, Development, and Demonstration Needs of the Oil and Gas Industry* (1995)
- *Future Issues – A View of U.S. Oil & Natural Gas to 2020* (1995)
- *U.S. Petroleum Product Supply – Inventory Dynamics* (1998)
- *Meeting the Challenges of the Nation’s Growing Natural Gas Demand* (1999)
- *U.S. Petroleum Refining – Assuring the Adequacy and Affordability of Cleaner Fuels* (2000)
- *Securing Oil and Natural Gas Infrastructures in the New Economy* (2001)
- *Balancing Natural Gas Policy – Fueling the Demands of a Growing Economy* (2003)
- *Observations on Petroleum Product Supply* (2004)
- *Facing the Hard Truths about Energy: A Comprehensive View to 2030 of Global Oil and Natural Gas* (2007). *One Year Later: An Update* (2008)
- *Prudent Development: Realizing the Potential of North America’s Abundant Natural Gas and Oil Resources* (2011)
- *Advancing Technology for America’s Transportation Future* (2012).

The NPC does not concern itself with trade practices, nor does it engage in any of the usual trade association activities. The Council is subject to the provisions of the Federal Advisory Committee Act of 1972.

Members of the National Petroleum Council are appointed by the Secretary of Energy and represent all segments of the oil and gas industries and related interests. The NPC is headed by a Chair and a Vice Chair, who are elected by the Council. The Council is supported entirely by voluntary contributions from its members.

Additional information on the Council’s origins, operations, and reports can be found at www.npc.org.

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Appendix B

STUDY GROUP ROSTERS

STUDY PARTICIPATION

Study group participants contributed in a variety of ways, ranging from full-time work in multiple study areas, to involvement on a specific topic, or to reviewing proposed materials. Involvement in these activities should not be construed as endorsement or agreement with all the statements, findings, and recommendations in this report. Additionally, while U.S. government participants provided significant assistance in the identification and compilation of data and other information, they did not take positions on the study's policy recommendations.

As a federally appointed and chartered advisory committee, the National Petroleum Council is solely responsible for the final advice provided to the Secretary of Energy. However, the Council believes that the broad and diverse study group participation has informed and enhanced its study and advice. The Council is very appreciative of the commitment and contributions from all who participated in the process.

This appendix lists the individuals who served on this study's Committee, Coordinating Subcommittee, and Subgroups, as a recognition of their contributions. In addition, the National Petroleum Council wishes to acknowledge the numerous other individuals and organizations who participated in some aspects of the work effort through workshops, outreach meetings, and other contacts. Their time, energy, and commitment significantly enhanced the study and their contributions are greatly appreciated.

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Appendix C

AFTER-ACTION REPORT SUMMARY

OVERVIEW

This appendix provides a review and analysis of over 30 documents including after-action reports of recent major energy emergencies caused during the 2005 and 2008 hurricane seasons (Katrina and Rita, Gustav and Ike), as well as Superstorm Sandy in 2012.¹ Other documents were also reviewed including energy exercise take aways, lessons learned, general emergency preparedness guidelines developed specifically for the energy industry, and technical studies relevant to the topic of emergency preparedness. Best practices and recommendations for improving energy emergency preparedness and response were summarized as a means of informing the NPC emergency preparedness study. The best practices and recommendations gleaned from the after-action reports and exercises were based on observations and feedback from representatives of the energy industry and local, state, and federal government agencies and reflect the experiences gained during actual energy emergencies.

The documents reviewed were grouped in the following categories:

- **After-Action Reports and Exercises/Workshops.** These include reports following recent energy emergencies and energy emergency exercises. The after-action report summaries contain recommendations from industry and government on practices and methods for

improving future emergency preparedness and response. The exercises/workshop summaries contain best practices and areas of emergency preparedness improvement as identified by participants from industry and local, state, and federal government.

- **Analytic Studies and Other Reports.** These include technical studies, journal articles, and other information that address emergency preparedness both in general and specific to the energy industry.
- **Guidelines and Other Documents.** These are guidelines related to emergency preparedness in general and energy emergency preparedness specifically.

In reviewing each document, only information relevant to emergency preparedness in the oil and gas industry was summarized. The summaries include information related to interdependencies with other sectors, and general emergency preparedness practices that may be useful to consider in the oil and gas sector. The summaries of these reports specifically address concerns, recommendations, and lessons learned for five areas of focus:

1. **Communications.** Actions that can be taken by industry and government to improve their interactions to prepare for and respond to emergencies that can disrupt oil and natural gas supplies.
2. **Information Management/Data.** Data, technologies, or other capabilities for preparation, response, and recovery.
3. **Supply Chain.** Market dynamics of the U.S. oil and natural gas industry, including strategies

¹ An after-action report is a formal analytical document intended to serve as an aid to performance evaluation and improvement, by registering situation-response interactions, analyzing critical procedures, determining their effectiveness and efficiency, and proposing adjustments and recommendations.

to address interdependencies among oil and natural gas and other critical infrastructure.

4. **Regulatory/Policy.** Legal, procedural, or physical gaps that can be addressed, or other strategies to improve emergency preparedness and resiliency.
5. **Planning and Exercises.** Planning and practices that enhance coordination between responding organizations and facilitate interoperability for effective response and energy restoration.

Recommendation highlights for each of the five focus areas are organized using the three document categories described above. These recommendations have been analyzed and validated. Valid recommendations have been included in the report for implementation. This appendix also contains a reading list of documents. The reading list includes those documents summarized herein as well as other documents relevant to emergency planning and response such as relevant Executive Orders, Presidential Policy Directives, and the Emergency Support Function #12 – Energy Annex.

SUMMARY OF RECOMMENDATIONS: AFTER-ACTION REPORTS AND EXERCISE/WORKSHOP REPORTS

Following recent energy emergency events, the federal government has convened after-action workshops to identify preparedness and response measures that worked well and areas for improvement. Participants in these workshops include representatives from industry, local, state, and federal agencies that were involved in each emergency event. After each workshop, after-action reports are developed to outline specific recommendations for industry and/or government to consider in future planning. The after-action reports collected in support of this NPC effort were those developed following Superstorm Sandy, Hurricanes Katrina and Rita, and the petroleum supply disruption in the southeast after Hurricanes Gustav and Ike. These after-action reports represent a sample of after-actions held following energy emergencies. Numerous other after-actions have been held by individual companies and at the state and local level.

In addition, exercises are regularly conducted to test emergency preparedness and response procedures. Exercises are often conducted within an individual organization, be it a private company or a state or federal agency. Joint exercises also may be held, which involve multiple organizations. Following exercises, participants use their expertise in the energy sector and emergency response to identify best practices and recommendations for improvement. The Energy Assurance Exercise reports summarized herein are examples of energy emergency exercises held by the public and private sector. They were selected because exercise participants included a cross-section of industry, local, state, and federal representatives from all regions of the United States. In addition, the exercises represent a wide range of energy emergencies—both natural disasters and physical/cyber attacks—across all regions of the United States. Common across nearly every after-action and exercise/workshop was the recognition that there must be better communication both within and across organizations. Examples from this focus area and others included the following:

Communications

- Identifying points of contact well in advance of an emergency event. One-on-one contact should be made in advance to the extent possible. These lists should be maintained on a regular basis.
- Using social media tools for both data gathering and communication with the public during energy emergencies. Industry has already begun using these forms of communication and additional opportunities to add value should be identified.
- Improving communication with the public to inform them on restoration timelines and the expected duration of outages when they occur. This will allow residents, businesses, and municipalities to plan and take appropriate response measures.

Information Management/Data

- Improving situational status updates on the availability of fuel supplies at retail level. A coordinated means of collecting, managing, and sharing damage assessments, situational status, and restoration status needs to be

established. It must respect data confidentiality issues and be compliant with antitrust legislation.

Supply Chain

- Assessing vulnerabilities and performing risk assessments across the supply chain in areas prone to natural disasters and developing a better understanding of interdependencies with the energy sector. These assessments can help establish restoration priorities.
- Improving the understanding among public and policymaker of how the energy sector works is needed to inform responses that addresses interdependencies.
- Knowing which operations are powered by backup generation and which sectors may be disrupted by power outages.
- Working with multiple states and having regional situational awareness to help inform states in an emergency.

Regulatory/Policy

- Communicating emergency declarations to all parties that need to be aware, and ensuring that the meaning of those declarations is well understood.
- Streamlining the waiver process and educating industry and state points of contact on how the waiver process works.
- Working with local law enforcement and across state borders to improve access for restoration crews, including mutual assistance crews.

Planning and Exercises

- Developing a schedule of regularly held emergency exercises and training events. These should be joint events that involve both public- and private-sector participants and that involve highly interdependent critical infrastructure sectors (e.g., water, electricity, and telecommunications).
- Conducting local drills to help cities understand pipeline capabilities and clarify roles and responsibilities.
- Educating city, county, and state officials on private-sector operations, capabilities, and in

planning for multi-phase, multi-sector cyber attacks.

- Planning for disaster preparedness with a community engagement team. Engage police, emergency responders, healthcare workers, energy organizations, and non-traditional businesses to plan for disasters.

A snapshot of recommendations from after-action and exercise/workshop reports is provided in Table C-1.

SUMMARY OF RECOMMENDATIONS: ANALYTIC STUDIES AND REPORTS

Federal agencies and industry have developed numerous studies to identify methods for improving emergency preparedness and response. Recent studies, as well as those with a particular emphasis on the energy sector, were reviewed to cull information of potential value to the NPC study. Many of the issues covered in these studies are similar to those identified in the after-action reports and exercise/workshop reports.

Examples of recommendations from these studies include:

Communication

- Integrating social media into public alert and warning systems as well as coordinating social media messaging and information sharing across state and local agencies.
- Increasing collaboration among emergency management practitioners and launching a cross-agency team to remove barriers to restoration crews trying to access impacted areas.
- Increasing information sharing between the energy sector and other sectors impacted by natural disasters (i.e., insurance, financial).

Supply Chain

- Identifying vulnerabilities and risks across the energy supply chain and investing in measures to reduce those vulnerabilities.
- Developing a better understanding of the energy infrastructure and interdependent sectors to inform impact analysis and response measures.

Report Name and Source	Communications	Information Management/Data
After-Action Reports		
Hurricane Sandy FEMA After-Action Report - FEMA, July 2013	<ul style="list-style-type: none"> • Smartphone apps can distribute critical information quickly • An online crisis management system to coordinate response operations 	<ul style="list-style-type: none"> • Online app utilizing mapping services to publish current information on fueling stations • Establish an analysis team afterwards to review and document the response for lessons learned
A Stronger, More Resilient New York - City of New York, June 2013		<ul style="list-style-type: none"> • Develop a reporting framework for fuel infrastructure operators status
Overview of Response to Hurricane Sandy-Nor'easter and Recommendations for Improvement - U.S. Department of Energy, February 2013	<ul style="list-style-type: none"> • Improve coordination across the energy industries • Embed fuels industry representatives in state and federal Emergency Operations Centers • Communication restoration time frames 	<ul style="list-style-type: none"> • Improved situational awareness on location and quantity of fuel supplies • Lack of data at the retail level (gasoline stations)
Southeast Petroleum Disruption and After-Action Workshop Report - U.S. Department of Energy and NASEO, January 2009	<ul style="list-style-type: none"> • Coordinate collection of data from industry; Understand pre-event baseline status of sector, convey to decision makers (i.e., Governor) • Develop and maintain contact lists and relationships • Coordinated and effective messaging to public 	<ul style="list-style-type: none"> • Provide data on situational status • Establish means to ensure data confidentiality • Improve methods for data collection • Improve cross-state data collection, analysis, and coordination
2006 Energy Leadership Forum, After Action Report - U.S. Department of Energy, January 2006 (AAR of Hurricane Katrina and Rita)	<ul style="list-style-type: none"> • Pre-establish contact lists and communication protocols • Pre-establish protocols for communicating with media • Pre-position communications equipment and have back-ups 	
Exercises and Workshops		
Energy Assurance and Interdependencies After Action Report - NASEO and U.S. Department of Energy, February 2014	<ul style="list-style-type: none"> • Utilize social media for outreach • Coordinated public outreach 	<ul style="list-style-type: none"> • Evaluate data needs of state and local government
Connecting Energy Officials from Across the Country: Lessons Learned from the Regional Energy Assurance Exercises - U.S. Department of Energy, June 2012	<ul style="list-style-type: none"> • Plan a back-up means of communication • Coordinate with other stakeholders to provide consistent information to the public 	<ul style="list-style-type: none"> • Keep contact information current
2012 National Energy Assurance Planning Conference After-Action Report - U.S. Department of Energy, August 2012	<ul style="list-style-type: none"> • Identify contact lists in advance • Leverage fusion centers • Communicate w/customers to manage expectations • Educate city, county, and State officials on private sector operations, capabilities, and interdependencies 	<ul style="list-style-type: none"> • Map locations of fuel stations • Pre-event Memorandums of Understanding/ agreements on how to manage sensitive data

Table C-1. Summary of Recommendations: After-Action Reports

Supply Chain	Regulatory/Policy	Planning and Exercises
After-Action Reports		
<ul style="list-style-type: none"> Establish fuel distribution points for first responders 		<ul style="list-style-type: none"> Coordinate among communities, localities, and states Develop an agile, professional, capable emergency workforce Make extensive preparations utilizing weather and news services Establish support bases to preposition commodities
<ul style="list-style-type: none"> List of hardening initiatives, including pipeline booster stations 	<ul style="list-style-type: none"> Work with the state to provide incentives for the hardening of gas stations to withstand extreme weather events 	
<ul style="list-style-type: none"> Industry should assess vulnerabilities to their system in areas prone to natural disasters Technology for real-time monitoring of fuel availability Establish standards for fuels facilities to accept generator power 	<ul style="list-style-type: none"> Guidelines for law enforcement re: access to restoration crews Assess value of a refined product reserve Clarify antitrust laws to facilitate mutual assistance and coordination Designate energy restoration crews as first responders 	<ul style="list-style-type: none"> Exercise Continuity of Operations Plans with suppliers and customers Conduct regional, public-private exercises
<ul style="list-style-type: none"> Identify critical assets and priorities across supply chain 	<ul style="list-style-type: none"> Understand legislative authorities and limitations of state and federal authority Communicate emergency declarations and the associated requirements/implications for industry Evaluate effectiveness of price gouging laws Consider methods to reduce variations in fuel specifications 	<ul style="list-style-type: none"> Conduct additional planning and exercises
<ul style="list-style-type: none"> Improve fuel supplies for evacuation and response Pre-plan resource management and allocation methods (i.e., inventories, pre-negotiated contracts) 	<ul style="list-style-type: none"> Streamline waiver process Establish mutual aid agreements in the oil and gas industry Establish fuel contracts 	<ul style="list-style-type: none"> Update energy assurance plans Clarify roles and responsibilities Re-evaluate emergency scenarios to consider “zero-based” scenarios which were a reality in some areas of the Gulf Coast Continue state and regional exercises; joint exercises Distribute best practices in energy sector preparedness Educate first responders on the energy sector
Exercises and Workshops		
<ul style="list-style-type: none"> Analyze interdependencies Analyze benefits of infrastructure upgrades to improve resilience 		<ul style="list-style-type: none"> Coordinated public-private planning Ongoing training involving multiple partners and regions Roadmap for responding to cyber events
	<ul style="list-style-type: none"> Understand relevant legal authorities and the chain of command 	<ul style="list-style-type: none"> Maintain awareness of interdependencies among energy sectors Clarify response roles and responsibilities in advance Conduct regular training and exercises Plan for non-weather-related events Establish a regular schedule for training exercises
<ul style="list-style-type: none"> Establish resource allocation priorities, in advance, across supply chain Perform risk assessment, identify vulnerabilities and interdependencies 		<ul style="list-style-type: none"> Clarify roles and responsibilities Coordinate energy assurance plans across jurisdictions Conduct multi-state, multi-sector exercises to improve understanding across industries and jurisdictions Regularly update plans Conduct local drills Increase cyber security planning

Table C-1. Summary of Recommendations: After-Action Reports (continued)

Report Name and Source	Communications	Information Management/Data
National Infrastructure Advisory Council (NIAC), Strengthening Regional Resilience through National, Regional, and State Partnerships - NIAC, November 2013	<ul style="list-style-type: none"> Integrate social media into public alert and warning systems, and work with state and local government partners to develop social media information sharing capabilities to inform response 	
U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather - U.S. Department of Energy, July 2013	<ul style="list-style-type: none"> Increase information sharing and partnership activities across energy sector, financial, insurance, etc. 	<ul style="list-style-type: none"> Improve regional and local characterization of climate change impacts on energy sector and vulnerabilities
Comparing The Impacts of Northeastern Hurricanes on Energy Infrastructure - U.S. Department of Energy, April 2013	<ul style="list-style-type: none"> Energy Restoration Task Force established 	<ul style="list-style-type: none"> Public-private collaboration to identify and address industry needs Facilitate power restoration in fuel distribution facilities
Crisis Response and Disaster Resilience 2030, Forging Strategic Action in an Age of Uncertainty - FEMA, January 2012	<ul style="list-style-type: none"> Practice multi-directional information sharing Utilize social media 	
The Federal Emergency Management Agency Publication 1 - FEMA, November 2010	<ul style="list-style-type: none"> Emergency management practitioners value collaboration 	
Hardening and Resiliency: U.S. Energy Industry Response to Recent Hurricane Seasons - U.S. Department of Energy, August 2010	<ul style="list-style-type: none"> Improving employee communications and tracking Installing redundant communications Procuring mobile command vehicles 	
Comparing the Impacts of the 2005 and 2008 Hurricanes on U.S. Energy Infrastructure - U.S. Department of Energy, February 2009	<ul style="list-style-type: none"> Significant impacts on interdependent sectors highlighted the need for improving communications across sectors 	<ul style="list-style-type: none"> Improvements in data collection of natural gas processing after 2005 enhanced the ability to analyze impacts and identify solutions during the 2008 hurricane season
The Role of Information Sharing and Analysis Centers (ISACS) in Private/Public Sector Critical Infrastructure Protection - National Council of ISACs, January 2009	<ul style="list-style-type: none"> Existing communication architectures among private/public sector organizations are useful for sharing information and analysis. 	<ul style="list-style-type: none"> Private sector expertise is critical in knowing what bits of information are important, knowing who to contact with the information, and knowing what action to take as a result
Facing the Hard Truths About Energy: A Comprehensive View to 2030 of Global Oil and Natural Gas - National Petroleum Council, July 2007		<ul style="list-style-type: none"> EIA should incorporate infrastructure-related data into its energy information collection
Industry Assistance to Government: Methods for Providing Petroleum Industry Expertise During Emergencies: An Emergency Preparedness Report of the National Petroleum Council - National Petroleum Council, January 1991	<ul style="list-style-type: none"> The NPC recommended three levels of response by the petroleum industry to energy emergencies, depending on their nature and severity: <ul style="list-style-type: none"> Company Emergency Contacts (Level 1) Executive Advisory Group (Level 2) A Petroleum National Defense Executive Reserve (Level 3) 	

Table C-2. Summary of Recommendations: Analytic Studies and Reports

Supply Chain	Regulatory/Policy	Planning and Exercises
<ul style="list-style-type: none"> • Create a strong value proposition for investment in resilient lifeline infrastructures and accelerate the adoption of innovative technologies in major infrastructure projects 	<ul style="list-style-type: none"> • Designate the energy, communications, water, and transportation sectors as lifeline sectors and direct all agencies to recognize the priority of the lifeline sectors and the individuality of regions • Launch a cross-agency team to develop solutions to site access, waiver, and permit barriers during disaster response 	<ul style="list-style-type: none"> • Form partnerships with senior executives from the lifeline sectors, based on the federal government's successful executive engagement with the electricity sector. • Identify or develop regional, public-private, cross-sector partnerships, led by senior executives, to coordinate lifeline sector resilience efforts within a given region
<ul style="list-style-type: none"> • Develop and deploy climate-resilient technologies and practices 		<ul style="list-style-type: none"> • Prioritize and evaluate vulnerabilities • Identify technologies and tools to improve resilience
	<ul style="list-style-type: none"> • Significant waivers of federal and state fuel requirements 	
<ul style="list-style-type: none"> • Adopt risk management tools to manage cascading consequences across infrastructure • Identify hidden supply chain vulnerabilities • Develop new technologies for emergency management 	<ul style="list-style-type: none"> • Encourage private sector to contribute to emergency management policy development 	<ul style="list-style-type: none"> • Plan around interdependencies to exercise a range of emergency management capabilities • Intensify disaster response planning with Canada and Mexico • Address shifts in local/regional demographics
		<ul style="list-style-type: none"> • Emergency management is a collaborative activity. Major disasters and emergencies are too complex for any one organization. • Current resources are rarely sufficient in large-scale incidents. Response operations for large incidents often focus on managing shortfalls.
<ul style="list-style-type: none"> • Harden infrastructure to reduce vulnerability • Perform storm-specific readiness 		<ul style="list-style-type: none"> • General readiness planning across infrastructure
<ul style="list-style-type: none"> • Awareness of market conditions and infrastructure status prior to each event is critical to identifying supply impacts and solutions • Oil and gas industry operations in regions not damaged by the hurricanes were able to help compensate for a portion of supply shortfalls • Ability of federal government to maintain perspective on entire energy sector and understand interdependencies enabled targeted assistance in restoration (i.e., restoring power to utility pole producer and critical pipeline facilities) 	<ul style="list-style-type: none"> • Significant waivers of federal and state fuel requirements • Timing of hurricane impacts in relation to seasonal fuel standards can impact supply and create need for waivers • Many states enacted price gouging laws during the 2008 hurricane season • Some states enacted legislation after 2005 hurricane season to require generator hookups at gasoline stations along evacuation routes 	<ul style="list-style-type: none"> • Industry preparations, which built upon lessons learned from the 2005 hurricane season, helped to reduce the impact of the 2008 hurricane season • Select companies undertook measures to prioritize fuel deliveries and install generators in gasoline stations along evacuation routes—a lesson learned from the 2005 season
	<ul style="list-style-type: none"> • ISACs were introduced in 1998, and the ISAC Council with its 14 members formed in 2003 • ISACs are sector specific information sharing organizations to share information, within each sector, about threats and vulnerabilities to that sector 	<ul style="list-style-type: none"> • Existing communication architectures among private/public sector organizations are useful for sharing information and analysis
<ul style="list-style-type: none"> • DOE should develop an integrated study of the energy infrastructure needs to 2030 • Continue to develop the international energy marketplace by expanding the energy dialogue with major consuming and producing nations 	<ul style="list-style-type: none"> • DOE should share an equal role with the Departments of Defense, State, Treasury, and Commerce on policy issues relating to energy and energy security 	

Table C-2. Summary of Recommendations: Analytic Studies and Reports (continued)

Planning and Exercises

- Prioritizing power restoration in fuel storage and distribution facilities.
- Developing regional, public-private, cross-sector partnerships, led by senior executives, to coordinate lifeline sector resilience efforts within a given region.

A brief summary of major recommendations is provided in Table C-2.

SUMMARY OF RECOMMENDATIONS: OTHER GUIDANCE DOCUMENTS

A final category of documents includes guidelines developed by the oil and gas industry, state organizations, and experts in the field. These documents provide specific guidelines that public- or private-sector organizations can

implement in improving emergency preparedness and response. Similar to the previous two categories, many of these recommendations surround the following:

Communication

- Improving communications and messaging with the public.
- Improving coordination across the public and private sectors.

Information Management/Data

- Developing guidelines for sharing data.

Supply Chain

- Assessing supply chain vulnerabilities.

A brief summary of major recommendations is provided in Table C-3.

Report Name and Source	Communications	Information Management/Data	Supply Chain	Regulatory/Policy	Planning and Exercises
Beyond the Storms: Strengthening Preparedness, Response, & Resilience in the 21st Century - Dane S. Egli, Journal of Strategic Security, Summer 2013			<ul style="list-style-type: none"> • Risk-map infrastructure interdependencies and single points of failure 		<ul style="list-style-type: none"> • Develop functional resilience framework and methodology to aid planners • Roadmap to synchronize planning and preparedness efforts
Oil and Natural Gas Industry Preparedness Handbook - American Petroleum Institute, October 2013			<ul style="list-style-type: none"> • Highlights oil and natural gas supply chain 	<ul style="list-style-type: none"> • Highlights government regulations along the supply chain 	
NASEO State Energy Assurance Guidelines - National Association of State Energy Officials, December 2009	<ul style="list-style-type: none"> • Improve public information and education campaigns • Coordinate across sectors and with government 	<ul style="list-style-type: none"> • Develop guidelines for data collection and data sharing 		<ul style="list-style-type: none"> • Understand state authorities 	

Table C-3. Summary of Recommendations: Other Guidance Documents

EMERGENCY PREPAREDNESS RESOURCE LIST

American Petroleum Institute. *Energy: Securing Our Natural Gas Supply Chain*. Washington, DC: API. <http://www.api.org/~media/Files/Policy/Safety/API-Natural-Gas-Supply-Chain.pdf>.

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U.S. Department of Homeland Security, U.S. Department of Energy. *Energy Sector-Specific Plan: An Annex to the National Infrastructure Protection Plan*. Washington, DC: DHS, DOE, 2010. http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/Energy_SSP_2010.pdf.

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U.S. Department of Energy. *2012 National Energy Assurance Planning Conference After Action Report*. Washington, DC: Infrastructure Security and Energy Restoration, Office of Electricity Delivery and Energy Reliability, DOE, August 2012.

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U.S. Department of Energy. *Comparing the Impacts of the 2005 and 2008 Hurricanes on U.S. Energy Infrastructure*. Washington, DC: Infrastructure Security and Energy Restoration, Office of Electricity Delivery & Energy Reliability, DOE, February 2009. http://energy.gov/sites/prod/files/Comparing_the_Energy_Infrastructure_Impacts_of_the_2005_and_2008_Hurricanes_-_February_2009.pdf.

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Appendix D

STAKEHOLDER ENGAGEMENT SESSIONS SUMMARY

STAKEHOLDER ENGAGEMENT SESSIONS

Engagement sessions were held with diverse stakeholders identifying lessons learned, best practices and innovative ideas to improve emergency preparedness across industry, federal, state, and local governments.

Topics Discussed:

- Supply Chain Understanding

- Situational Awareness
- Legal/Regulatory

Sessions Held:

- April 30 (East Coast and Gulf Coast)
- May 1 (Federal Government)
- May 14 (West Coast and Mid-Continent)
- May 21 (East Coast and Gulf Coast)

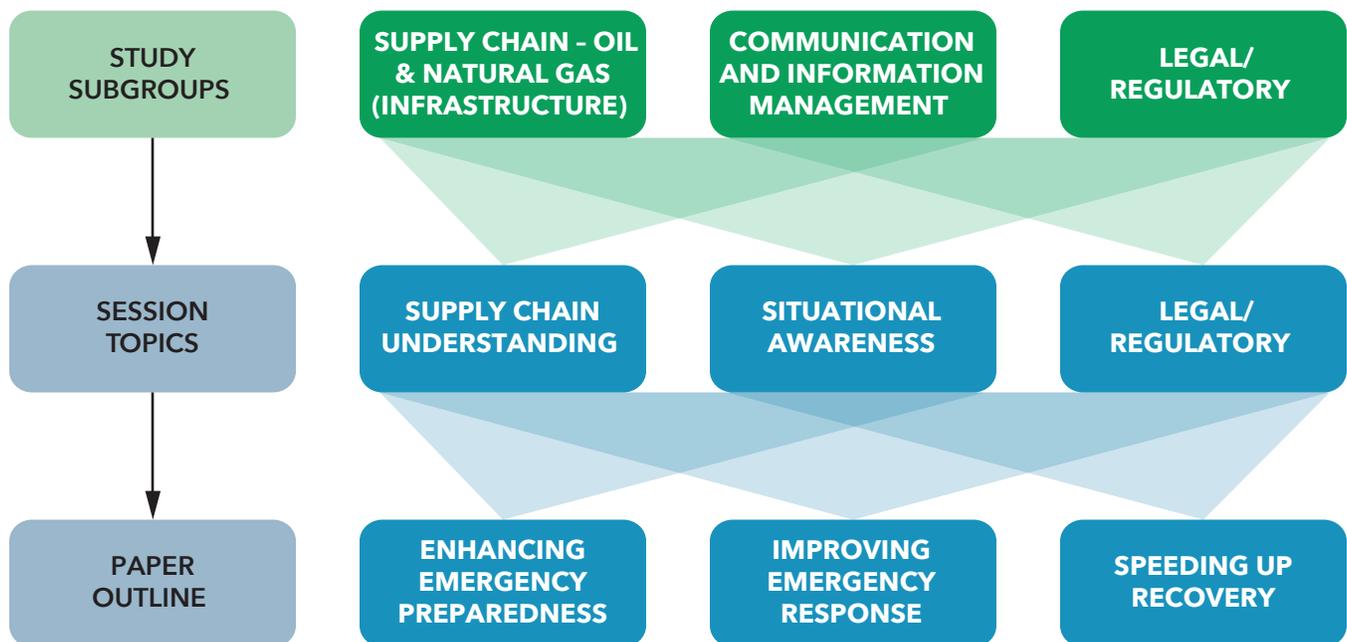


Figure D-1. Engagement Session Topic Alignment

KEY TAKEAWAYS FROM ENGAGEMENT SESSIONS

Enhancing Emergency Preparedness:

- Enhance supply chain clarity and flexibility
- Improve pre-event planning
- Establish routine education and training
- Perform regular drills and exercises to validate/improve plans

Improving Emergency Response:

- Identify government information needs
- Standardize data gathering systems and processes
- Improve situation assessment, coordination and communications

Speeding Up Recovery:

- Standardize templates for key temporary regulatory relief measures
- Best Practice language for temporary regulatory relief
- Streamline processes for granting temporary regulatory relief

ENHANCING EMERGENCY PREPAREDNESS

Opportunity: Enhance supply chain clarity and flexibility

Discussion Highlights:

- Visual tools useful (API, EIA)
- Limited knowledge of ethanol, propane, and natural gas liquids supply chains
- Limited awareness of supply chain interdependencies
- Commodity ownership vs. custody is misunderstood
- Expanding un-conventionals is improving flexibility/resiliency
 - Infrastructure permitting limiting growth

Follow-Up Areas:

- Clarify ethanol chain – piped mogas not finished till ethanol blended at terminals

- Clarify commodity vs. delivery asset ownership
- Expand narrative on natural gas liquids, need for separation
- Discussion on regional flexibilities/resiliency

Opportunity: Improve pre-event planning

Discussion Highlights:

- DOE working with states to establish energy assurance plans
- State funding an issue at times; federal grants help
- Build relationships through regular, proactive work on a state-by-state basis
- Interdependencies not well understood/considered

Suggested Practices:

- Re-energize energy coordinators network with DOE
- Understand criticalities, contingencies, and align on priorities before event
 - Understand steady state, then consider what could go wrong
 - Consider seasonality of hazards and consequences
 - Integrate risk profiles and criticalities into business continuity plans
- Address interdependencies in pre-event planning/meetings/drills
 - Identify cross regional interdependencies – East Coast supplied from Gulf Coast
 - Address mutual interdependencies – Power generation increasing dependence on gas supply
- Ensure accountability of stakeholders is clearly defined
- Increase O&G industry involvement in local plan development

Opportunity: Establish routine education and training

Discussion Highlights:

- Supply chain understanding is event driven

- Need for ongoing education/drills
 - High government turnover; industry restructuring, changes in interdependent parties
- Leverage existing federal, state, local, and industry forums for education
- Engage the correct level of stakeholders (e.g., local decision-makers)
- Improve awareness of supply chain interdependencies

Education Focus Areas:

- Steady state supply chain
- Intricacies of commodity ownership
- Supply chain interdependencies (e.g., electricity, ethanol, natural gas liquids)
- Seasonality of hazards and cross regional consequences
- Incident command structure and communication protocols; include senior managers
- National Response Framework (NRF), Emergency Support Functions (ESF), National Incident Management System (NIMS)

Opportunity: Perform regular drills and exercises to validate/improve plans

Discussion Highlights:

- Need to engage correct level of decision-makers in exercises during steady state
- Cannot engage multiple companies in private sector exercises
- Joint drills/exercises between industry and governments is important

Suggested Practices:

- Hold regular drills and exercises to train new personnel
- Leverage existing drills/exercises to identify joint exercise opportunities
- Participation of senior management and personnel involved during real incidents
- Trained backup personnel for continuity
- Unannounced drills to imitate live scenarios
- Federal government to coordinate larger exercises with multi-state/multi-stakeholders

- Test critical areas, contingencies, interdependency response
- Use specific scenarios to evaluate the effectiveness of analysis and assessment
- Incorporate lessons learned into business continuity plans

Resources for Further Information:

Federal

- Energy Emergency Coordinators Network – David Terry, NASEO; Alice Lippert, DOE
- National Emergency Management Association – Ahsha Tribble, DOE
- EIA Interactive Maps
- US Coast Guard Forums – Drew Tucci, USCG
- FEMA Field Reps – Jim Kish, FEMA; Jeremy Greenberg, DOT
- National Response Framework and Emergency Support Functions – Alice Lippert, DOE; Jim Kish, FEMA
- FEMA National Exercise Program Capstone Efforts – Tom Roston, National Security Council

State

- State Energy Assurance Plans and NASEO Guidelines – David Terry, NASEO; Alice Lippert, DOE
- Missouri Petroleum Council Quarterly Meetings – Ryan Rowden, Missouri Petroleum Council
- California Critical Infrastructure and Lifeline Council – David Michel, CA Energy Commission
- Alyeska Pipeline Tabletop Exercises – Kim Harb, Alyeska Pipeline
- California “Great Shakeout Exercise” – Ron Morones, Kinder Morgan
- Ohio Energy Provider Forums (twice a year) – Tom Pearce, Ohio

Industry

- API Handbook
- API Quarterly Meetings – Jim Benton, API

IMPROVING EMERGENCY RESPONSE

Opportunity: Identify government information needs

Discussion Highlights:

- Industry is responsible for emergency response and recovery
- Government needs information to form an assessment and support recovery
 - Stabilize communities, prioritize industry support, upward government communications
- DOE and states need to define critical information requirements
 - Collect only information necessary for analysis and problem solving
- Situational analysis requires the right real time data and targeted questions

Suggested Practices:

- DOE should coordinate the data requirements and requests to industry
- Develop real time critical information requirements/questions from industry
 - What is needed for problem solving?
 - What can be provided considering antitrust and confidential information?

Opportunity: Standardize data gathering systems and processes

Discussion Highlights:

- Confusion caused by breaking out of the established structure (e.g., NRF, ESF, ICS) and using personal relationships
 - Process will differ based on FEMA activation vs. non-activation
- Sensitive information must be handled with restrictions
- Several states have good systems for receiving industry data
 - Information can be pushed up through ICS with industry entry into a system

- Contact list of operations centers, rather than individuals
 - Mitigate challenges of personnel turnover
 - Consider using O&G SCC or trade associations to maintain industry contact list for DOE

Follow-Up Areas:

- Several states have potential best practices (e.g., Alaska, California, Washington)
- ESF-12 (DOE) process for receiving data/information from states/local
 - Coordination with state ESFs and PSAs
- Consider HSIN as platform for industry data

Opportunity: Improve situation assessment, coordination and communications

Discussion Highlights:

- DOE under ESF-12 is focal point for energy issues in emergencies
 - DOE uses Incident Command Structure (ICS); expanding training to senior managers
 - Industry needs to better understand the National Response Framework process
- Antitrust laws preclude joint industry support to DOE for situation assessment
- Senior leadership talking to each other is an important role in the process
- Could improve information sharing in government and coordination with industry
 - WebEOC platform growing (protected)
- Early, clear, aligned public communication is important to maintain confidence

Suggested Practices:

- DOE to enhance capability to gather info/perform situation analysis
 - Channel information through DOE; discourage bypassing (leverage PSAs)
- Improve communications and response coordination with private sector EOCs
 - Industry ICS/EOC's best source for clarity on supply, delivery issues, and support needs

- Develop communication best practice: did today, doing tomorrow, where in plan
 - DOE/DOT developing various public tools (e.g., apps, web links, social media)
 - Need process to avoid last minute hoarding; train public on personal preparedness

Resources for Further Information:

Federal

- National Response Framework and Emergency Support Function (e.g., ESF-12) – Jim Kish, FEMA; Alice Lippert, DOE
- HSIN Platform – Bill Cummins, DHS
- DHS Field personnel, Protective Service Advisors (PSAs) – Bill Cummins, DHS
- DHS National Operations Center (NOC) – Bill Cummins, DHS
- NIMS (National Information Management System)
- FEMA Region Plans (e.g., All Hazard Plan) – Jim Kish, FEMA
- www.DOT.Gov/Emergency – Jeremy Greenberg, DOT

State

- Alaska’s information system on HSIN – John Madden, Alaska Homeland Security
- Washington’s energy supply disruption tracking process (geo-database tracking and communications tool) – Mark Anderson, Washington DOC
- California’s Petroleum Industry Information Reporting Act (PIIRA) – Robert Oglesby, California Energy Commission
- California web portal for asset information – Dave Michel, California Energy Commission
- Louisiana Emergency Preparedness Group – Richard Metcalf, Louisiana Mid-Continent Oil and Gas Association
- Louisiana web based program providing fuel station data – Sara Krupa, Louisiana Homeland Security

SPEEDING UP RECOVERY

Opportunity: Standardize templates for temporary regulatory relief measures

Discussion Highlights:

- Need to identify all the key federal and state key measures
- Standard relief application templates would be helpful
 - Some are state specific, some are joint state/federal
 - Address in state/regional plans
- Companies should consider alternatives to give comparable protection in plans

Follow-Up Areas:

- Update/expand list of key regulatory relief measures included in API handbook
- Develop standard one page template for requesting each regulatory relief
 - Include contacts, data needed, etc.
 - Leverage agency websites
- Develop accountable stakeholder(s) to maintain/update templates.

Opportunity: Best Practice language for temporary regulatory relief

Discussion Highlights:

- Uncertainty on language, duration, and extensions limit usefulness
 - Waiver may be issued, but companies can not take advantage due to ambiguity and risk
- No action assurances do not provide sufficient legal certainty for industry

Suggested Practices:

- Develop best practice language for key temporary regulatory relief measures
 - Clear and concise verbiage
 - Fuels waivers already under development
 - Provide flexibility where possible to tailor waivers to incident

Opportunity: Streamline processes for granting temporary regulatory relief

Discussion Highlights:

- Timely, clear temporary regulatory relief is key tool to allow speedy recovery
 - Process has improved significantly over last few incidents
 - Feds fast; states sometimes slower; consider steps to speed up processes
- Need to clarify who has authority at state/federal level to grant regulatory relief
- Gouging laws and price controls can be a deterrent to rapid resupply

Follow-Up Areas:

- Blanket or regional regulatory relief vs. individual company or state requests
- Streamlined process for state waiver requests that received a federal waiver
- Contingent regulatory relief before event; Proactive vs. reactive
- Jointly coordinated federal, multi-state regulatory relief steps
 - DOE planning regional workshops
 - Can ESF-12 endorsement support confirmation of due diligence for federal waivers
- Clear process for industry when identifying a new waiver need

- Process for proactively authorizing waiver extensions
- Coordination with DHS to streamline restoration support
 - Cross border support from Canada: access/credentialing requirements for each state

Resources for Further Information:

Federal

- DOT comprehensive waiver list – Jeremy Greenberg, DOT
- EPA website, waiver information
- USCG alternatives and waivers (examples) – Drew Tucci, USCG
- FEMA Resource Allocation Workshops (RAW) – Jim Kish, FEMA
- Statutes governing EPA waivers – Jacqueline Werner, EPA
- DOE Energy Assurance Plans, potential regional workshops – Alice Lippert, DOE

State

- NJ matrix for waiver contacts (in development) – Cherrie Black, NJ Homeland Security
- Louisiana general permit vs. waiver process – Richard Metcalf, Louisiana Mid-Continent Oil and Gas Association



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APPENDIX E

THE ADMINISTRATOR

The Honorable Bill Haslam
Governor
State of Tennessee
Tennessee State Capitol
Nashville, Tennessee 37243

Re: Fuel Waiver Concerning Shelby County, Tennessee

Dear Governor Haslam:

This letter is in response to your June 5, 2014, request that the United States Environmental Protection Agency waive the federal gasoline low volatility requirements under the Clean Air Act for Shelby County, Tennessee, due to a disruption in the supply of fuel caused by an unanticipated equipment failure at the Memphis refinery owned and operated by Valero Energy Corporation. The EPA and the United States Department of Energy have been actively monitoring the supply of fuel to Shelby County. In addition, we have been coordinating with Tennessee officials throughout this period. The EPA has determined, and DOE concurs, that it is necessary to take action to minimize or prevent disruption of the fuel supply in Shelby County. By this letter, I am granting a waiver of the federal low volatility gasoline requirements, as provided below.

The regulations promulgated under the CAA require gasoline sold in Shelby County, Tennessee, to have a maximum Reid Vapor Pressure of 7.8 pounds per square inch during the “high ozone” season, which ends September 15, 2014. *See* 40 C.F.R. § 80.27(a)(2)(ii) and the EPA guidance at <http://www.epa.gov/otaq/fuels/gasolinefuels/volatility/standards.htm>. These requirements apply to gasoline distributed and sold in Shelby County between June 1, 2014, and September 15, 2014. The unanticipated equipment failure at Valero’s Memphis refinery has resulted in a significant curtailment of the supply of 7.8 psi RVP gasoline available for distribution in Shelby County because Valero’s Memphis refinery supplies much of the gasoline to Shelby County.

The EPA has concluded, with DOE’s concurrence, that it is necessary to take action to minimize or prevent disruption of an adequate supply of gasoline to Shelby County, Tennessee. I have determined that an “extreme and unusual fuel supply circumstance” exists that will prevent the distribution of an adequate supply of gasoline to consumers in Shelby County. CAA § 211(c)(4)(C)(ii)(I), 42 U.S.C. § 7545(c)(4)(C)(ii)(I). This extreme and unusual fuel circumstance is the result of refinery equipment failure at Valero’s Memphis refinery, an event that could not reasonably be foreseen or prevented, and is not attributable to a lack of prudent planning on the part of suppliers of the fuel to these areas. CAA § 211(c)(4)(C)(ii)(II), 42 U.S.C. § 7545(c)(4)(C)(ii)(II). Further, I have determined that it is in the public interest to grant this waiver and that this waiver applies to the smallest geographic area necessary to address the fuel supply circumstances. CAA § 211(c)(4)(C)(ii)(III) and (iii)(I), 42 U.S.C. § 7545(c)(4)(C)(ii)(III) and (iii)(I).

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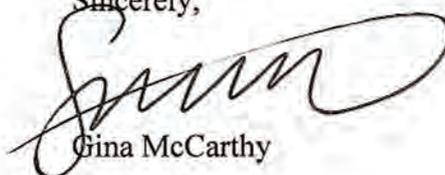
Recycled/Recyclable • Printed with Vegetable Oil Based Inks on Recycled Paper (Minimum 50% Postconsumer content)

Therefore, to minimize or prevent problems with the supply of gasoline, I am today issuing this waiver of the 7.8 psi RVP requirement for gasoline sold in Shelby County, Tennessee. This waiver is effective immediately and will continue through June 26, 2014. Under this temporary waiver, regulated parties may sell or distribute gasoline with a maximum RVP of 9.0 psi (10.0 psi if the gasoline contains between 9% and 10% ethanol) in Shelby County.

Gasoline that does not meet the 7.8 psi RVP requirement of 40 C.F.R. § 80.27(a)(2)(ii) may not be introduced into terminal storage tanks from which gasoline is dispensed into trucks for distribution to retail outlets in Shelby County after June 26, 2014. Any gasoline meeting the 9.0 psi RVP standard that is stored in terminal storage tanks for distribution to retail outlets and wholesale purchaser-consumers in Shelby County on June 26, 2014 may be distributed and sold in Shelby County until the supply is depleted. Likewise, retailers and wholesale purchaser-consumers in Shelby County may continue selling or dispensing 9.0 psi RVP gasoline after June 26, 2014, until their supplies are depleted. This waiver applies only to the applicable federal requirements cited above. Other state or local requirements or restrictions related to this matter may need to be addressed by the appropriate authorities.

The EPA will continue to work with DOE to monitor the impact of the refinery equipment failure on the fuel supply situation in Shelby County. If you have questions you may call me, or your staff may call Phillip A. Brooks at (202) 564-0652.

Sincerely,

A handwritten signature in black ink, appearing to read 'Gina McCarthy', is written over a printed name.

Gina McCarthy

cc: The Honorable Dr. Ernest Moniz
Secretary of Energy

Appendix F

THE DEFENSE PRODUCTION ACT

Set out below are: (1) excerpts from (a) the July 28, 2014, Congressional Research Service Report about the Defense Production Act (DPA), which was recently reauthorized for a period of five years, and (b) the National Infrastructure Advisory Council (NIAC) report, *Framework for Dealing with Disasters and Related Interdependencies: Final Report and Recommendations*, July 14, 2009; (2) a discussion of contract priority and allocation authority delegated to the Departments of Energy and Commerce; and (3) a discussion of some of the issues raised by proposals to employ voluntary agreements and plans of action provided for in the DPA.

EXCERPTS

Congressional Research Service Report

The Defense Production Act of 1950 (P.L. 81-774, 50 U.S.C. App. §2061 et seq.), as amended, confers upon the President a broad set of authorities to influence domestic industry in the interest of national defense. Gradually, Congress has expanded the term “national defense,” as defined in the DPA, so that it now includes activities related to homeland security and domestic emergency management. The current authorities of the DPA include, but are not limited to:

- Title I: Priorities and Allocations, which allows the President to require persons (including businesses and corporations) to prioritize and accept contracts for materials and services as necessary to promote the national defense.
- Title III: Expansion of Productive Capacity and Supply, which allows the President to incentivize the domestic industrial base to expand the

production and supply of critical materials and goods. Authorized incentives include loans, loan guarantees, direct purchases and purchase commitments, and the authority to procure and install equipment in private industrial facilities.

- Title VII: General Provisions, which includes key definitions for the DPA and several distinct authorities, including the authority to establish voluntary agreements with private industry...

National Infrastructure Advisory Council Report

DPA section 708, 50 App. U.S.C. section 2158, affords a defense against a lawsuit or prosecution under federal or state antitrust law, and a breach of contract defense, for actions taken to carry out a “voluntary agreement,” or a “plan of action” formed by the some or all of the private sector participants in the voluntary agreement.

The purpose of a voluntary agreement is “to help provide for the defense of the United States through the development of preparedness programs and the expansion of productive capacity and supply beyond levels needed to meet essential civilian demand in the United States.” The green light for consulting with industry to organize such an agreement is a finding that “conditions exist which may pose a direct threat to the national defense or its preparedness programs.” These requirements need to be understood in light of the DPA’s expansive definition of “national defense” mentioned above. Participants must be “reasonably representative of the appropriate industry or segment of” the concerned industry. A voluntary agreement cannot

become effective unless the Attorney General, after consultation with the Chairman of the Federal Trade Commission, makes a finding that its purpose “may not reasonably be achieved through a voluntary agreement or plan of action having less anticompetitive effects or without any voluntary agreement or plan of action...” Once a voluntary agreement is approved, a plan of action under it can be adopted with less procedural delay than the voluntary agreement itself entails, although the plan of action does require the same finding by the Attorney General as is needed for the voluntary agreement.

Historical Experience...

As originally enacted in 1950, DPA section 708 conferred upon private sector participants complete immunity from, rather than merely a defense to, the antitrust laws for any act or omission to act requested by the President and found by him to be in the public interest as contributing to the national defense. The Attorney General’s approval of the voluntary agreement or plan of action was required, but without a need for any particular finding. There were no other procedural requirements and only minimal monitoring provisions.

Voluntary agreements under the original section 708 were used extensively to enable companies to cooperate in weapons manufacture ... and they were used in other sectors of the economy... Section 708 also served as the basis for several voluntary agreements covering domestic and international petroleum allocation both during and after the Korean War...

In 1975, while the Congress was enacting section 252 of the Energy Policy and Conservation Act of 1975 (EPCA), 42 U.S.C. 6272, according antitrust protection for oil companies that agreed to participate in a voluntary agreement to carry out the oil sharing system of the just-established International Energy Agency (IEA), it amended DPA section 708 to conform it with the new EPCA authority. This introduced numerous changes including those establishing detailed procedural safeguards, requiring heavy monitoring of and reporting on activities by the Justice Department and the Federal Trade Commission, and reducing the antitrust immunity to a defense. EPCA sec-

tion 252 contained a breach of contract defense, and in 1991 Congress added the breach of contract defense to DPA section 708...

Voluntary agreements could in principle be put in place in advance of the occurrence of a disaster, although it might be difficult to know in advance of the disaster what entities ought to be invited to participate. A large universe of participants possibly could be invited with the intention of having plans of action formed by those among them that have a capability to contribute in the response to a particular disaster.

DELEGATED CONTRACT PRIORITY AND ALLOCATION AUTHORITY

The Secretaries of Energy and Commerce have been delegated the President’s authorities under section 101(a) and 101(c) of the DPA, 50 USC 2071(a), (c) to require the priority performance of contracts or orders relating to materials (including energy sources), equipment, or services, including transportation, or to issue allocation orders, as necessary or appropriate for the national defense or to maximize domestic energy supplies. DPA section 101(a) permits the priority performance of contracts or orders necessary or appropriate to promote the national defense. “National defense” is defined in DPA section 702(13) to include “emergency preparedness activities conducted pursuant to title VI of the Robert T. Stafford Disaster Relief and Emergency Act and critical infrastructure protection and assurance.” The Secretary of Energy has been delegated (Executive Order 13603) DPA section 101(a) authority with respect to all forms of energy. The Secretary of Commerce has been delegated (Executive Order 12919) the section 101(a) authority with respect to most materials, equipment, and services relevant to repair of damaged energy facilities. Section 101(c) of DPA authorizes contract priority ratings relating to contracts for materials (including energy sources), equipment, or services to maximize domestic energy supplies, if the Secretaries of Commerce and Energy, exercising their authorities delegated by Executive Order 13603, make certain findings with respect to the need for the material, equipment, or services for the exploration, production, refining, transportation, or conservation of energy supplies.

The DPA's priority contracting and allocation authorities could be used to expedite repairs to damaged energy facilities, and for other purposes, including directing the supply or transportation of petroleum products, to maximize domestic energy supplies, meet defense energy needs, or support emergency preparedness activities. In the case of both the section 101(a) and 101(c) authorities, if there are contracts in place between the entity requiring priority contracting assistance and one or more suppliers of the needed good or service, the Department of Energy (with respect to the section 101(c) authority) or the Department of Commerce (with respect to the section 101(a) authority) would issue an order requiring suppliers to perform under the contract on a priority basis before performing other non-rated commercial contracts. If no contracts are in place, DOE or DOC would issue a directive authorizing an entity requiring the priority contracting assistance to place a rated order with a supplier able to provide the needed materials, equipment or services. That contractor would be required to accept the order and place it ahead of other nonrated commercial orders.

DISCUSSION OF ISSUES RAISED BY VOLUNTARY AGREEMENTS

In its 1991 report, *Industry Assistance to Government*, the NPC concluded (p. 4) that "existing antitrust ... constraints place substantial limitations on the ability of petroleum companies" acting in an advisory capacity "to respond fully to inquiries from the Secretary" of Energy, and that "the creation and function of" of a National Defense Executive Reserve "under existing antitrust ... laws is severely restricted." It recommended (p. 5) that the Secretary seek a prompt resolution by Congress of the relevant legal issues. With specific regard to voluntary agreements, the report noted (p. 13) the pendency of legislation (subsequently enacted) that would provide the Secretary with greater flexibility to seek advice while reducing the antitrust exposure of participating companies; this referred to elimination of the statutory requirement that a voluntary agreement participant's actions be taken in "good faith" (see p. C-14). Nonetheless, the report concluded (p. 13) that "the utility of a voluntary agreement is

limited" because it is possible that the strict rules regarding antitrust monitoring, record-keeping, scope, and duration "would offset the benefits of the broadened protections."

A fundamental problem is that the amendments made to sec. 708 of the DPA by the 1975 legislation, described in the NIAC report quoted above, resulted in substantially reduced antitrust protection for companies participating in voluntary agreements and plans of action. As originally enacted in 1950, sec. 708(b) provided that, "No act or omission to act pursuant to this Act which occurs while this Act is in effect, if requested by the President pursuant to a voluntary agreement or program approved under subsection (a) and found by the President to be in the public interest as contributing to the national defense shall be construed to be within the prohibitions of the antitrust laws or the Federal Trade Commission Act of the United States." The 1975 amendments reduced the DPA's antitrust protection for voluntary agreements from immunity to a defense, and introduced language placing on the participating company the burden of proving the facts that provide the basis for the defense. Sec. 708(j)(4), entitled "Exception for actions taken to violate the antitrust laws," provides that the antitrust defense contained in subsection (j) "shall not be available if the person against whom the defense is asserted shows that the action was taken for the purpose of violating the antitrust laws." No explanation is given of how the "purpose" for which an action was taken is to be ascertained. This vague, subjective test, which is expressed independently of any facts concerning the effects of the action taken, opens even the most scrupulous of companies to a risk of litigation.

This weakening of the DPA's antitrust protection could encourage private plaintiffs or state attorneys-general to pursue baseless but burdensome treble damage antitrust litigation that might be discouraged if statutory immunity were accorded. It is noteworthy that since the 1975 amendments were enacted, the use of voluntary agreements has diminished.

An obstacle to the formation of a petroleum-related or other voluntary agreement is that neither the Department of Energy nor any other

cabinet department has promulgated the rules required by DPA sec. 708(e)(1), “incorporating standards and procedures by which voluntary agreements and plans of action may be developed and carried out.” This is a problem for oil companies that might be invited to participate in a voluntary agreement because, in order to enjoy the benefit of the sec. 708(j) antitrust defense, they carry the burden of proving that the voluntary agreement was initiated and approved, and that any plan of action thereunder was approved “in accordance with this section,” despite the fact that it is the government that is responsible for such initiation and approval. If the sponsoring agency had not promulgated the required implementing rules (which is the current situation with DOE), a plaintiff could challenge the availability of the antitrust defense for actions to develop or carry out a voluntary agreement or a plan of action adopted thereunder on the ground that initiation or approval of the voluntary agreement, or approval of the plan of action, was not “in accordance with” sec. 708. According to the NIAC report cited above, this has been recognized within the Executive Branch as a regulatory deficiency since at least 2004, yet it remains unremedied.

Executive Order 13603, issued March 16, 2012, which delegates sec. 708 authority to agency heads, sought to remedy the deficiency by directing the Secretary of the Department of Homeland Security to promulgate rules pursuant to sec. 708(e), and further providing that other federal agencies such as DOE may adopt them in satisfaction of their own sec. 708(e) rulemaking requirements, but the Secretary of Homeland Security has not promulgated such rules and DOE has not promulgated its required implementation rules.

Moreover, outdated sec. 708 implementing regulations promulgated in 1981 by the Federal Emergency Management Agency, which are not consistent with the requirements of Executive Order 13603, would subject sponsoring department heads such as the Secretary of Energy to the “direction and control” of the FEMA Administrator in their carrying out of voluntary agreement activities. It should be noted that although the recent reauthorization of the Defense Production Act requires agencies to review their implementing regulations for Title I of the Act (priorities and

allocation), it contains no such requirement with respect to their Title VII regulations, including sec. 708.

Finally, even if implementing regulations for sec. 708 were promulgated, the section’s legal, structural, and procedural complexity limit the utility of voluntary agreements and plans of action for emergency response. This is because the highly fragmented nature of the petroleum and natural gas delivery systems makes it highly unlikely that the necessary participants could be assembled and coordinated to meet the desired goal in a timely manner.¹ In the event of a supply disruption, all levels of the supply chain would be affected differently and potentially have different incentives depending on their asset base, contractual positions, and corporate structure. Achieving a consensus among refiners, terminal operators, product traders, transporters, and retailers would be nearly impossible in the desired time horizon. Also, a company may have business concerns about revealing its non-public, proprietary, operating information to competitors who may be in a position to take advantage of that information to the company’s detriment, whether in the immediate crisis or over the long term.

Moreover, a voluntary agreement is not well suited to emergency events because the DPA and its implementing regulations impose cumbersome standards and procedures. Among other requirements, the voluntary agreement must be approved by the sponsoring agency; the participants must participate in public meetings with government officials to formulate the details of the agreement; and the Attorney General, after consultation with the Chairman of the Federal Trade Commission, must find that the purpose of the voluntary agreement could not reasonably be achieved with less anticompetitive methods. Once an agreement is approved, a plan of action under it can be adopted with less procedural delay, although the plan of action requires the same finding by the Attorney General as is needed for the voluntary agreement. Sec. 708(e)(3)(B) requires that a notice of a

¹ This very fragmentation and diversity of transportation options distinguish the downstream petroleum industry from other energy industries. It allows for the flexibility and speed inherent in any market-based supply response, and any interference with such a response would only impose delays, costs, and inefficiencies.

meeting with the participants to form a voluntary agreement be published in the Federal Register at least seven days in advance of the meeting; that requirement makes it impossible to put a voluntary agreement in place immediately upon the occurrence of an emergency.

The participants to the agreement must take steps to comply with numerous legal requirements, which can be burdensome and costly for participants. Failing to comply with any requirements could subject the participants to legal action. Federal antitrust authorities are required to closely monitor voluntary agreements.²

Even assuming that all DPA procedures and standards are satisfied, participating in a voluntary agreement poses substantial legal risks for the participant. As noted above, Congress has provided partial relief from the antitrust laws in sec. 708 of the DPA, but as currently formulated, that section provides only a limited and conditional defense to antitrust claims, which provides relatively little comfort for participants. If a voluntary agreement were challenged in a private lawsuit or enforcement action, for example, the burden would be on the defendant to show that its challenged activity was within the scope of the DPA's requirements. Overcoming such a burden could be onerous and expensive: for example, it might require substantial discovery and motions practice, and, as in any antitrust case, the defen-

dant's chances of success would be difficult to predict and could depend on the tendencies of a specific judge, who may not be familiar with the DPA. Even if the petroleum company prevails, there is no provision for shifting or reimbursement of attorneys' fees. Because the defendant bears the cost and legal burden of showing that the DPA applies—and is subject to treble damages if it loses—there is little disincentive for class action counsel or state or local enforcers to pursue claims that consumers have been harmed by the agreement. Moreover, the DPA does not exempt participants from the burden of Congressional and other government investigations, which impose further costs on the participants.³

It is also important to note that there is a critical distinction between voluntarily undertaking an action without legal cover at the request of the government and being forced by the government to do so. The federal government may have the ability to order a result under its regulatory authority (as the Federal Energy Regulatory Commission recently did with regard to the allocation of pipeline space for propane) or under the DPA's sec. 101 allocation power or pursuant to other authority. Being compelled by the government to act in a particular manner typically provides a company with legal protection from criminal prosecution, massive fines, and commercial lawsuits that it would not otherwise enjoy if it were merely asked or urged by the government to act in this manner. But a government order, while perhaps providing protection for the affected businesses, presents risks for the government, especially where the affected businesses view the action as an unnecessary interference.

² The only current use of the voluntary agreements provision of the DPA is the Voluntary Intermodal Sealift Agreement (VISA). Under VISA, U.S.-flag operators of certain vessels have separately agreed with the U.S. Department of Defense to provide commercial sealift and shipping services to meet government-directed national defense contingency requirements or national emergencies, and each receives ongoing benefits from the government commensurate with the scope of its capacity pledge. See Voluntary Intermodal Sealift Agreement, 75 Fed. Reg. 14245 (March 24, 2010).

³ There is at least one reported incidence of a DPA-approved participant still being investigated by Congress.

Appendix G

HYDROCARBON LIQUIDS SUPPLY CHAIN

OVERVIEW

The supply chains for gasoline, diesel, and other hydrocarbon liquid fuels are complex yet resilient and robust systems. The system continually reacts and adjusts to market changes, supply changes, and system stresses. These market responses result in a consistent, efficient, and robust supply of fuels to customers across the country.

The supply chains of hydrocarbon liquid fuels, including gasoline and diesel, can be broadly divided into distinct phases: exploration and production (E&P), transport to refineries, refining, transport from refineries, and marketing. Companies in the industry operate in one or more phases of this supply chain. Within the business, E&P and the transportation of oil from wells to refineries are referred to as “upstream” operations, while phases of the supply chain from operations at the refineries to retail sale is referred to as the “downstream.”

This appendix provides an overview of normal steady state operations of the hydrocarbon liquids supply chain. Additionally, the types of impacts to the supply chain and infrastructure that can be anticipated under disrupted conditions, including natural disasters, are discussed. Strategies that are typically employed to overcome stresses and disruptions to the supply chain are also described.

HYDROCARBON LIQUIDS SUPPLY CHAIN

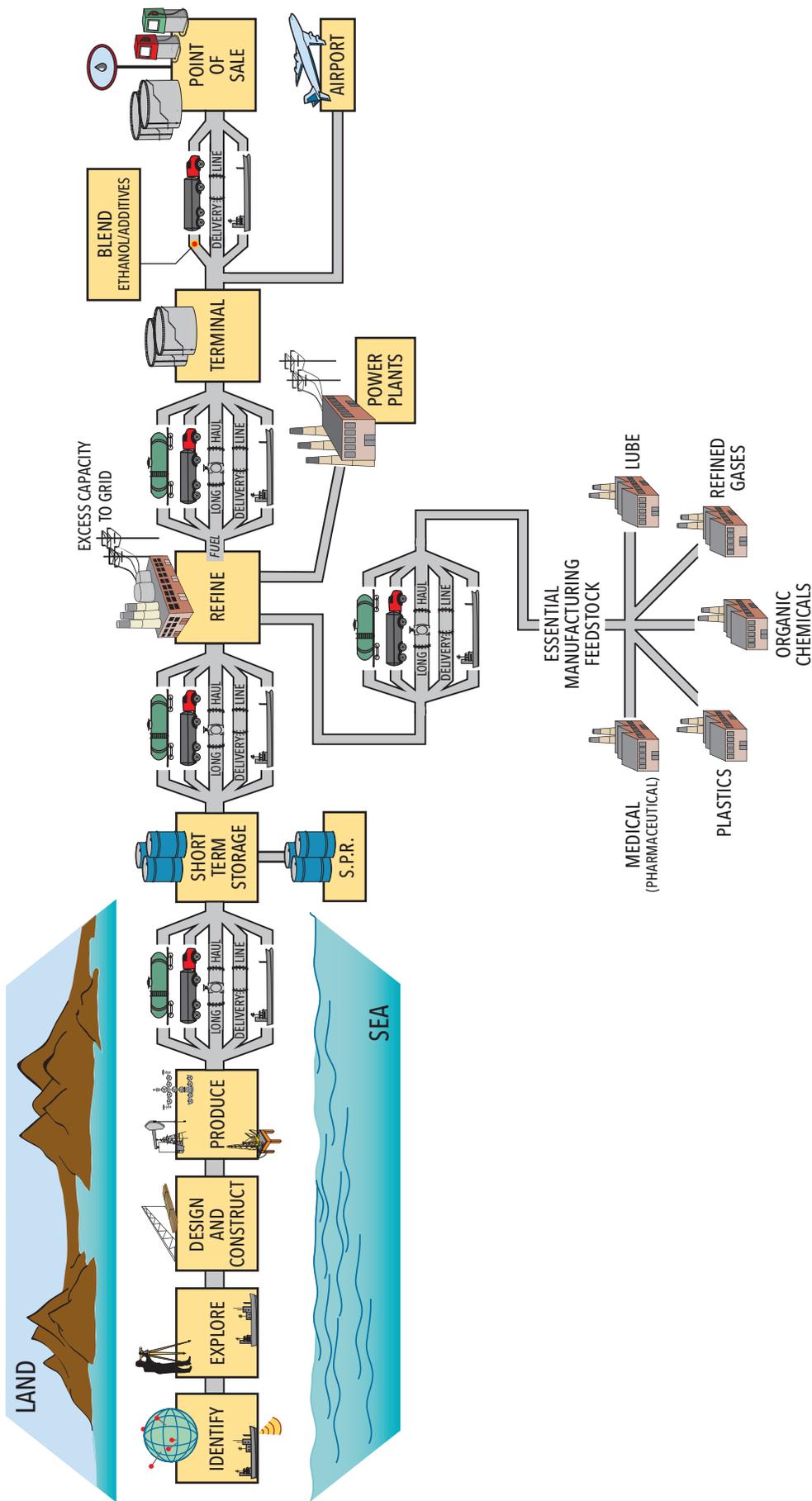
The U.S. supply chain for hydrocarbon liquids involves an extensive and complex network

of producers, shippers, pipelines, suppliers, distributors, retailers, and others across the country and around the world. The United States’ comprehensive supply chain for the production, transportation, and processing of crude oil and distribution of refined petroleum products is generally illustrated in Figure G-1. This complex supply chain meets the U.S. transportation fuel demand of approximately 14 million barrels per day (MMB/D) consistently and efficiently. The system operates 24 hours a day, 7 days a week, 365 days a year, continuously delivering fuels to consumers.

A key trait of the supply chain has been its adaptability over time as demand evolves. The oil supply chain supplies fuel to every corner of the country. Approximately 168,000 miles of pipeline combine to deliver crude oil from producing fields and import hubs to refineries, and to move products from refineries to distribution terminals. The nation’s railroads are increasingly an essential means to bring domestic crude oil into the system. This infrastructure combined with U.S. distribution channels that include trucking, rail, and shipping links to an even larger global supply chain make up an efficient and diverse worldwide distribution model. These complex and integrated regional, national, and global systems enable hydrocarbon liquids to travel regionally or globally in response to market forces, stresses, and occasional supply disruptions that result from causes ranging from planned refinery maintenance outages to natural disasters or other unplanned events.

Hydrocarbon Liquids Production

Hydrocarbon liquids feedstocks for domestic gasoline and diesel fuels are sourced both



Source: American Petroleum Institute, *Oil and Natural Gas Industry Preparedness Handbook*, October 2013.

Figure G-1. Hydrocarbon Liquids Supply Chain
 (Source: American Petroleum Institute, *Oil and Natural Gas Industry Preparedness Handbook*, October 2013. <http://www.api.org/~/media/Files/Policy/Safety/ONG-Industry-Preparedness-Handbook-v2.pdf>)

domestically and internationally. Recently there has been an upturn in U.S. oil production, reversing a long declining trend. This is specifically due to a dramatic rise in unconventional production.

Domestic Oil Production

Conventional oil is produced as a liquid from wells drilled into underground reservoirs. Natural gas liquids (NGLs) are another source of liquid oil that is a valuable by-product of natural gas production and is addressed in detail later in this chapter. Both conventional oil and NGLs can be used to produce transportation fuels. Advanced technologies enable identification and economic recovery of new resources of conventional oil, such as the development of ultra-deep and shale reservoirs, as well as previously inaccessible offshore resources. Additionally, deepwater production has grown significantly in the last few decades through an expanding array of advanced engineering structures such as tension-leg platforms, spars, floating production systems, and subsea producing systems. The assessment of global oil production in the 2011 NPC *Prudent Development* study updates prior work done by the Council in the 2007 *Hard Truths* study. Both remain relevant today and the reader is referred to these studies for further information on supply and demand issues.

Unconventional oils are petroleum liquids in accumulations that were not historically available to the supply chain due to technological restrictions or economic infeasibility. Development of new unconventional oil plays is having a large impact on the U.S. supply chain and an increased role in North American oil production. Unconventional resources currently being harvested are most heavily concentrated in North and South America. These include Canadian heavy oil, Canadian and U.S. oil sands, U.S. tight oil and oil shale, and the Venezuela Orinoco Heavy Oil Belt. The reader is referred to the 2011 NPC *Prudent Development* report for a more complete analysis on unconventional hydrocarbon supply and demand.

Market Dynamics of Crude Oil

While much oil is produced domestically, the United States still imports significant quanti-

ties of crude oil and blendstocks to make finished fuels. Like all other traded commodities, crude oil responds quickly to global supply and demand. Hydrocarbon liquids markets are fundamentally global and well established.

Large global markets and the fungible nature of crude oil and hydrocarbon products allows for rapid and relatively low-cost responses to changes in market demand. A diverse supply promotes price competition, and using the lowest cost/most efficient supplies first provides economic advantage to the world economy.

In recent years, the U.S. trend of increasing oil demand and decreasing oil production has reversed.¹ The sources of crude oil used in the United States are geographically diverse, with the predominant sources being domestic production, imports from Canada and Mexico, supplemented by Saudi Arabia, Iraq, Nigeria, and other sources.² The role of Canada has been steadily increasing and is now the largest source of imported oil to the United States. This trend is forecast to continue as production from Canadian oil sands increases.

Fungibility is the property of a good or a commodity capable of mutual substitution.

Crude Oil Transportation to Refineries

Crude oil is transported to refineries in several ways. Much of the crude oil is transported by pipeline, but increasingly it is transported by rail. The significant growth in rail transport is due to increased North American crude oil production and absence of pipeline capacity.³ Crude oil can also be transported by barge and ship to refineries. In some cases, crude oil is transported

1 U.S. Energy Information Administration, "Lower demand, higher supply drive oil prices to lowest level since 2012," *Today in Energy*, October 8, 2014. <http://www.eia.gov/todayinenergy/detail.cfm?id=18311>

2 Congressional Research Service, "The U.S. Oil Refining Industry: Background in Changing Markets and Fuel Policies," November 2010.

3 Association of American Railroads, "Moving Crude Oil by Rail," September 2014.

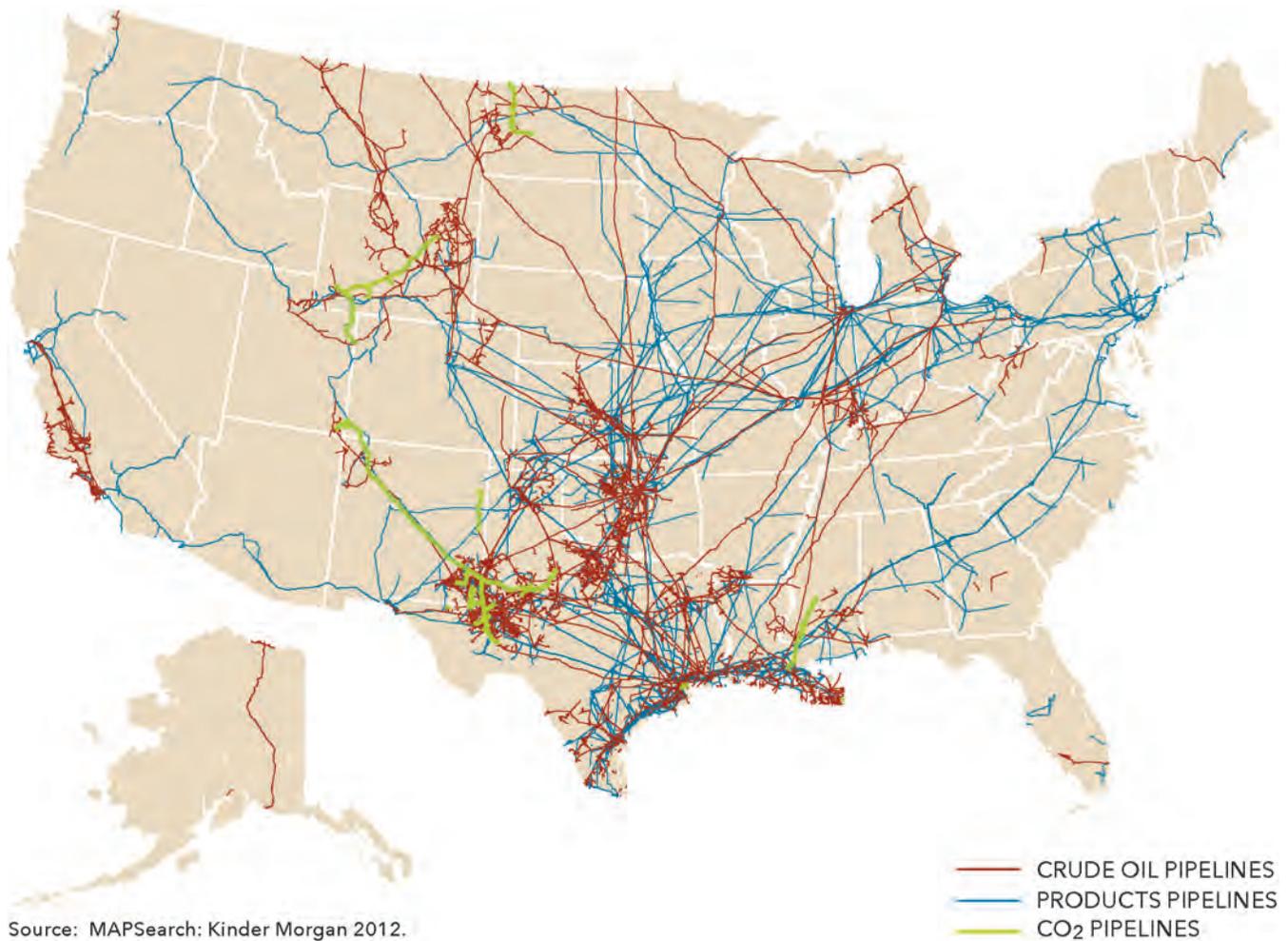


Figure G-2. U.S. Pipeline System

via a combination of these modes. For example, crude oil may be transported to the Gulf of Mexico by ship where it is offloaded at the Louisiana Offshore Oil Platform (LOOP). From there, the oil is shipped by pipeline to onshore refineries. Some of this crude oil may be utilized far inland at Midwestern refineries. This is one of the reasons why hurricanes in the Gulf of Mexico can temporarily affect production of gasoline, diesel, and other fuels at distant refineries in the Midwest. Figure G-2 shows the U.S. pipeline system, including crude oil pipelines.

Refining

Oil is delivered to refineries where it is distilled and processed into gasoline, diesel, and other products. U.S. refineries are some of the most highly complex in the world. They produce high-

quality transportation fuels and are undergoing continual upgrades to improve efficiency, product quality, and feedstock utilization. By law, liquid hydrocarbon fuels must be produced to specifications compatible with specific types of combustion systems and regional specifications that address environmental concerns. The manufacture of fuel products at very large scale and to molecular level specifications makes refining an exceptionally complex industry employing a wide range of technologies.

In addition to transportation fuels, the refining sector provides a number of products that play an essential role in the economy:

- **Petrochemicals.** The refining sector is closely integrated with petrochemicals. The exchange of feedstocks and products between refineries

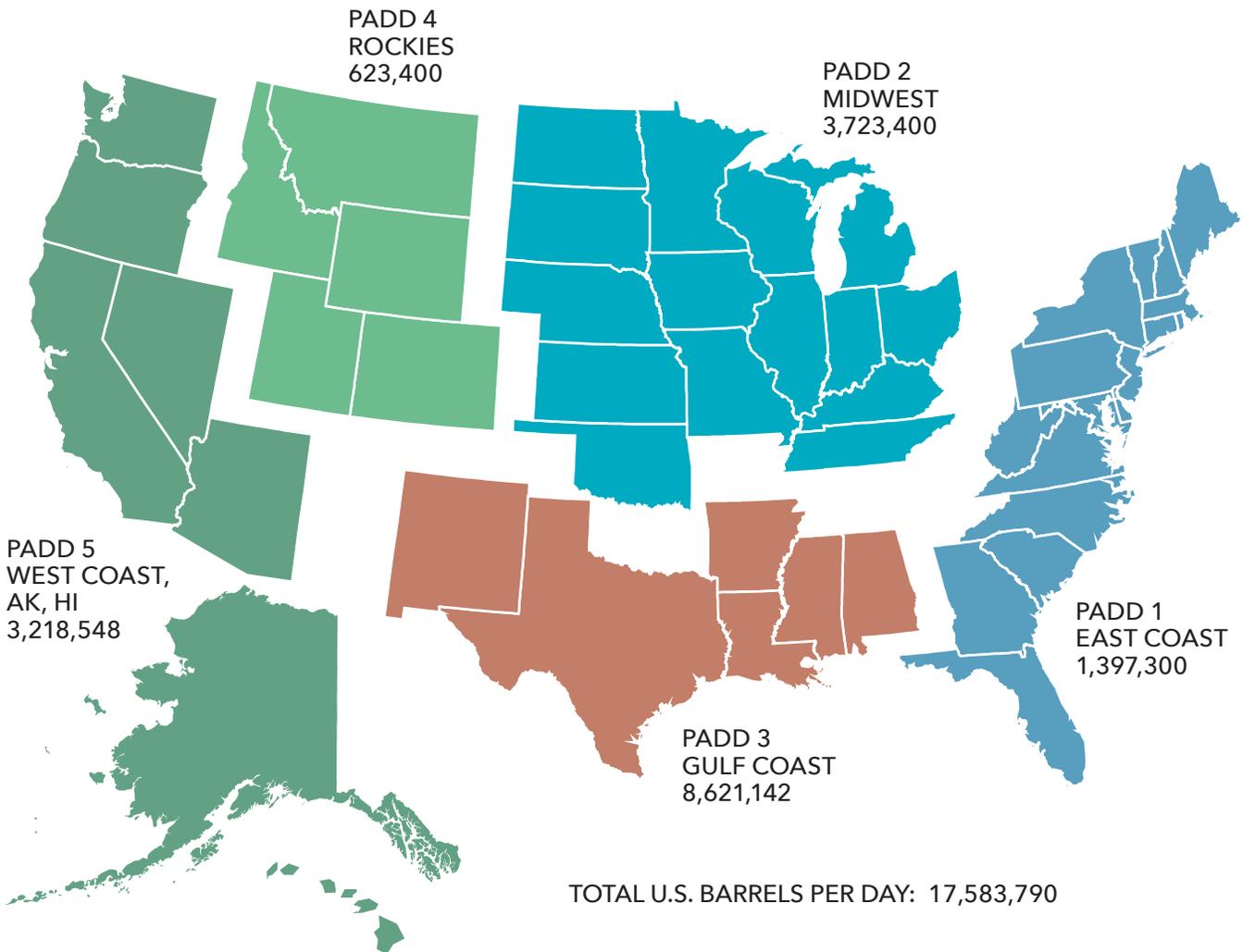
and petrochemical plants improves competitiveness and is often seen in the formation of industrial clusters such as the U.S. Gulf Coast. End products from the petrochemical industry include fertilizers and plastics.

- Industrial Materials.** The refining industry also supplies critical raw materials to other industrial supply chains: asphalt for road construction and roofing, lubricants for use in transportation and industry, high-quality petroleum coke for use in the metals industry, waxes, solvents, and other products. Many of these products are difficult to manufacture and highly specialized.

Geographic Distribution

The majority of U.S. refineries are geographically concentrated in large refining centers within defined regions, called Petroleum Administration for Defense Districts, or PADDs.⁴ Their boundaries and refining capacity are shown in Figure G-3. This information is useful when analyzing and discussing crude oil and petroleum product movements throughout the nation. For example, in

⁴ During World War II, the War Department (now the Department of Defense) delineated Petroleum Administration for Defense Districts (PADDs) to facilitate oil allocation. At one time, refineries in each PADD processed crude oil and distributed petroleum products for use in the district.



Note: During World War II, the then-War Department delineated PADDs to facilitate oil allocation.
 Source: U.S. Energy Information Administration, "Number and Capacity of Petroleum Refineries," as of January 1, 2010.

Figure G-3. Fuel Refining Capacity by Petroleum Administration for Defense District (Barrels per Day)

2010 more than half of the total U.S. inter-PADD movements were from PADD 3 (an area with significant refining capacity) to PADD 1 (major population centers).⁵

Capacity and Size Distribution

As of January 1, 2014, the Department of Energy reported U.S. refining capacity of 17.9 MMB/D from a total 142 refineries (see Figure G-4). This reflects a capacity growth of 2 MMB/D, even though the number of refineries has decreased from 205 in 1990 (see Figure G-5). This trend toward fewer, larger refineries continues. The largest 11 refineries make up one-quarter of U.S. capacity. The smallest 71 refineries total approximately one-quarter of U.S. capacity.

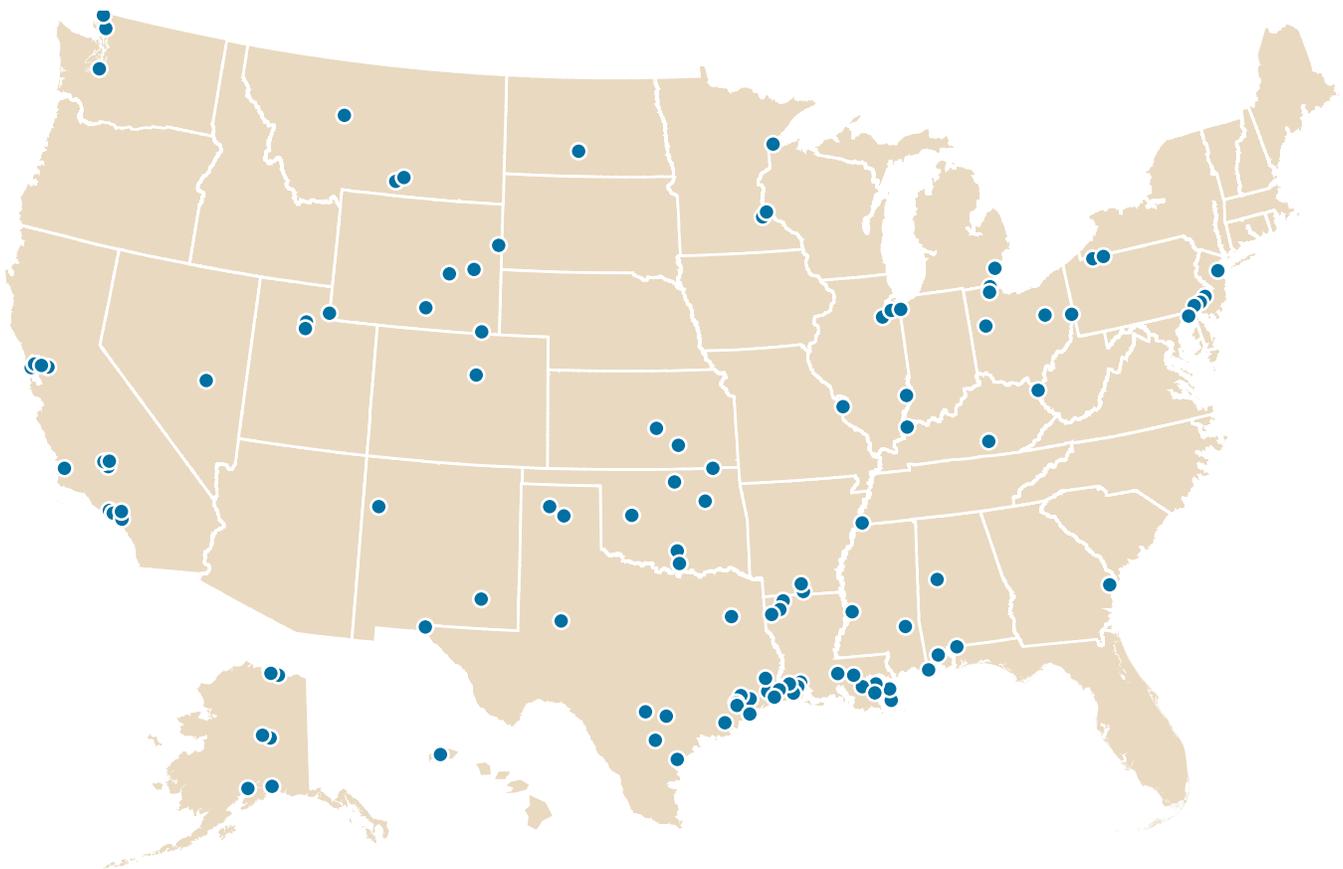
5 U.S. Energy Information Administration, "PADD regions enable regional analysis of petroleum product supply and movements," *Today in Energy*, February 7, 2012.

Distribution Infrastructure

After oil is processed at the refineries and converted into gasoline, diesel, and other products, the fuels are distributed to consumers. The distribution system has a backbone of large, high-volume pipelines, supplemented by water carriers and rail, which deliver hydrocarbon liquid fuels from the refineries to distribution terminals. The final part of the journey to the consumer is almost exclusively via truck from terminals to retail stations.

Distribution Pipelines

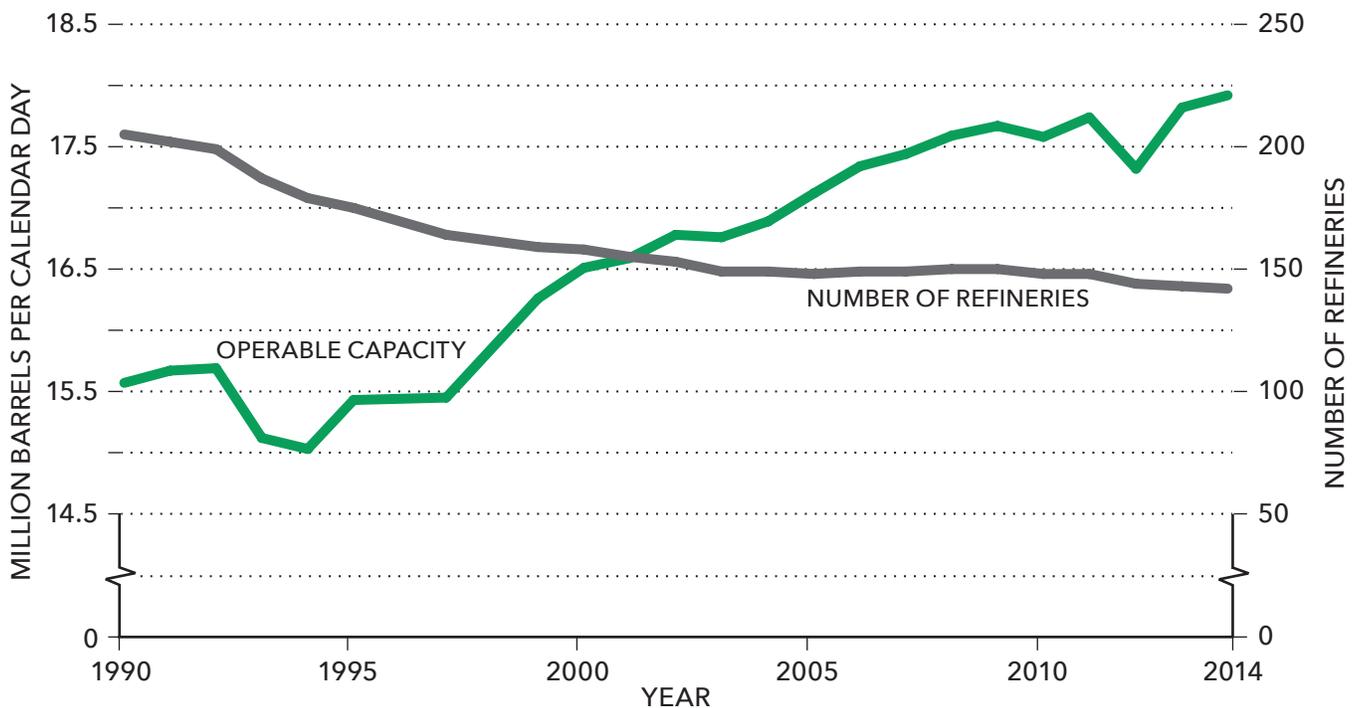
Most of the gasoline and distillate fuels in this country are transported by common carrier pipelines systems as a fungible commodity. Figure G-2, seen earlier in this appendix, shows the major U.S. petroleum products pipelines.



Source: U.S. Energy Information Administration, U.S. Energy Mapping System, 2013.

Figure G-4. U.S. Refineries

(Energy Information Administration, U.S. Energy Mapping System, 2013.
<http://www.eia.gov/state/maps.cfm?v=Energy Infrastructure>)



Source: U.S. Energy Information Administration, "Number and Capacity of Petroleum Refineries," as of January 1, 2014.

Figure G-5. Capacity at Existing U.S. Refineries

(Source: U.S. Energy Information Administration, "Number and Capacity of Petroleum Refineries," as of January 1, 2014. <http://www.eia.gov/todayinenergy/detail.cfm?id=12111>)

Pipeline operators determine the appropriate specifications for various types of fuels to be distributed in a market area, consistent with regulatory requirements. Refiners deliver fuels that meet the specifications of the pipeline company. The pipeline company then aggregates the products produced from multiple refiners into a batch that is then moved through the pipeline in sequence with other product batches and delivered to the distribution terminals, which are located near the market that requires the fuel. For example, the gasoline and distillate fuels that supply the Washington, D.C., area are mostly produced in Texas and Louisiana and transported by two pipeline companies to distribution terminals located in the Washington, D.C., metro area.

Over time, the transportation of petroleum products has become more complex. **For pipeline operators, the proliferation of regional product grades for gasoline and diesel, predominantly as a result of regional environmental regulatory requirements, are a complicating factor that required expanding the number**

of managed batches of various products sent through a single pipeline. Various regulations affect the number of types of fuels that must be batched in the pipeline system, and affect the number of different types of fuel that must be stored at a terminal. A terminal will operate separate tanks for each type of fuel it supplies. The number of different fuel specifications needed to meet regulatory requirements creates additional complexity for pipeline operators, product manufacturers, and product distributors in managing product quality and integrity (Figure G-6).

Further complicating matters, seasonal environmental vapor pressure restrictions force facilities to lower their inventories to minimum levels in order to replenish with gasoline meeting the new requirements. This unavoidable annual regulatory supply constraint occurs around September of each year, coincident with the peak of hurricane season. These regional and seasonal complexities can impede the supply chain's natural ability to quickly respond to unplanned disruptions.

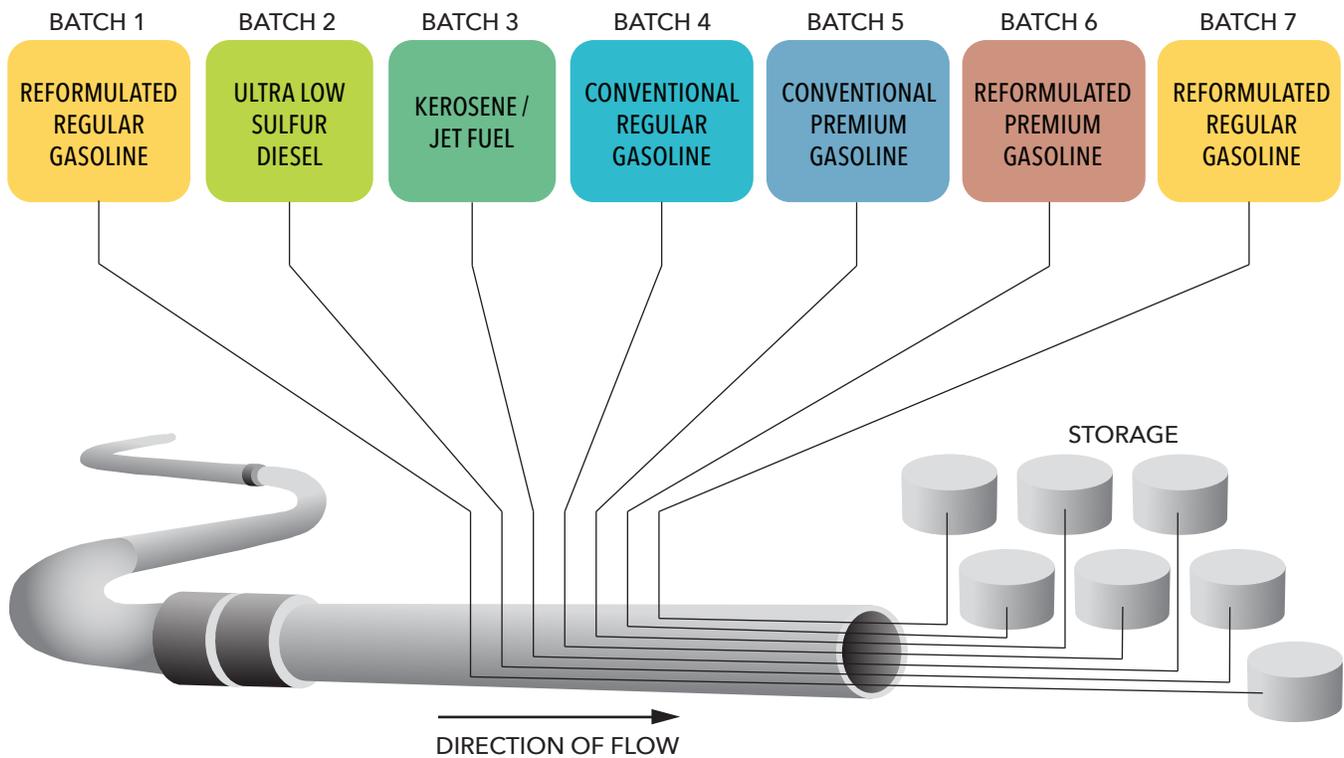


Figure G-6. Typical Refined Products Pipeline Batch Sequencing

The interface between product batches contains a narrow phase of comingled product. Depending on the specifications of adjacent batches, it may be possible to market the comingled interface material as downgraded, lower quality material (such as premium gasoline into regular gasoline). However, downgrading the comingled products between batches is not always feasible. In those situations, it becomes necessary to segregate the comingled product (called transmix) and arrange for it to be sent to a reprocessing facility. These processing facilities are located throughout the country. Transmix is typically not returned to refineries.

Pipelines are able to continuously move large volumes of crude oil and refined products over great distances. Because pipelines are the most efficient and cost-effective mode of transportation, they are the primary source for transportation in this industry. Pipelines accounted for 71% of all petroleum transportation in 2008, up from approximately 54% in 1990.⁶ Water carri-

ers provided the second highest level of ton-miles in 2008, 16% of crude oil, and 27% of petroleum products. The relative shares of refined product movements by mode are shown in Figure G-7. It is important to recognize that the fuels distribution system is a continuous, one-way flow from the wellhead to the refinery and on to retail service stations to consumers.

Terminals

Gasoline, diesel fuel, and other products are transported from refineries by pipeline, rail, ship, barge, or tanker truck, to distribution terminals situated around the country (see Figure G-8). These terminals are large storage facilities primarily along pipeline routes or waterways, and located close to the demand centers where product will be consumed. Terminals play an important role in supplying product to the end-user market by providing the following services:

- Distribution
- Blending to achieve specified grades of gasoline

⁶ Association of Oil Pipe Lines, Shifts in Petroleum Transportation: 1990–2009, 2012.

- Injection of additives and filtering of jet fuel
- Storage and inventory management.⁷

Typically, refined product terminal facilities consist of multiple storage tanks and are equipped with automated truck-loading equipment. This automated system provides for control of security, allocations, and credit and carrier certification by remote input of data. In addition, most terminals are equipped with truck-loading racks capable of providing automated blending to customer specifications. Terminals are equipped with vapor recovery units to meet EPA emissions requirements by capturing emissions during product transfer from water carrier to tank, and from tank to tanker truck.

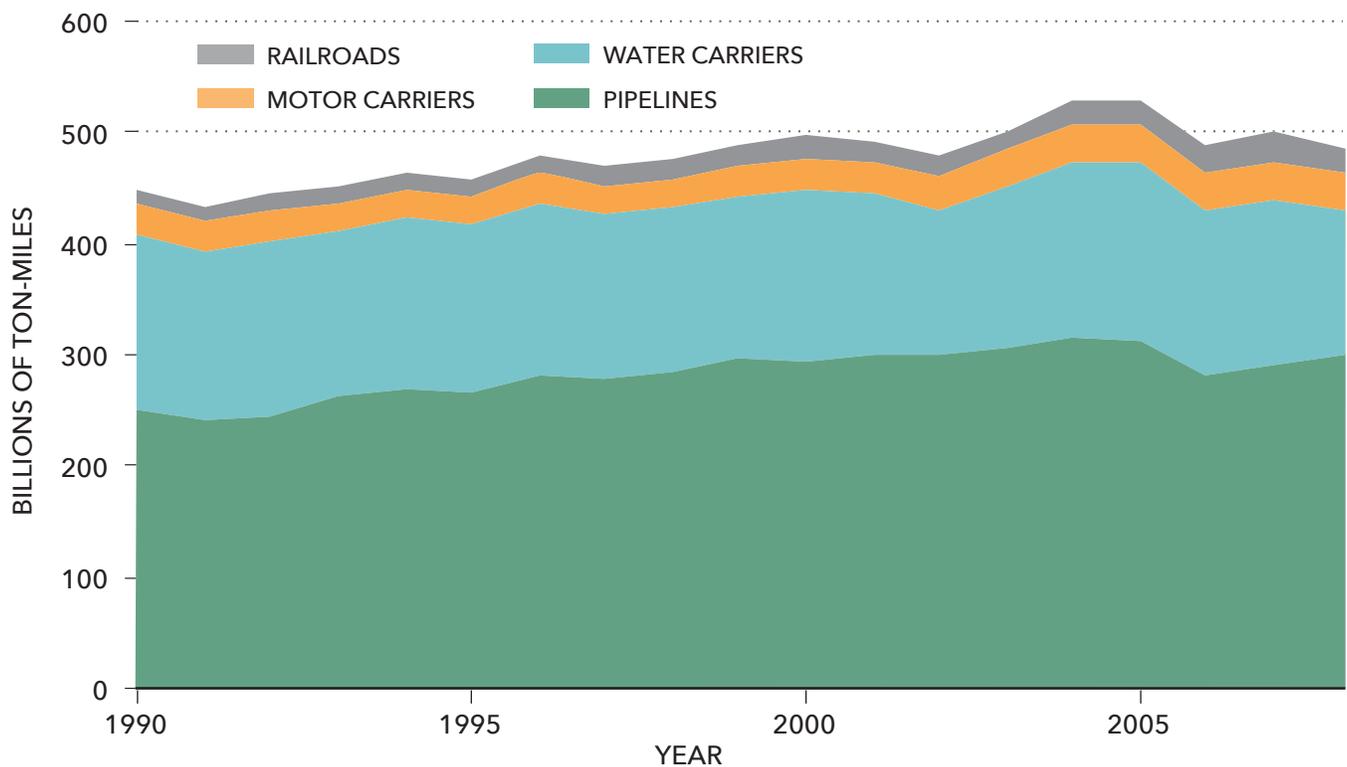
When the fuel arrives by pipeline at the terminal, it is diverted from the main pipeline flow and placed in storage tanks by batches as previously described. Because gasoline is blended with etha-

nol, the gasoline that is stored in terminals is not a finished product. Specifically, it is a sub-octane blendstock (referred to as CBOB or RBOB, referring to conventional blendstock for oxygenate blending and reformulated blendstock for oxygenate blending respectively). It does not become finished gasoline until mixed with ethanol as the fuel enters the truck. Thus, the supply of ethanol to terminals is essential to the supply of gasoline to consumers.

Distribution and Blending of Biofuels

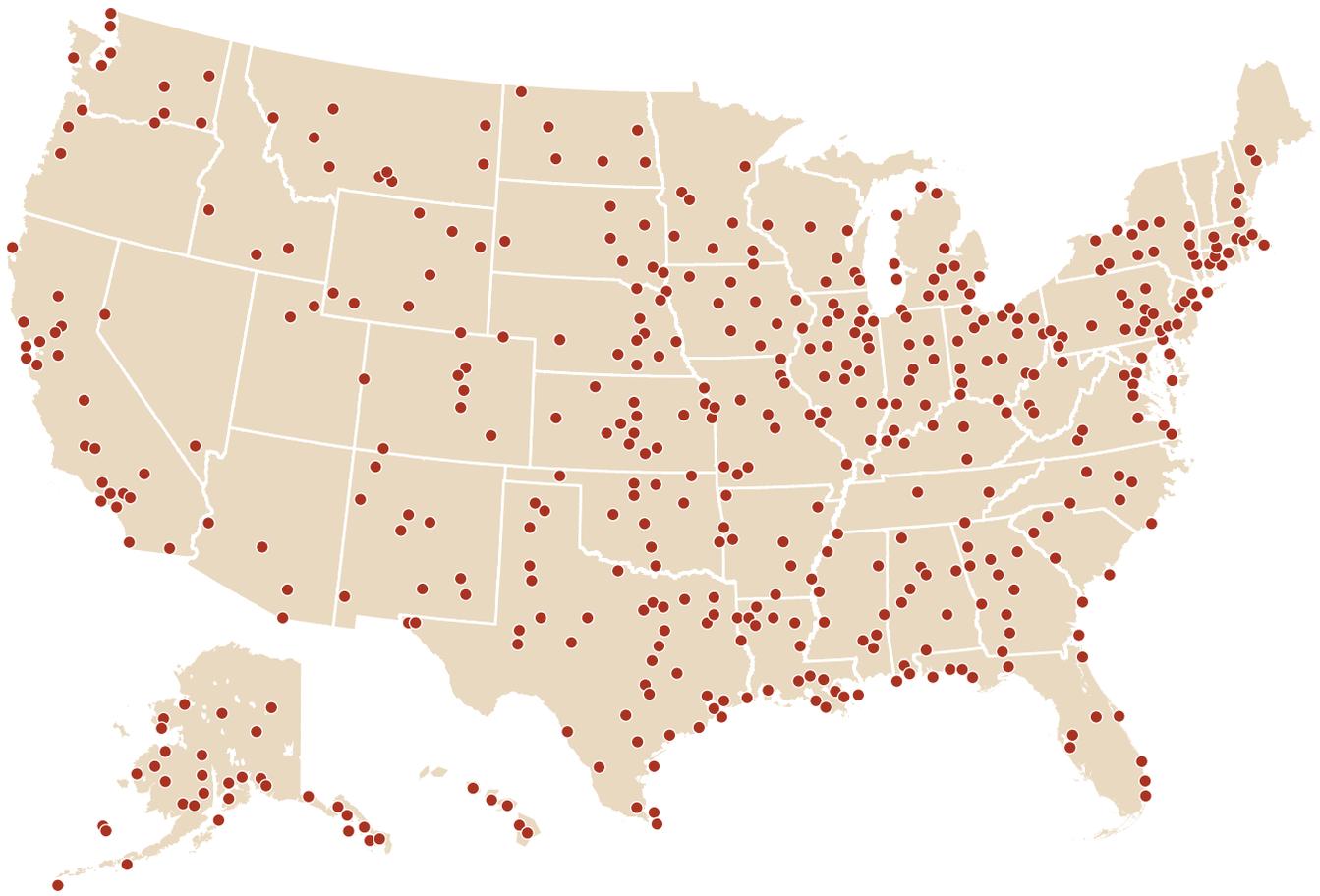
As a result of the Renewable Fuel Standard 2 (RFS2) program, almost all of the gasoline sold at retail contains 10% by volume ethanol. Where diesel contains biodiesel, it typically contains up to 5% by volume. Biofuels are usually transported and stored separately from gasoline and diesel fuels and blended together with gasoline at distribution terminals as it is loaded onto trucks before being transported to distributors and retail stations. This is because ethanol and biodiesel are not compatible with the pipeline

⁷ Holly Energy Partners website, Operations: Terminals, http://www.hollyenergy.com/operations_terminals.cfm.



Source: Association of Oil Pipe Lines.

Figure G-7. Total Petroleum Product Movement



Source: IRS Active Fuel Terminals.

Figure G-8. Major U.S. Product Terminals

systems. Ethanol, for example, has corrosive properties that can result in pipelines becoming more susceptible to internal stress corrosion cracking, which is difficult to detect and manage. Additionally, ethanol is water soluble and can pick up water in the pipeline, causing the blended product to “phase separate” resulting in off-specification product. Ethanol is typically added to gasoline (CBOB or RBOB) and biodiesel is typically added to diesel fuel at the terminals as the fuel is loaded on to the tanker truck that will deliver the fuel to the local retail stations.

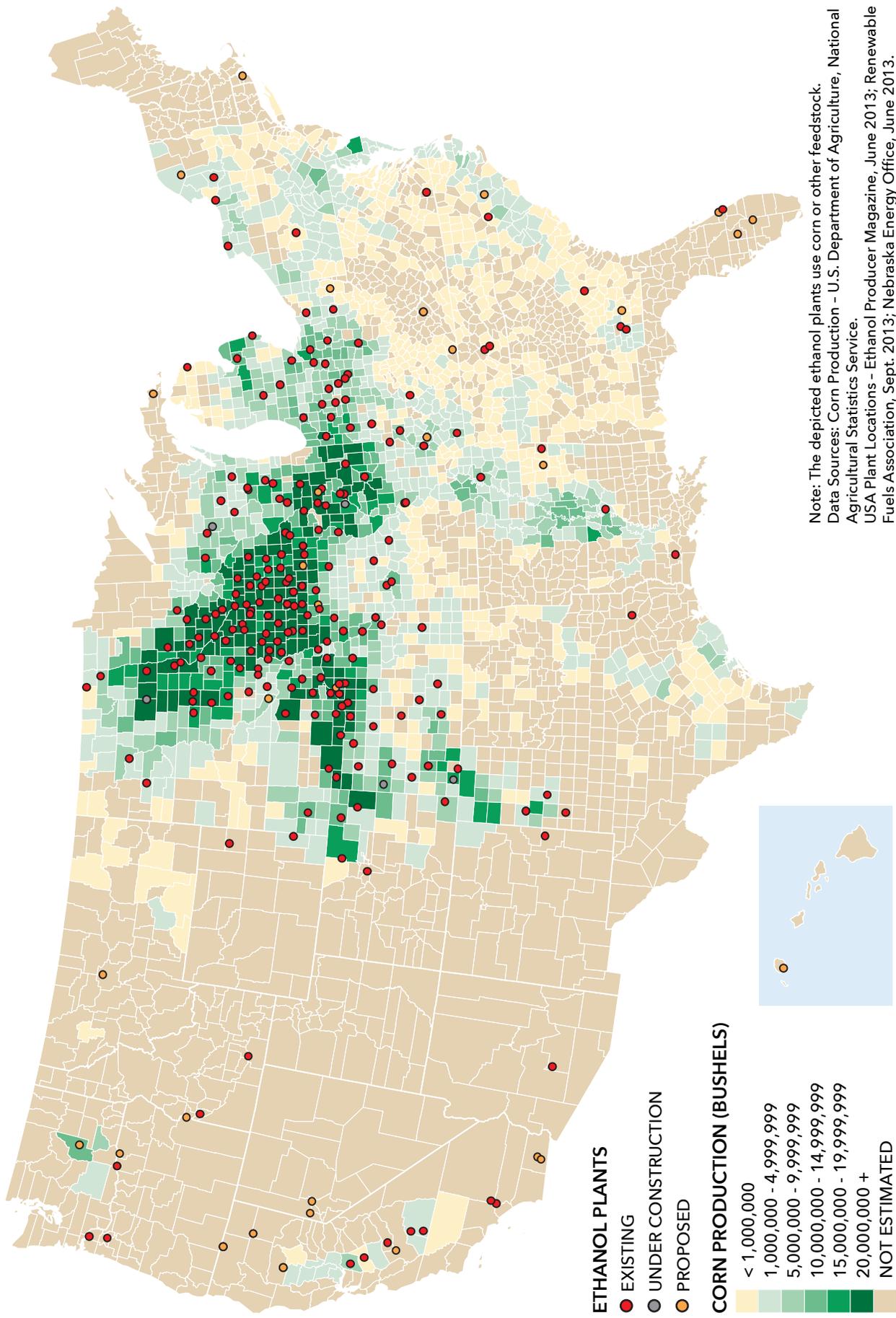
The product flows of biofuels are different from petroleum fuels. For the most part, biofuel production is located near their agricultural feedstocks.

Given that most biofuel in the United States is currently made from corn or soybeans (i.e.,

corn-based ethanol and soy-based biodiesel), the predominant flow of biofuels is from the Midwest outward to other regions. In contrast, the major flow of gasoline and diesel is from the U.S. Gulf Coast to other regions. Figure G-9 is a map showing the ethanol biorefineries in the United States.

Delivering Finished Fuel to Retail Stations

The last link in the distribution system is from the terminal to the retail gasoline station by tanker truck. At the terminal, gasoline blendstock (CBOB or RBOB) is typically blended with ethanol as it is loaded onto the tanker truck. Fuel additives are also blended at this time. From there, the finished gasoline is trucked to the local retail station where it is transferred to underground storage tanks until dispensed to consumers.



Note: The depicted ethanol plants use corn or other feedstock.
 Data Sources: Corn Production - U.S. Department of Agriculture, National Agricultural Statistics Service.
 USA Plant Locations - Ethanol Producer Magazine, June 2013; Renewable Fuels Association, Sept. 2013; Nebraska Energy Office, June 2013.

Figure G-9. Location of Ethanol Biorefineries in the United States as of 2013
 (Source: USDA National Agricultural Statistics Service. http://www.nass.usda.gov/Charts_and_Maps/Ethanol_Plants/U_S_Ethanol_Plants/index)

Product Ownership and the Supply Chain

The fungibility of hydrocarbon products is a primary factor in the efficient operation of the U.S. fuels distribution system. This essential characteristic of fuels in the distribution system allows for more efficient and cost-effective transportation of fuels to market and provides the system with significant flexibility. The majority of liquid hydrocarbon fuels are transported from refineries to terminals in common carrier pipelines. These pipelines have custody of the product in their system, but they do not own (i.e., hold title to) the product. The actual ownership of the product can change hands many times as the product moves through the system. As a result, the common carrier pipeline operator has limited decision-making authority regarding the product. Common carrier pipeline operators, and in many cases terminal operators, work under strict regulatory restrictions regarding the disclosure of customer, volume, and scheduling information to third parties.

At fuel distribution terminals, a company may own and operate a terminal, but it does not necessarily own the product that is stored in its tanks. Thus, as with the common carrier pipelines, the owner/operator of the terminals may not have decision-making authority with regard to the disposition of the products held in its storage tanks. Similar to common carrier pipelines, the terminal operators are not permitted to divulge the identity of the parties that own the product stored at the terminal.

Nationally, 97% of existing gas stations are independently owned. While many of the retail gasoline stations operate under a major brand label (approximately 60%), the major oil companies do not own or manage the product in the retail tanks at these independent retail locations. These independent owner operators are the decision-makers with regard to the disposition of the products in their retail tanks.

The fungible product supply chain brings efficiency, flexibility, and resiliency into the system, enabling fuel suppliers to meet shifting market demand. It is common in the industry for companies to have exchange agreements with other companies whereby one company agrees to sup-

ply a second company in a particular city, while the second company supplies the first company in another city. It is also common for a company with supplies stored at a terminal to engage in the buying or selling of fuel supplies with other companies storing fuel at the terminal. These arrangements are possible because the fuel remains fungible until it crosses a loading rack and is blended with ethanol and the proprietary additives in the tanker truck. This arrangement provides considerable flexibility to adjust supply sources during normal day-to-day operations, and also in the aftermath of natural disaster.

Normal business arrangements may be impacted during a fuel supply emergency. When supplies are short due to a supply disruption, the various parties in the distribution system must first honor their contractual arrangements. This means that parties that do not have contractual relationships may not be able to readily obtain supplies from their typical suppliers. In addition, during supply disruptions, even parties with a contractual relationship could have their supplies curtailed. During supply emergencies, it is typical for various parties along the supply chain to allocate supplies to equitably distribute limited supplies amongst their customers. For example, during a supply emergency, a supplier may set the allocation level at 100%, which means that a customer cannot receive more than the amount they typically received before the emergency. If the situation is more severe, the supplier might, for example set the allocation level at 50%, which means that a customer can only receive half as much supply as they would typically receive before the emergency. Such allocations can be applied at all levels of the distribution system.

The implication of the allocation concept and contractual relationships is particularly important to understand as it relates to wholesale distributors and retail fuel marketers. There are many different business models employed by marketers and distributors. Approximately 97% of retail fuel stations are independently owned and operated. Approximately 60% of those retail stations are branded while the other 40% are unbranded. Unbranded retailers may or may not have binding supply contracts with the wholesale distributors that supply them.

As discussed above, in the event of a supply disruption, supplies are often allocated and parties along the supply chain must first honor their contractual relationships. Regardless of whether a wholesaler or retailer has a supply contract with the party that supplies them, their supplies may be reduced due to allocations, as determined by the terms of their supply contracts. Wholesalers and retailers without supply contracts will likely have their supplies curtailed in such situations. These issues can therefore affect fuel availability at retail locations, and consumers that rely on those retail fuel locations.

The implications of these commercial terms also affect restoration of fuel supply after a supply disruption. For example, even if regulatory relief has been granted and alternative supply modes are being utilized, contractual relationships affect restoration of fuel supplies to retail locations.

Fuel Regulatory Requirements

There are many different regulatory fuel specifications in the United States that dictate the types of products that can be sold in a given area. These numerous resulting regional formulations have also been described as “boutique fuels.” These specifications were established primarily to address environmental concerns. Variations include but are not limited to formulations that lower volatility of fuel to reduce emissions that contribute to ozone pollution. It should be noted that all varieties of gasoline in the United States that are distinguished based on environmental regulations (i.e., reformulated gasoline vs. low volatility gasoline vs. conventional gasoline) are interchangeable with regards to vehicle compatibility. In other words, a regular unleaded conventional gasoline can be substituted for a regular unleaded reformulated gasoline without impacting vehicle performance. Similarly, a premium conventional gasoline can be substituted for a premium reformulated gasoline. The map in Figure G-10 summarizes the various types of gasoline required in the United States by state and federal environmental laws.

Supplying fuels that do not meet the locally required specifications is illegal. Limitations presented by these specifications are challenging

when normal supply sources are disrupted due to a natural disaster. For example, if a hurricane disrupts refineries, pipelines, and terminals, causing insufficient supply of reformulated gasoline on the East Coast, regulations prohibit a supplier from simply delivering conventional gasoline to the area. If conventional gasoline is available at a storage terminal outside the affected area, for example, fuel suppliers may be able to transport that gasoline to supply the affected area. Yet, this will only be allowed if EPA and the affected states issue appropriate temporary regulatory relief to make it legal to do so.

DISRUPTIONS TO THE HYDROCARBON LIQUIDS SUPPLY CHAIN FROM NATURAL DISASTERS

Although the fuels supply chain includes a complex series of production facilities, multiple modes of distribution, and a complex regulatory framework, the overall system operates very efficiently and is typically quite resilient to stresses. When everything is running smoothly, compliant fuel is readily available and is delivered to the consumer in the most efficient way possible. Typically this means gasoline is delivered to the retail station via the shortest route possible from the nearest terminals.

In the event of some type of disruption to a particular transportation mode or at a particular supply point, an alternative source or transportation mode is used to supply fuel. For example, if the rail system were disrupted, interfering with ethanol supplies, suppliers would likely switch to transport ethanol via barges, ships, and trucks. If pipelines were disrupted, suppliers would switch to barges, ships, and trucks to move product. If domestic refineries were disrupted, suppliers would look to inventories or imports to provide the needed volumes of fuels. Many of these types of supply chain adjustments happen frequently in the normal course of business. The ability to draw supplies from a variety of sources throughout the system is a major component of the system’s resiliency.

A major hurricane that makes landfall in Texas or Louisiana could result in a temporary reduction in refining capacity and reduced flows of

product on the Colonial and Plantation pipelines, which supply the majority of the southeast and eastern United States. As a result, suppliers may replace the volumes lost from refinery closures through imports into the New York Harbor, Baltimore, and other ports. Suppliers might also look to alternative modes of transportation, such as barges and ships, to move product due to the pipeline outages. Suppliers would also likely look to send tanker trucks to more distant terminals to obtain gasoline supplies to deliver to local retail stations.

In the event of a hurricane or other natural disaster that impacts available fuel supplies, the industry is likely to need the government's assistance to adjust supply logistics to speed up recovery. If there are readily available alternative supplies of fuels, government waivers of regulatory requirements can be helpful to restore supply to

an affected area. For example, the next best option to supply fuels to the Washington, D.C., area may be with gasoline from alternate terminals that does not comply with the reformulated gasoline specifications. But, it would only be possible to supply such fuel if the government temporarily waives the reformulated gasoline requirements.

Government action for temporary regulatory relief may also be required for other parts of the distribution system to speed up recovery. For example, Jones Act waivers may be needed to transport products by water. Additionally, in the event of a disruption of rail shipments of ethanol, suppliers may be willing to move ethanol by barge to terminals where it is needed, but Clean Air Act permit requirements may need to be temporarily waived for the vapor recovery unit at the loading facility so that it can operate in a non-routine manner.

Appendix H

NATURAL GAS AND NATURAL GAS LIQUIDS SUPPLY CHAINS

OVERVIEW

The supply chain of natural gas from the wellhead to the end user can be broadly divided into four distinct phases: Exploration and Production, Midstream, Transmission, and Distribution. Some companies may elect to only operate within a single phase while others may focus on multiple phases. Some companies may pursue only natural gas opportunities but not crude oil while others specialize in crude oil or both resources. The natural gas liquid (NGL) supply chain begins at exactly the same place as the natural gas supply chain, since NGLs are comingled in the natural gas stream. NGLs and natural gas go through much of the energy supply chain together, but part at the tailgate of the processing plant. After the processing plant, NGLs are transported to a fractionator for further processing into the five discrete products of ethane, propane, normal butane, isobutene, and natural gasoline (also known as pentanes plus).

There is a unique relationship between the natural gas and NGL supply chains since the functions performed at processing plants such as removal of impurities and NGLs is necessary to produce natural gas that meets pipeline and user specifications. This unique relationship, including its economic drivers, will be discussed more fully later in this appendix.

NATURAL GAS SUPPLY CHAIN

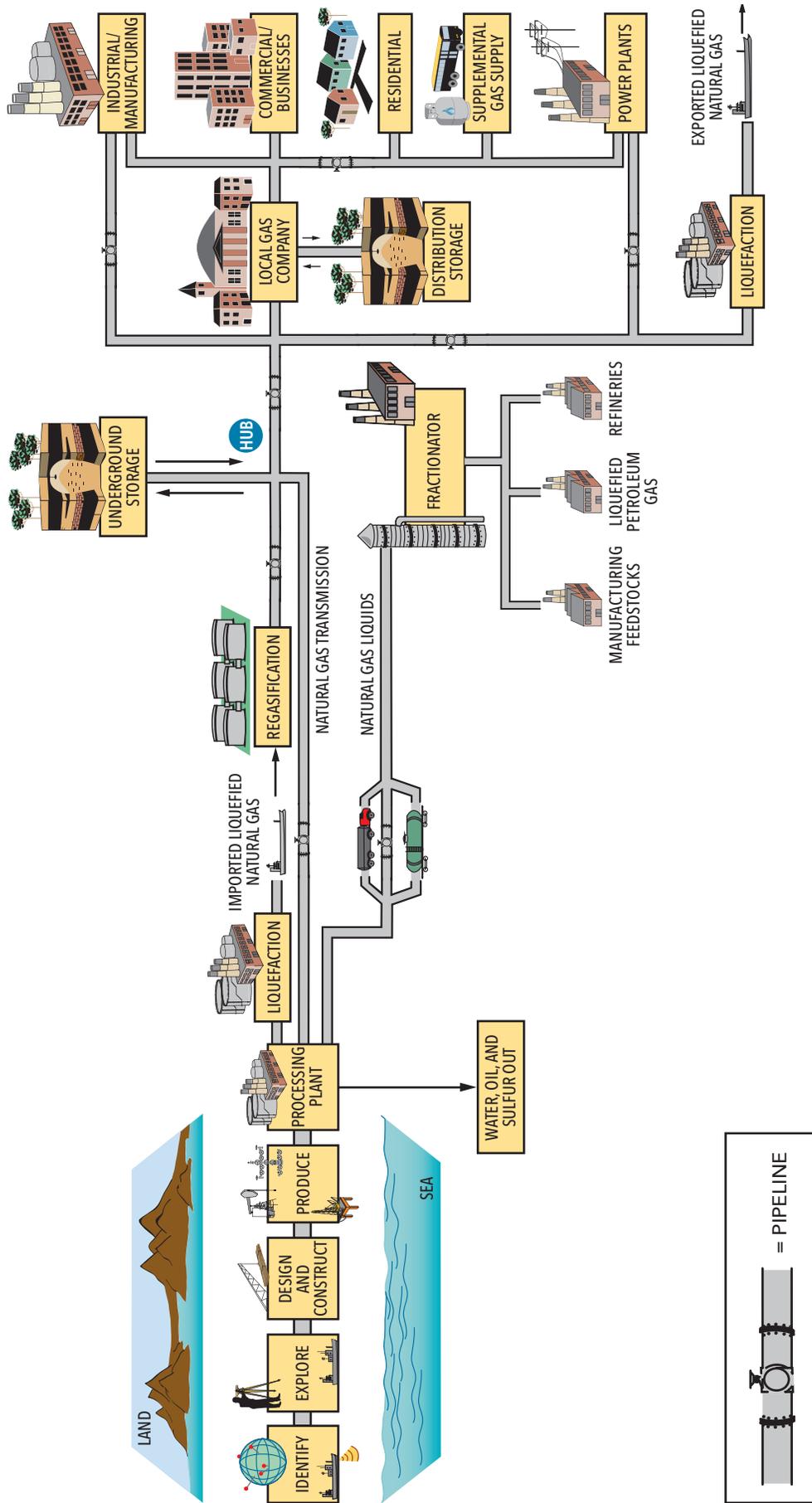
The U.S. supply chain for natural gas involves an extensive and complex network of producers, gatherers, processors, shippers, marketers, transporters, storers, and distributors across the coun-

try. The purpose of this appendix is to explain the natural gas supply chain as distinct from the hydrocarbon liquids supply chain. The operations within each phase of the natural gas supply chain will be discussed separately.

A key trait of the natural gas supply chain has been the technology-driven expansion of onshore production and the ability to respond to demand to expand gathering, processing, and transmission infrastructure. Interstate natural gas pipelines transport gas through 200,000 miles of pipeline in 11 distinct corridors or flow patterns. The overall natural gas supply chain is depicted in Figure H-1. This infrastructure connects with distribution pipelines to serve millions of end-use customers. Supply diversity and transportation optionality enables natural gas to be moved between geographic areas in response to market demand.

Natural Gas Production

The exploration and production phase includes activities related to exploring for and extracting hydrocarbons from below the earth's surface. Impermeable rock layers in the ground trap the hydrocarbons into formations called reservoirs. Natural gas that is trapped in reservoirs holding primarily natural gas alone is called non-associated gas, while natural gas that is in contact with or dissolved in crude oil is labeled associated gas. Associated gas typically has a parallel production flow to capture NGLs. There are many uses for NGLs, such as inputs for petrochemical plants, burned for space heat and cooking, and blended into vehicle fuel. The NGL supply chain is discussed later in this appendix.



Source: American Petroleum Institute, *Oil and Natural Gas Industry Preparedness Handbook*, October 2013.

Figure H-1. Natural Gas and Natural Gas Liquids Supply Chain
 (Source: American Petroleum Institute, *Oil and Natural Gas Industry Preparedness Handbook*, October 2013.
<http://www.api.org/~media/Files/Policy/Safety/ONG-Industry-Preparedness-Handbook-v2.pdf>)

From 2000 to 2008, lower-48 offshore and onshore conventional production of natural gas comprised the great majority of the natural gas produced and consumed in the United States. Since 2008, technological advances in horizontal drilling and hydraulic fracturing have allowed unconventional resources such as shale gas to be economically developed. In 2012, 40% of U.S. production was from shale. The Energy Information Administration (EIA) predicts that shale gas's share of total U.S. natural gas production will rise to 53% in 2040. Shale formations are geographically dispersed across the nation from the Marcellus in the northeast through traditional producing areas in Louisiana, Texas, and Oklahoma, to the Rockies and on to the Monterey on the west coast, as shown in Figure H-2.

Natural gas production is projected to increase significantly, as shown in Figure H-3. Due to the increase in production and demand, the natural gas industry is in a significant expansion of midstream and transportation capacity. To take advantage of the increased availability of this resource, the energy industry must undertake further immense capital projects to increase the system's capacity at every stage of production and transportation. These large projects are necessarily long-term investments that require substantial advanced planning. The energy industry is "characterized by long lead times [usually 1-3 years], huge capital requirements [billions of dollars]" with "very real investment risks [energy policy and tax framework that encourages investment, rather than discourages it]."¹

Natural Gas Midstream

Midstream services are a critical part of the natural gas value chain, connecting the exploration and production of natural gas from the wellhead or lease and the delivery of the gas to end-use markets. Natural gas gathering and processing systems create value by collecting raw natural gas from the wellhead and separating dry gas (primarily methane) from NGLs such as ethane, propane, normal butane, isobutane, and natural gasoline. A significant portion of natural gas produced at

the wellhead contains NGLs. Natural gas produced in association with crude oil typically contains higher concentrations of NGLs than natural gas produced from gas wells. This "wet," unprocessed natural gas is generally not acceptable for transportation in the nation's interstate transmission pipeline system or for commercial use. Processing facilities extract the NGLs, leaving residual dry gas that meets interstate transmission pipeline and commercial quality specifications. Midstream service providers then transport this residual dry gas to end-use markets. Extracted NGLs are sent to fractionators for separation into purity products to become marketable commodities and, on an energy equivalent basis, usually have a greater economic value as feedstock for petrochemicals and petroleum refiners than they would as a component of the natural gas stream.

Figure H-4 illustrates the groups of assets commonly found along the natural gas and NGL value chains.

The range of services offered by natural gas midstream service providers are generally divided into the following categories:

Gathering. At the initial stages of the midstream supply chain, a network of typically small diameter pipelines known as gathering systems directly connect to individual wellheads in the production area. Natural gas gatherers may also install larger diameter pipelines to connection points, referred to as central receipt points, where producers and midstream operators can connect their wells or gathering infrastructure. These systems typically gather raw natural gas to central locations for processing and/or treating. A large gathering system may involve thousands of miles of gathering lines connected to thousands of wells and multiple central receipt points. Gathering systems are often designed to be highly flexible and scalable to allow gathering of natural gas at different pressures, to flow natural gas to multiple plants and to quickly connect new customers allowing for additional production without significant incremental capital expenditures. Midstream service providers generally charge a fixed fee to gather raw natural gas.

Compression. Wells produce at progressively lower field pressures as they deplete, and

¹ Energy Tomorrow, "Capital Spending for U.S. Projects," <http://www.energytomorrow.org/economy/capital-spending-for-us-projects>.

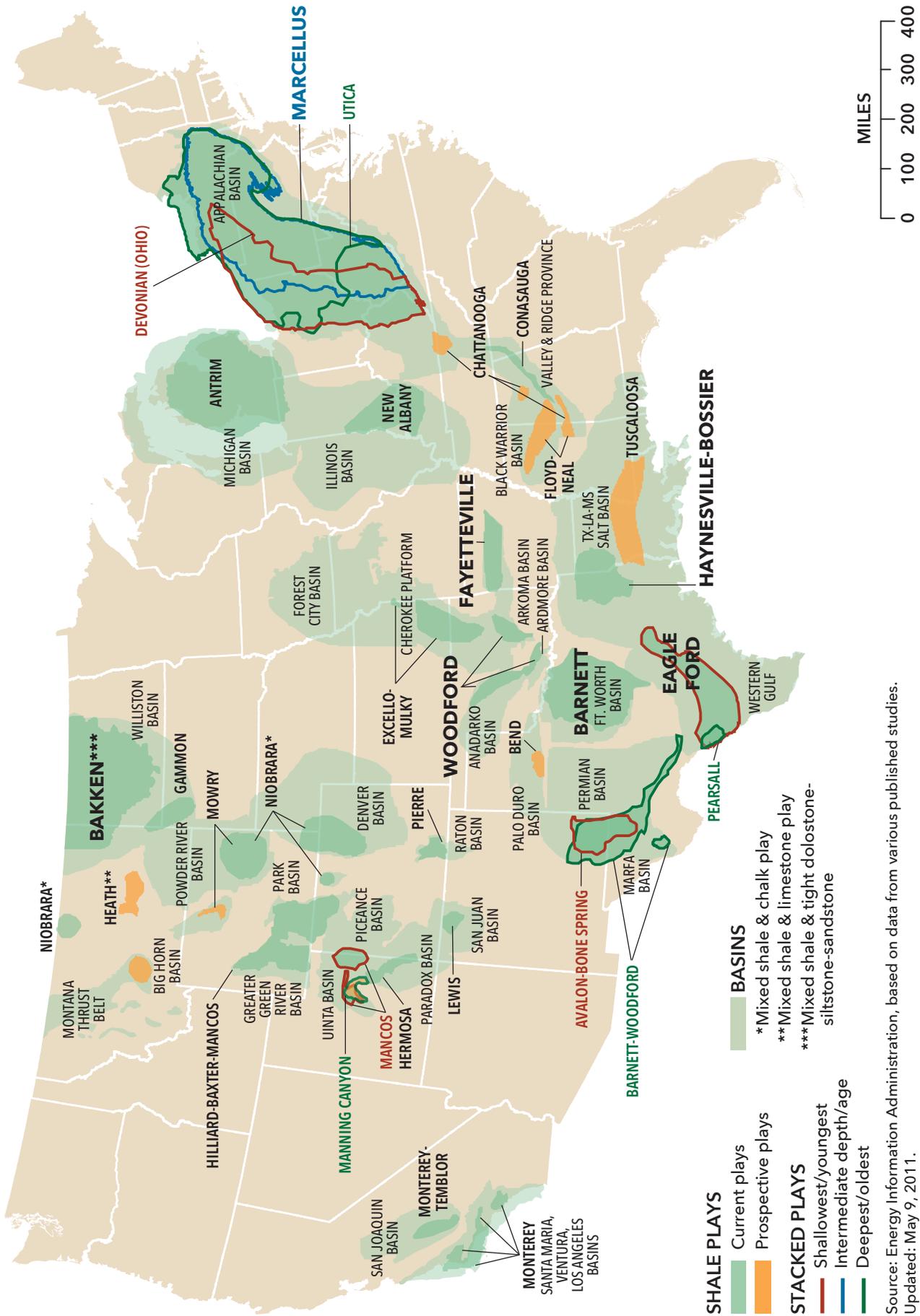
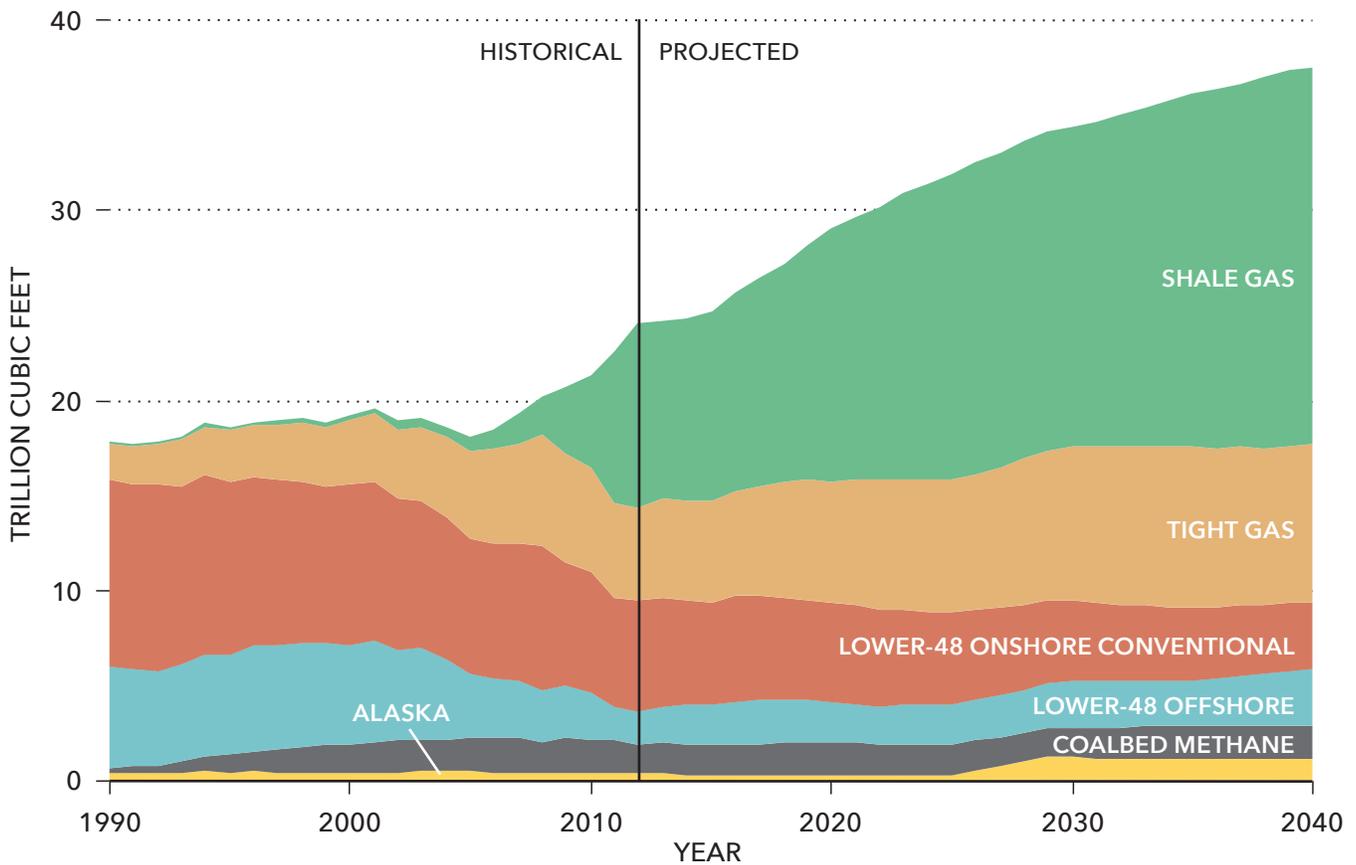


Figure H-2. Lower-48 Shale Plays
 (Source: U.S. Energy Information Administration. http://www.eia.gov/pub/oil/natural_gas/analysis_publications/maps/maps.htm)

Source: Energy Information Administration, based on data from various published studies.
 Updated: May 9, 2011.



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2014*.

Figure H-3. Projected Domestic Natural Gas Production

(Source: U.S. Energy Information Administration. *Annual Energy Outlook 2014: with projections to 2040*. April 2014. <http://www.eia.gov/forecasts/aeo/index.cfm>.)

it becomes increasingly difficult for the remaining reserves at these lower pressures to enter the gathering system against a higher pressure that exists in that system. Natural gas compression is a mechanical process in which a volume of natural gas at a given pressure is compressed to a desired higher pressure, which allows the natural gas to flow into a higher-pressure system. Compression is typically used to allow a gathering system to operate at a lower pressure or provide sufficient discharge pressure from the compressor to deliver natural gas into a higher-pressure pipeline system. If compression is not installed, then the remaining natural gas will not be produced if it cannot overcome the higher gathering system pressure. With compression, however, a well can continue delivering natural gas that otherwise would not be produced. Consequently, gathering systems may operate at lower pressures or

provide tiered compression service. Midstream service providers typically provide compression services in exchange for a fixed fee, a percentage of the applicable commodity, or a combination of the two. Federal, state, and local regulations may compel the installation of electric-driven compression, particularly if the gathering system is located within an area with strict emissions limits.

Treating and Dehydration. Raw natural gas contains various contaminants, such as water vapor, carbon dioxide, and hydrogen sulfide, that can render the gas unacceptable for transmission on intrastate and interstate pipelines. In addition, end users will not purchase natural gas with an unacceptable level of these contaminants. To meet downstream pipeline and end user natural gas quality standards, natural gas is dehydrated

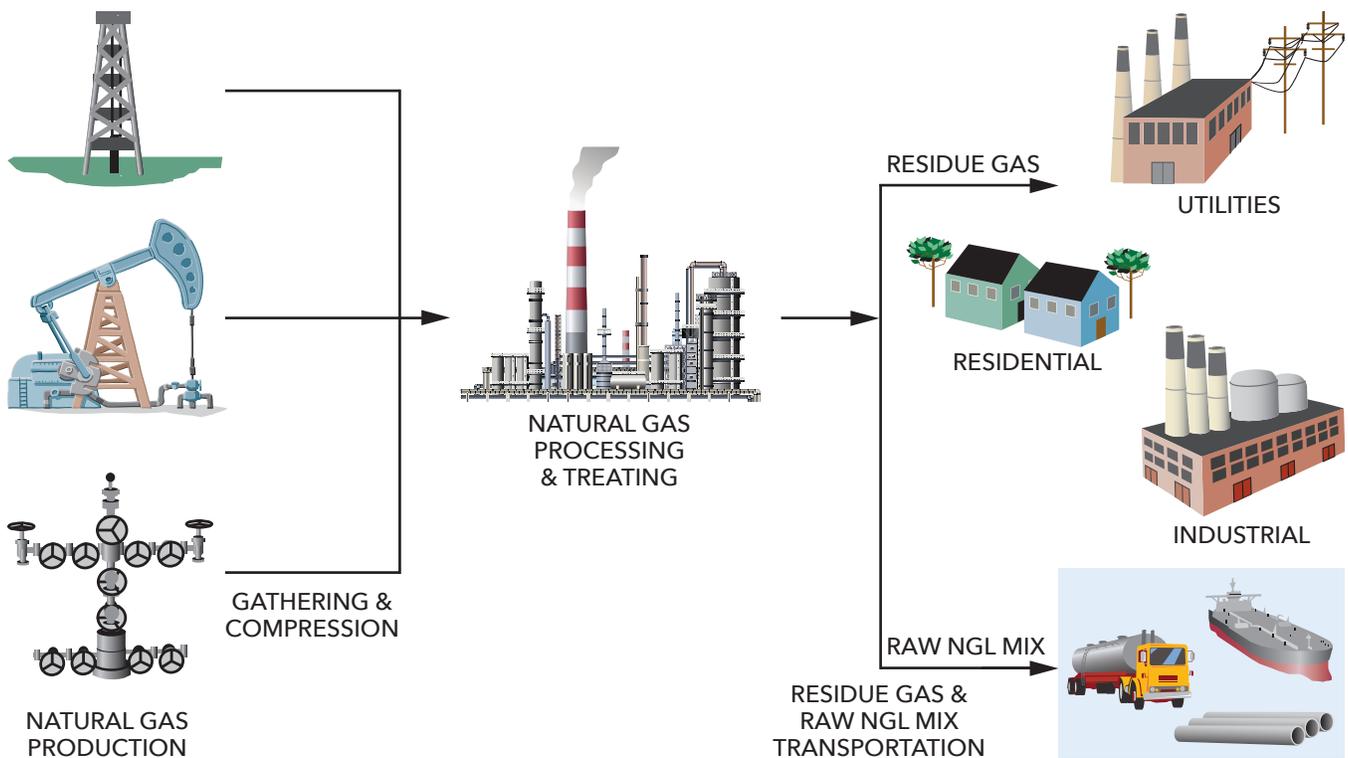


Figure H-4. Natural Gas and NGL Value Chain Asset Groups

to remove water vapor and is chemically treated to separate carbon dioxide and hydrogen sulfide from the gas stream to the extent required. Mid-stream service providers generally charge a fixed fee, and may also retain a percentage of the natural gas for use as fuel in the treating plant, to treat and dehydrate natural gas.

Processing. After the contaminants are removed, the next step involves the extraction of NGLs from the natural gas stream through a procedure known as processing. Most decontaminated natural gas with a significant NGL content is not suitable for long-haul pipeline transportation or commercial use and must be processed to extract the heavier hydrocarbon components in order to meet pipeline specifications. This process will be discussed more fully in the Natural Gas Liquids Supply Chain section later in this appendix.

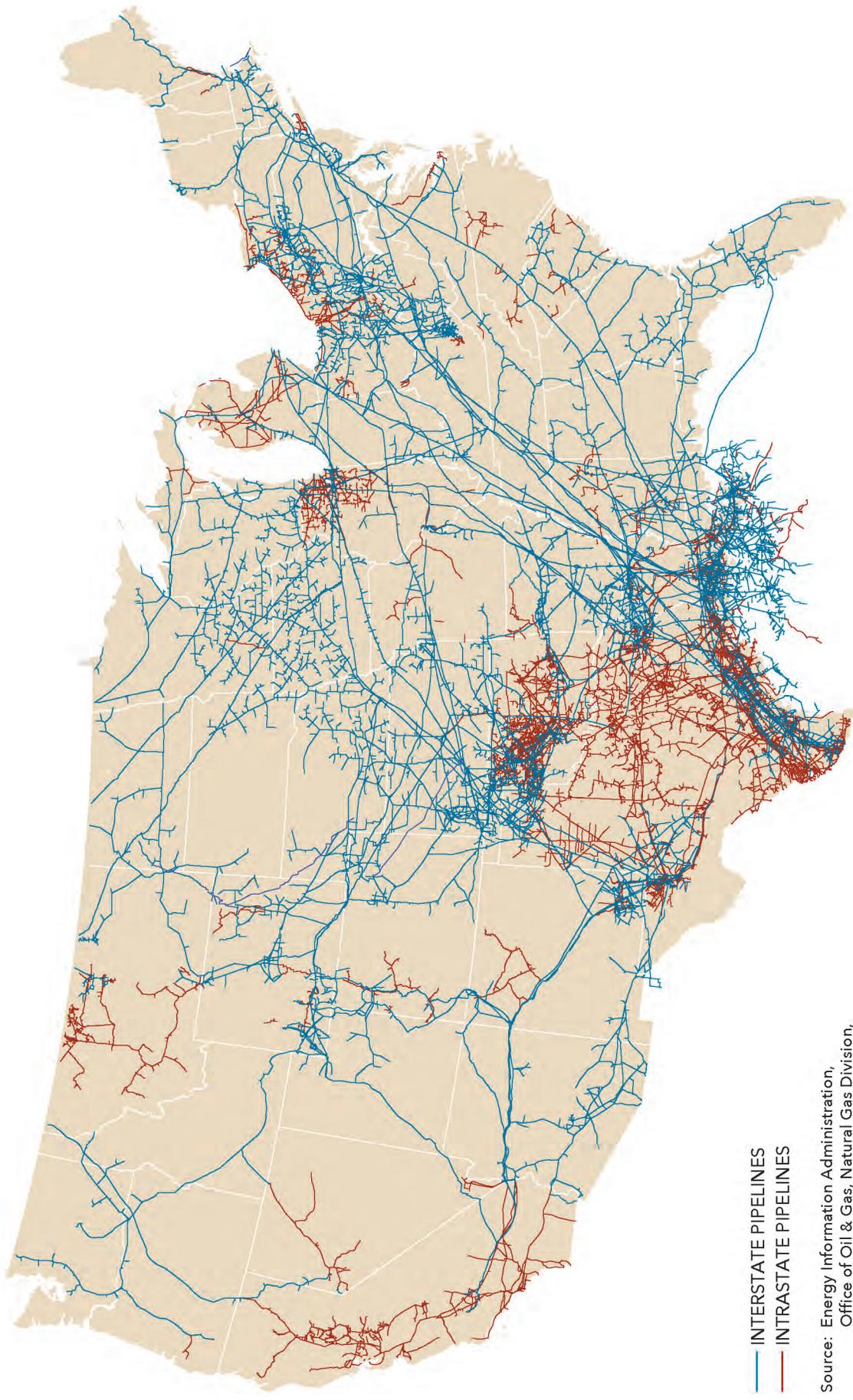
Natural Gas Transmission

Natural gas transmission pipelines transport natural gas meeting quality specifications

to local distribution companies and directly to large end-use customers. The natural gas pipeline network has developed over decades in the United States and continues to evolve to move product from supply centers to demand markets safely and efficiently. Pipelines that transmit natural gas within the boundaries of a single state are called intrastate pipelines and are regulated by that state. Interstate pipelines, which traverse more than one state, are regulated by the Federal Energy Regulatory Commission, or FERC. Transmission lines transport natural gas between major hubs to lateral lines. Lateral lines move natural gas to end-use customers. The natural gas pipeline infrastructure is depicted in Figure H-5.

Natural Gas Delivery Network

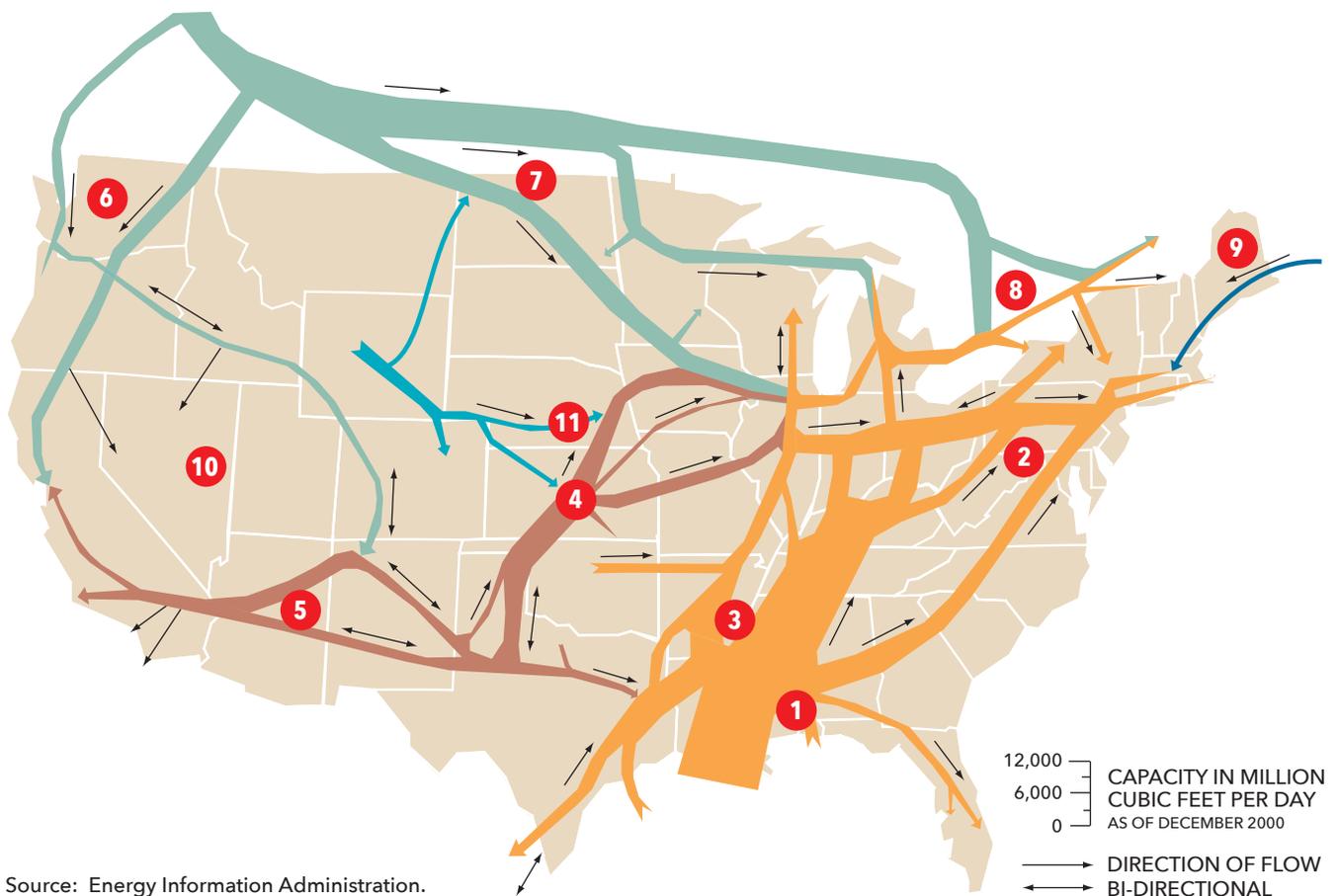
The national natural gas delivery network is intricate and expansive, but most of the major transportation routes can be broadly categorized into 11 distinct corridors or flow patterns as shown in Figure H-6.



— INTERSTATE PIPELINES
 — INTRASTATE PIPELINES

Source: Energy Information Administration,
 Office of Oil & Gas, Natural Gas Division,
 Gas Transportation Information System.

Figure H-5. U.S. Natural Gas Pipeline Infrastructure



Source: Energy Information Administration.

Figure H-6. Natural Gas Transportation Corridors

(Source: U.S. Energy Information Administration, "About U.S. Natural Gas Pipelines – Transporting Natural Gas," http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/transcorr.html)

Routes from the Southwest Region

1. Southwest-Southeast: from the area of East Texas, Louisiana, and the Gulf of Mexico, to the southeastern states.
2. Southwest-Northeast: from the area of East Texas, Louisiana, and the Gulf of Mexico, to the U.S. Northeast (via the Southeast Region).
3. Southwest-Midwest: from the area of East Texas, Louisiana, Gulf of Mexico, and Arkansas, to the Midwest.
4. Southwest Panhandle-Midwest: from the area of southwestern Texas, the Texas and Oklahoma panhandles, western Arkansas, and southwestern Kansas, to the Midwest.
5. Southwest-Western: from the area of southwestern Texas (Permian Basin) and northern

New Mexico (San Juan Basin) to the western states, primarily California.

Routes from Canada

6. Canada-Western: from the area of western Canada to western markets in the United States, principally California, Oregon, and Washington State.
7. Canada-Midwest: from the area of western Canada to Midwestern markets in the United States.
8. Canada-Northeast: from the area of western Canada to Northeastern markets in the United States.
9. Eastern Offshore Canada-Northeast: from the area of offshore eastern Canada (Sable Island) to New England markets in the United States.

Routes from the Rocky Mountain area

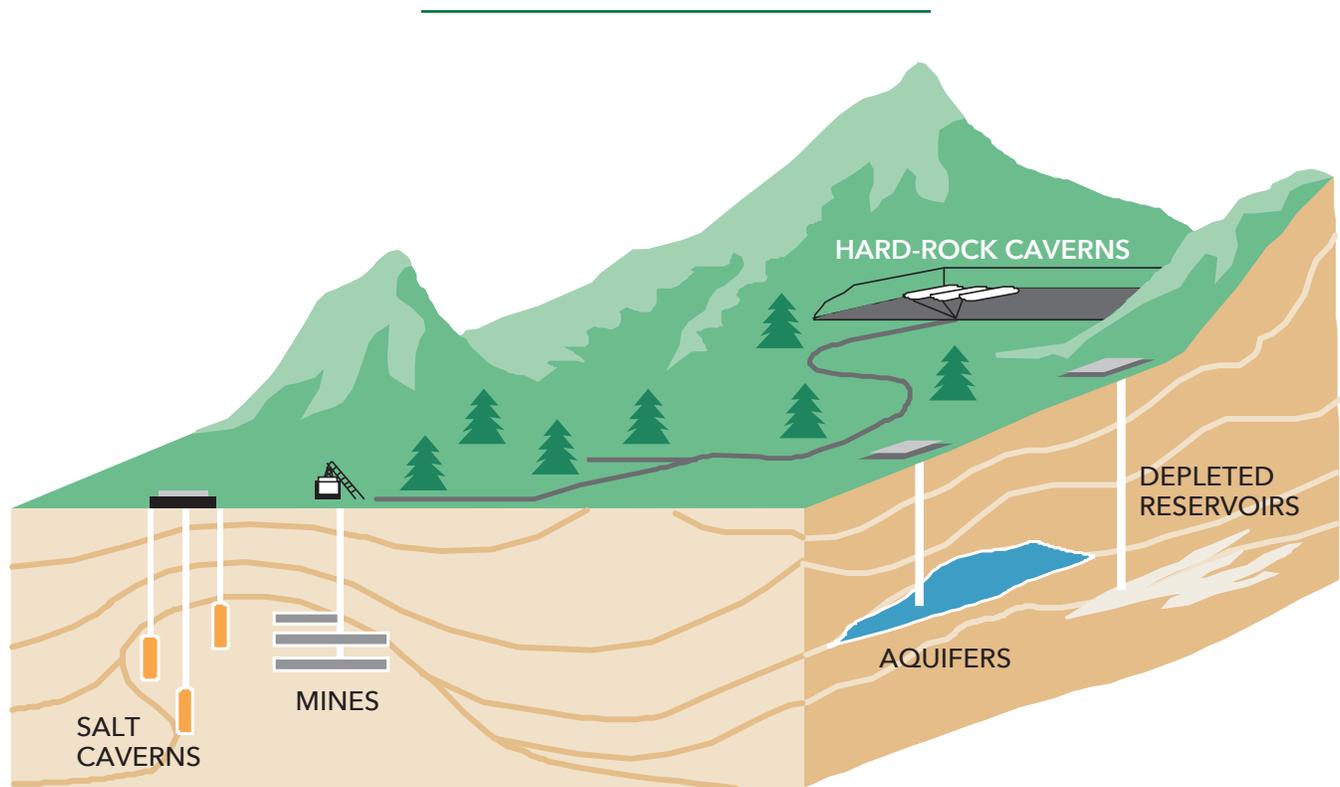
10. Rocky Mountains-Western: from the Rocky Mountain area of Utah, Colorado, and Wyoming, to the western states, primarily Nevada and California with support for markets in Oregon and Washington.
11. Rocky Mountains-Midwest: from the Rocky Mountain area to the Midwest, including markets in Iowa, Missouri, and eastern Kansas.

Natural Gas Storage to Meet Seasonal Demand

Natural gas is produced at a fairly steady rate, and is transmitted through the United States' pipeline infrastructure at a consistent flow rate. However, demand for natural gas may have normal peaks or lulls dependent on factors such as weather. Temporarily placing natural gas into storage for later withdrawal helps provide a valuable tool for systemic balance between supply and demand forces. A representation of the various types of underground storage facilities is shown in Figure H-7.

The United States burns more natural gas in the winter than summer due to space heating needs. This creates a relatively predictable seasonal pattern of higher demand coinciding with colder weather. Natural gas is injected into storage facilities from the spring and through summer. The industry considers the beginning of April through the end of October as the "injection" season, and the remaining months (November through the following March) constitute the "withdrawal" season. Figure H-8 shows the location of the nearly 400 active storage facilities in the lower-48 states.

Pulling natural gas out of storage helps bring supplemental supply to meet market demand during seasonal peaks. Occasionally short-term, volatile demand swings call for a quicker response than standard storage facilities are equipped to manage. Peaking facilities are capable of liquefying natural gas during off-peak periods, storing it in above-ground tanks, and then regasifying the product for injection into the transmission



Source: PB-KBB, Inc.

Figure H-7. Types of Underground Natural Gas Storage

(Source: U.S. Energy Information Administration, "The Basics of Underground Natural Gas Storage," August 2004. http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/storagebasics/storagebasics.html)

or distribution system. FERC identifies 13 such peaking units under their jurisdiction serving interstate commerce. “Satellite” peaking units do not have liquefaction capabilities but rather receive liquefied natural gas (LNG) from truck deliveries and store the product for eventual line injection on peak demand days. The EIA reports a total of about 100 LNG and satellite peaking facilities in the United States.

Natural Gas Distribution

The inter- and intrastate pipeline networks deliver natural gas to distribution lines, which in turn make deliveries to end users. Some large industrial facility customers or power generators may connect directly to an interstate natural gas pipeline but the majority of consumers (industrial and business) receive their natural gas from local distribution companies, or LDCs. LDC service territories are depicted in Figure H-9.

LDCs rely heavily on natural gas storage to manage their demand load from their customers. Abnormally cold weather conditions mean abnormally high natural gas demand. Many storage facilities are owned and operated by large LDCs to provide natural gas delivery security for their customers’ needs.

Product Ownership and the Supply Chain

The natural gas supply chain is very complex, but very efficient, resilient, and robust. Fungible product specifications and diversity of supply sources are key reasons for these favorable aspects of the system. While producers own the raw natural gas at the point of production, the deregulation of the natural gas market allows customers to purchase natural gas from hundreds of suppliers and marketers using countless market options in a market considered to be one of the most competitive, liquid, and well-functioning markets that exists today. The actual ownership of the product can change hands many times as the product moves through the system.

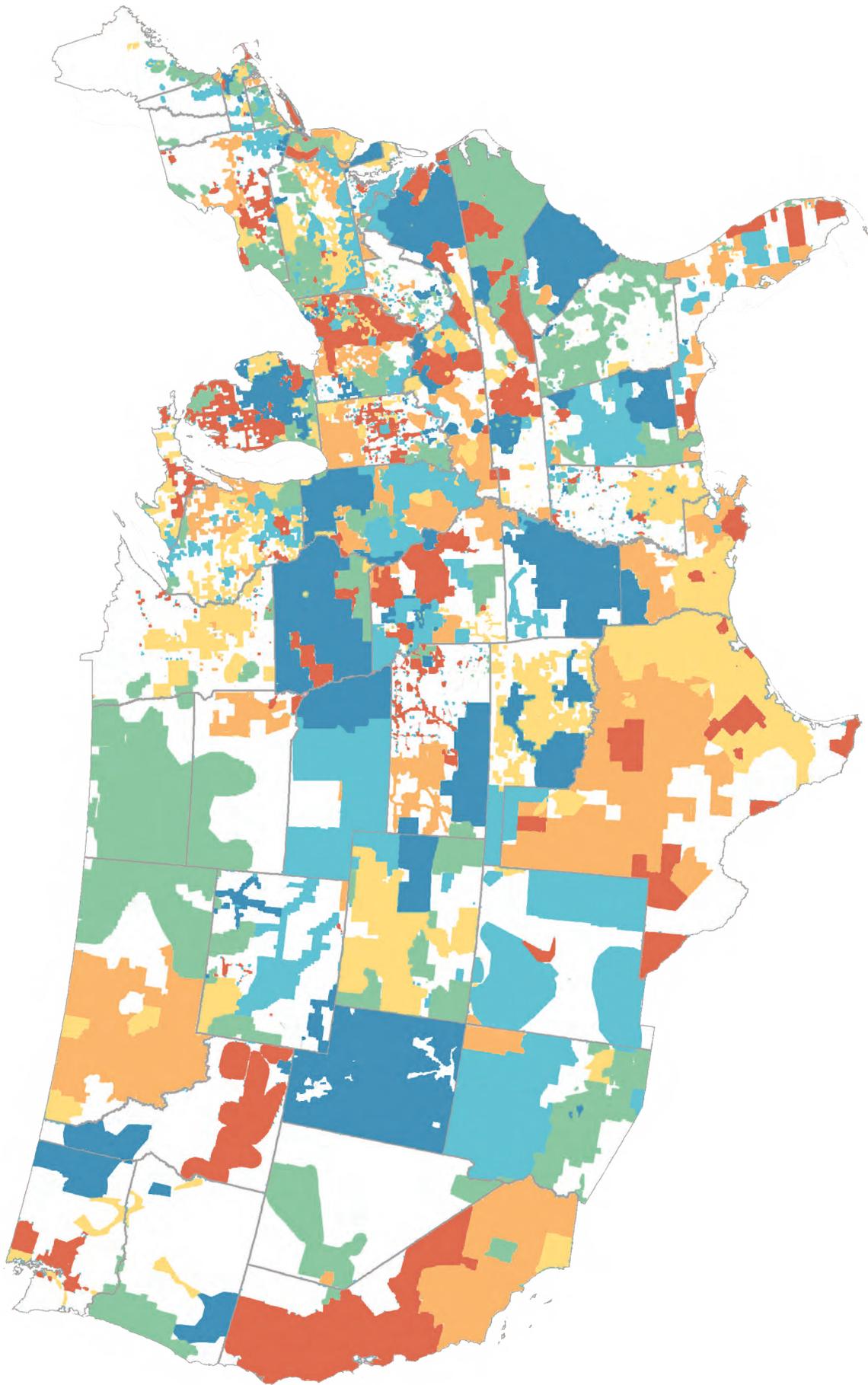
The majority of natural gas enters the interstate pipeline system for ultimate delivery to end users. While interstate pipelines have custody of the gas in their pipelines, they do not own (i.e., hold title to) the product. FERC issued Order 636 in 1992,

which required interstate pipelines to unbundle their services and provide a pure transportation service. Pipeline customers, called shippers, retain ownership while the product is in custody of the pipeline operator. In order to ensure that all pipeline customers had meaningful access to transmission services and that the market for these services was transparent, FERC retained its policy that the shipper must have title to the gas being transported and promulgated rules to create a transparent market for the exchange or release of capacity between shippers. These rules also prohibit discrimination between shippers even in an emergency, and provide for the public posting of certain information related to capacity on pipeline websites.

Access to an interstate pipeline’s capacity is governed by the type of service purchased and the pipeline’s tariff. A shipper may choose from many types of service but there are two basic forms of transportation agreements:

- **Firm.** Firm transportation service requires the reservation of pipeline capacity by a customer between certain receipt and delivery points. Firm customers generally pay a “demand” or “capacity reservation” fee based on the amount of capacity being reserved, regardless of whether the capacity is used, plus a usage fee based on the actual volumes of natural gas transported.
- **Interruptible.** Interruptible service is typically short term in nature and is generally used by customers that either do not need firm service or have been unable to contract for firm service. These customers pay based on the volume of natural gas transported. The obligation to provide this service is limited to available capacity not otherwise used by firm customers, and as such, customers receiving services under interruptible contracts are not assured capacity on the pipeline.

When purchasing firm or interruptible service, the shipper must choose the primary points at which the pipeline will receive and deliver its gas. If a pipeline’s capacity is constrained, a shipper moving gas from a primary receipt point to a primary delivery point has the highest priority in the allocation of capacity. Any deviation from the primary to primary path lessens the priority.



Note: Clear (white) areas represent geographic regions where little or no natural gas service is available. A large number of municipal local distribution companies (LDCs) are not shown because their service territories are too small to be reflected at this scale. Color shading and patterns do not have any significance other than to distinguish between adjoining LDC service territories.
 Source: Ventyx Velocity Suite.

Figure H-9. Local Distribution Companies by Service Territories

Once transportation service has been purchased, a shipper must nominate the volume of gas it intends to tender at the receipt point for delivery at the delivery point each day. The nomination process begins the day before the gas is to flow with “timely” nominations. While there are additional opportunities to nominate gas for transportation after the timely cycle, the ability for a shipper to access its capacity becomes more limited. Adherence to the nomination and scheduling protocol is important to pipeline operations and the functioning of the market for pipeline capacity. An interstate pipeline’s tariff sets forth the terms and conditions under which natural gas can be transported. Whether the shipper has access to natural gas to nominate for transport depends on how a shipper is acquiring gas. A shipper may have a long-term contract with a producer or, more often, the shipper may be participating in the daily or monthly markets for natural gas.

In contrast, gatherers and intrastate pipelines may offer both a merchant and transportation function. As a merchant, gatherers and intrastate pipelines may own and sell gas from their pipeline system. This may be done through a marketing affiliate. Nomination and scheduling processes on gathering systems’ intrastate pipelines are often less structured and the pipelines will allow volume adjustments as long as the change does not impact pipeline operations. However, most states prohibit discrimination between shippers but do not require the posting of shipper and capacity information. Shipper information including names and receipt and delivery points are generally considered confidential.

Local distribution companies own gas in their distribution lines for resale to the ultimate consumer.

NATURAL GAS LIQUIDS SUPPLY CHAIN

NGLs refer to five purity products: ethane, propane, normal butane, isobutane, and natural gasoline (also known as pentanes plus). Once fractionated into purity products, NGLs can be transported by pipe, rail, truck, or ship for petrochemical feedstocks, home heating fuel, agricultural uses, gasoline blending, or export.

Infrastructure

NGL infrastructure has three parts: processing, transportation, and fractionation.

Natural gas production at the wellhead that is rich in NGLs, or “wet,” must be processed to remove the NGLs from the natural gas stream. This process ensures that the natural gas consistently meets specifications designed to enable safe and reliable delivery to end-use customers of the natural gas. Additionally, NGLs that are extracted from the natural gas have an economic value to producers, which is currently driving many drilling decisions.

As shown in Figure H-10, the separation of raw natural gas into NGLs and dry gas adds value for producers.

The intra- and interstate pipeline system for pipeline quality natural gas is far more developed and sited closer to the production fields than the system for NGLs. Historically, fractionation centers were developed on the U.S. Gulf Coast and,

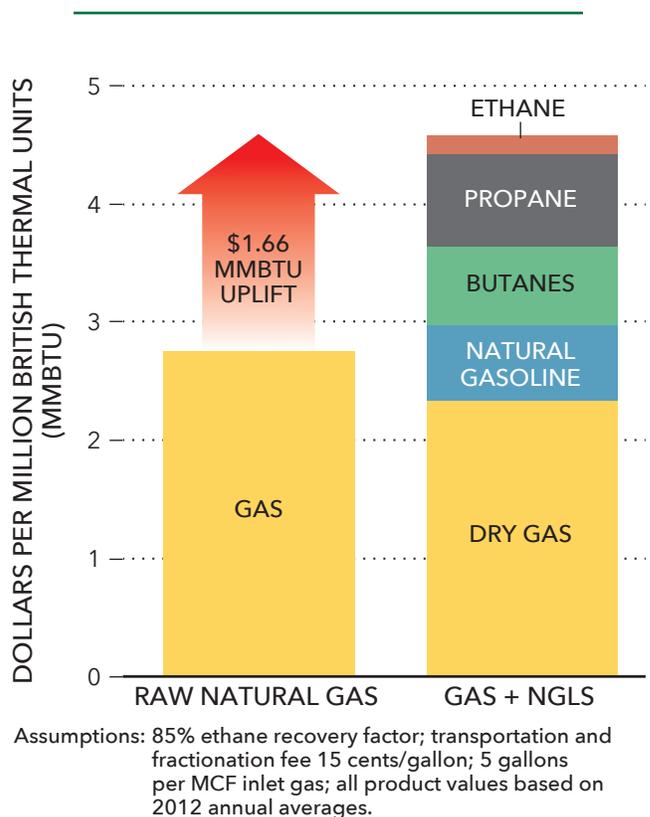


Figure H-10. NGLs Value Uplift to Producers

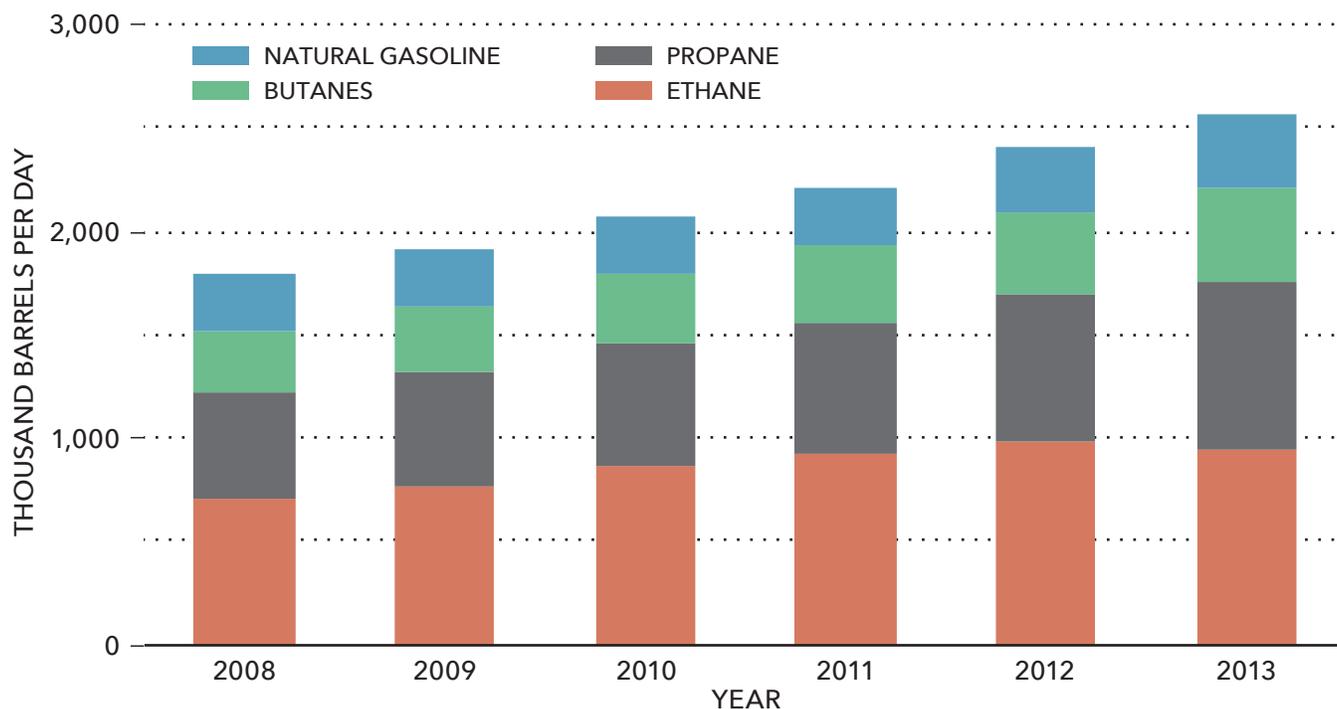
to a lesser extent, the Midcontinent region, to be close to the market for their products, rather than to supply. Production of natural gas liquids is increasing, as shown in Figure H-11. As production continues to ramp up, the volume of NGLs produced will drive the development of pipeline networks to the well-developed fractionations hubs of the United States unless market centers closer to production are developed.

The comingled stream of NGLs at the tailgate of a gas processing plant are usually piped, but sometimes trucked or railed, to fractionation facilities, where the stream is heated and cooled until five distinct products are distilled. After fractionation, the distinct products can be transported to end users or placed into storage. This can be accomplished through purity product pipelines, rail, truck, or ship.

Y-grade Transportation and Fractionation

The comingled NGL stream created at the gas processing plant is called Y-grade. Y-grade is a mix of the five purity NGLs. To be commercially marketed, this Y-grade must be further processed

in a fractionator, which separates the comingled stream into purity products. The vast majority of the U.S. fractionator capacity is in the Mt. Belvieu, Texas area. A number of small fractionators are spread throughout the country, such as the Midcontinent area (Kansas, Oklahoma) and the Appalachian area (Ohio, West Virginia). Y-grade produced in other areas often needs to be transported from processing plants to fractionation facilities. Y-grade cannot be transported in the same pipelines that transmit natural gas. Instead, the mixed NGL stream must use its own pipeline system, which has different specifications and requirements. Y-grade is delivered by pipe, rail, and truck to one of the fractionation centers. Purity products are shipped separately from the fractionators and delivered via truck, rail, pipeline, or ship. Pipelines have the flexibility of delivering multiple purity products through batching or delivering on a single product through a particular line. Purity pipelines are prevalent on the Gulf Coast as they typically connect directly to the petrochemical complexes that use purity products as feedstock. Most NGLs are not consumed at the time of production or fractionation for a variety of reasons, including seasonality. This necessitates



Source: U.S. Energy Information Administration.

Figure H-11. Annual Production of Natural Gas Liquids from Natural Gas Processing Plants

storage facilities. Descriptions of the purity products are listed below.

Ethane. More than 90% of the ethane supply comes from natural gas processing plants. Demand for ethane is almost exclusively from petrochemical plants, specifically to produce ethylene. Ethylene is an essential component for the production of plastics.

Propane. Approximately 60% of propane comes from natural gas processing plants. Petrochemical demand consumes approximately one-third of the propane supply, while heating and other fuel uses account for more than half of propane demand in the United States. The primary demand factors for propane are weather, ethylene/propylene prices, and export economics.

Normal Butane. Approximately 45% of normal butane comes from natural gas processing plants. While 10% of normal butane is used as petrochemical feedstock, 90% is used for gasoline blending demand. The motor gasoline market, ethylene/propylene prices, and export economics all impact the demand for normal butane.

Isobutane. Approximately 60% of isobutane is derived from natural gas processing plants. Approximately 95% is consumed for alkylation, a process for the manufacture of a high-octane motor gasoline component. The balance of isobutane is used for refrigerant/aerosol markets. The demand for isobutane is driven by the motor gasoline market and export dynamics.

Natural Gasoline. About 80% of natural gasoline is supplied by natural gas processing plants. Demand for natural gasoline is 30% petrochemical feedstock and 70% gasoline blending. The motor fuel market, ethylene/propylene prices, and naphtha market impact the demand for natural gasoline.

Purity Transportation

The five purity NGL products cannot be transported together. They must be kept in their purity form and transported through pipelines, ships, rail, or truck. Pipelines have the flexibility of delivering multiple purity products through batching or delivering on a single product through a particular line. Purity products are prevalent on

the Gulf Coast as they typically connect directly to the petrochemical complexes that use purity products as feedstock.

Storage

Most NGLs are not consumed at the time of production or fractionation for a variety of reasons including seasonality. This necessitates storage facilities. One of the contributing factors to Mt. Belvieu's dominance in NGL fractionation is its number of salt domes.

Exports

NGLs are sometimes transported domestically by ship, but the emerging use of water carriers for NGL transportation is for export outside of North America. While there are some NGLs being transported by pipeline internationally within North America, in order to leave the continent, NGLs must be sent by ship. These exports have thus far been confined to propane and butanes, together known as liquefied petroleum gas or LPG.

DISRUPTIONS AND STRESSES TO THE NATURAL GAS AND NATURAL GAS LIQUIDS SUPPLY CHAINS DUE TO NATURAL DISASTERS

All phases in natural gas supply chain are very efficient in the normal day-to-day operations to ensure safe and reliable service to the end user. Considerable resources are in place to ensure that equipment, personnel, and plans and processes are in place for pre-disaster preparations and post-disaster recovery efforts.

Natural Gas Processing

Hurricanes in the Gulf of Mexico are the most common natural disaster impacting the natural gas supply chain. There are two primary scenarios that occur with Gulf of Mexico hurricanes that directly affect natural gas processing: a storm triggering precautionary offshore evacuation or a storm resulting in onshore gas processing plant disruption.

In the first case, as a named storm enters the Gulf of Mexico, offshore operators begin

the process of shutting in individual wells and evacuating personnel from associated production structures. These shut-ins have a multiplying effect as processing facilities onshore begin to feel the impact of the lower volume throughput and begin the process of throttling back on plant processing. Such losses of processing supply not only reduce the amount of natural gas moving to market on transmission systems, but also reduce the volume of NGLs and condensate normally extracted during the process, and in turn delivered to area fractionators. Many of the natural gas transmission systems can resource alternate onshore supplies or pull natural gas from storage, but the NGL market may continue to suffer during the outage of the richer gas supply.

In the second scenario, where there is little to no impact to offshore systems but the storm activity causes localized disruption to an onshore natural gas processing facility, it is critical to reroute rich natural gas to an active natural gas processing facility in order to maintain offshore oil and gas production. If rerouting is possible, and there is available processing capacity, the natural gas and associated oil production will continue. In the event of a widespread impact to multiple natural gas processing facilities, the impact to gas flow will potentially disrupt natural gas transmission supplies, NGL markets, and oil production from where the natural gas is being produced.

Additionally, the local power grid is a critical element of the natural gas processing system's reliability. Although the primary movement of natural gas may be driven by natural gas compression, much of the plant processes require purchased power from the local electric grid to sustain operation. However, in the event that gas quality parameters cannot be attained at the tailgate of the plant, the rich gas streams must be interrupted, effectively shutting in production.

Natural Gas Transmission

From the perspective of the natural gas transmission, there are two primary scenarios resulting in a supply disruption triggered by a natural disaster: (1) a storm impacting offshore production or resulting in an onshore gas processing plant disruption, or (2) a cold weather event that impacts an onshore production area.

In the first case, as a named storm appears in the Gulf of Mexico, offshore operators respond by shutting in wells and evacuating personnel from associated production structures. These shut-ins limit the amount of raw hydrocarbon stream coming from offshore production to the onshore processing plants, ultimately reducing the volume of processed natural gas available for transmission. Pipeline transmission operators may have options to manage the subsequent supply shortfall, such as imposing customer curtailments, lowering the pressure in the transmission pipelines, or accepting natural gas with a higher than normal BTU level. During curtailment periods, some customers may have the capability to switch from natural gas to an alternate fuel. Just as processing plants may at times be able to blend natural gas with higher and lower BTU quantities to achieve a balanced product, transmission lines may have blending options. Immediate price spikes in natural gas spot prices generally follow when a storm is named in the Gulf of Mexico.

The transmission and distribution sectors of the natural gas supply chain have integrated additional assets into their portfolio to provide a higher level of reliability in the event of a supply disruption. Assets may include multiple large-diameter pipelines, redundant compression (gas and electric), underground natural gas storage, LNG storage, and propane storage that can be deployed very quickly to provide alternate sources of gas when a supply disruption occurs. These assets are finite in size and can only be utilized for short durations (typically 4–5 days) to make up supply shortfalls from Gulf of Mexico production.

In the second scenario, a significant cold weather event causes a supply disruption to conventional and unconventional onshore production. Causes for the supply disruption may include freeze-offs at the wellhead, loss of electricity to gas processing plants and compressor stations, and possible shutdown of equipment due to gas quality. The electric transmission grid is essential to operating facilities in the natural gas supply chain. In fact many installations depend on utility power with certain critical locations having back-up natural gas generators available in the event of a power disruption.

As discussed in the first scenario where offshore production is disrupted by an offshore

disturbance and shale gas provides the alternate supply to the end user, the converse is true for the second scenario. In the event that a supply disruption occurs in the onshore producing regions due to well freeze-offs, the end user may be able to resource their gas from Gulf of Mexico production, or other onshore production basins not impacted by the cold weather. The transmission and distribution sectors will also rely on storage and other assets to minimize impact to end users and consumers. As experienced during the Polar Vortex of 2014, certain areas of the Marcellus Shale experienced wellhead freeze-offs in early January during periods of extreme cold weather and ice. End users in the Northeast, including power generators, were able to resource their gas from Midcontinent shale basins as well as Gulf of Mexico production to meet their heating demand, which was very high. The overall impact to end users who had pipeline capacity was minimal, but spot prices in the Northeast increased significantly during this period indicating insufficient pipeline capacity being available to meet end-user demand in January. The increased diversity in natural gas supply sources has significantly limited the impact to the end users during a natural disaster.

Natural Gas Liquids/Fractionation

As previously discussed, the natural gas liquids supply chain includes a complex series of pipelines, fractionation facilities, storage facilities, and terminals. When fully operational, the system efficiently optimizes the infrastructure in place and delivers Y-grade and purity products to the desired industrial and retail end users.

Industrial users of purity products have historically clustered most plants and other facilities in close proximity to the underground storage centers capable of storing and delivering millions of barrels of product every day. This assists in making deliveries to the industrial customers generally reliable even after natural disasters have occurred.

Unfortunately, when compared to the liquid hydrocarbon and natural gas infrastructure, the purity NGL network of pipelines and facilities with deliveries to retail customers is less robust and less resilient when stressed during natural disasters in certain regions of the United States.

The primary retail NGL product is propane, and an extensive network of pipelines exists to service retail customers. With the seasonal nature of propane demand, much of the network relies on vast underground storage of product in the summer months with deliveries in the winter months. The pipeline systems in place are designed to efficiently deliver stored propane to retail customers ratably during the winter months and it is common for most of the pipelines to run at or near full capacity in the winter months during periods of “normal” winter weather. In periods of extreme weather, demand for propane increases significantly and the pipeline system cannot effectively keep pace. Alternative delivery options to meet the excess demand are primarily over the road truck traffic and rail deliveries to the regions affected by the extreme weather, but depending on the size of the affected region these measures may or may not be effective in satisfying the increased demand. Because of its chemical make-up, propane requires unique truck trailers or rail cars, both of which tend to have a high utilization rate in the peak winter months. At a minimum, this will increase the price of propane within a given region, sometime significantly, while at worst, alternative means may not be available to meet the increased demand.

Fractionators rely on: natural gas to fuel burners; NGLs as feedstock in the process; and power provided by the local electric grid connection. Backup power contingency equipment for fractionators varies widely but is deployed to throttle down operations safely rather than to maintain full operations. There are no options to provide off-spec product or apply waivers granting wider product parameters.

IMPROVING RESILIENCY THROUGH DIVERSITY OF SUPPLY

There are many widely followed industry best practices that improve the resiliency of natural gas and natural gas liquids supply chains in the event of an emergency. For example, in extremely cold weather, operators will set methanol drips to prevent well freeze-offs, while staging auxiliary storage and auxiliary power at strategic locations. While these localized efforts are important, the reliability created by geographically diverse supply

and highly interconnected pipeline infrastructure provides the best mechanism for the market to quickly recover from an emergency while avoiding potential supply chain disruptions. This places a priority on pipeline infrastructure connecting traditional high-demand centers, such as the North-

east and Midwest, with emerging, unconventional natural gas supply basins. Improved energy delivery flexibility gained through the enhancement of multi-directional pipelines, for example, goes a long way towards protecting natural gas supply chain reliability in the event of a natural disaster.

PROPANE SUPPLY DISRUPTION - A CONVERGENCE OF EXTREMES

Two main contributing factors resulting in the Midwest propane market tightness and resulting price spikes during winter 2013–14 include:

- High agricultural demand for crop drying from a late and atypically wet 2013 corn harvest
- Abnormally high residential/commercial demand due to extreme winter conditions (“Polar Vortex”).

Once harvested, corn must be dried for storage. Midwest crop drying typically relies on large-scale propane fueled heaters. In October and November of 2013, an unusually large corn crop combined with unusually heavy rainfall during the harvest led to unusually large propane demand for crop drying. This heavy demand pull caused a drop in Midwest propane inventories of more than 2 million barrels by the first week in November 2013, an unprecedented single-week draw for any period in November since 1993 according to the EIA.¹ At the same time, pipeline maintenance and rail transportation disruptions reduced propane deliveries into the upper Midwest and prevented inventories from fully restocking before the onset of winter.

Propane accounts for 4.5% of the U.S. primary residential space heating needs, but regionally that figure rises to 7% in the Midwest.² Across the nation, that translates to 5.5 million homes relying on propane for space heating with nearly

2 million of them concentrated in the Midwest alone. So when the extreme weather between October 2013 and February 2014 resulted in temperatures that were 19% colder in the Midwest compared to the prior winter,³ propane demand jumped.

Retail propane prices quickly reflect supply and demand fundamentals within a region. Propane retailers generally have limited storage capability and use small, specialized trucks to deliver the fuel to residential/commercial and agriculture end users. These end-use customers typically elect either to receive regular, small propane deliveries keeping their tanks more or less full or they may opt for a “will-call” schedule in which the customer orders a partial or whole tank refill on-demand. Managing the unpredictable demand load of “will-call” consumers led to localized areas of demand outpacing supplies, and triggered price spikes. In the propane market, wholesale price movements are quickly reflected in retail prices. This is in direct contrast to retail electricity and natural gas consumers receiving service through local utilities who are largely shielded from short-term price spikes.

Industry can never plan for every supply dynamic caused by a combination of extreme factors, such as those seen in the winter of 2013–14. However, supply chains can be enhanced through increasing diversity of supply sources and distribution channels. New pipelines that strengthen the supply chain and increase resiliency will help to alleviate potential future supply disruptions.

1 U.S. Energy Information Administration, “Midwest propane markets tighten further on cold weather,” *Today in Energy*, January, 23, 2014, <http://www.eia.gov/todayinenergy/detail.cfm?id=14711>.

2 U.S. Energy Information Administration, “Propane Situation Update,” April 22, 2014, http://www.eia.gov/pressroom/presentations/propane_briefing_04222014.ppt.

3 U.S. Energy Information Administration, “Heating fuel expenditures rise this winter, especially for propane-heated homes,” *Today in Energy*, March, 12, 2014, http://www.eia.gov/todayinenergy/detail.cfm?id=15371#tabs_SpotPriceSlider-2.

NATURAL GAS COMPRESSION—ELECTRIC VS. NATURAL GAS DRIVEN

An important consideration when assessing supply chain vulnerabilities to natural disasters include those introduced through regulatory requirements. For example, vulnerabilities introduced through a reliance on the electric grid need to be considered when deciding on how to power natural gas compression. The pros and cons of each type of compression system, natural gas fired or electric driven, must be considered in totality.

Natural gas is compressed to move the product through pipelines from supply areas to market. Compressors are driven by either natural gas fired drivers (i.e., engines and turbines) or by electric drivers (i.e., motors). For a specific project, the selection of compressor driver is based upon factors such as the availability of reliable electric power, equipment efficiencies, required operating flexibility, environmental impacts, and capital/operations & maintenance costs. Some benefits of natural gas driven compression include the ready availability of fuel onsite, non-reliance on the electric grid, and lower initial capital costs. Where reliable power is available, benefits of electric motor driven compression may include higher efficiencies, wider operating ranges, and lower maintenance costs, as well as reduced noise impacts and less air emissions generated from the facility. Selection of the compressor driver appropriate for a specific project/location is typically based upon evaluation of these types of factors.

However, proposed projects are often subject to state and/or federal air quality regulatory requirements. As regulatory requirements have become more stringent in recent years, air permitting of natural gas fired sources has increased in complexity—and can significantly impact project timelines.

For larger horsepower projects or for projects located in EPA designated ozone non-attainment areas, which are typically located near urban centers, federal air regulatory

requirements mandate broader evaluation of project impacts, as well as installation of stringent emission controls. Some states have also established stringent air regulatory requirements that can impact even small projects that include natural gas fired sources.

While the state air permitting process for new natural gas fired compressor drivers can typically take from 12 to 18 months, the federal air permitting process can typically take from 24 to 36 months. Due to the complexity of federal air permitting of natural gas fired sources, especially in ozone non-attainment areas, industry often selects electric motor driven compression as the most expedient solution to getting critical projects into service.

While this approach makes emissions a moot issue for the natural gas facility itself, the emissions issue is merely transferred to the electric utilities. In many areas of the country, the environment might be better served by natural gas driven compressors, but the current complex regulatory structure the industry faces discourages that choice. Federal environmental policy and permitting should encourage rather than discourage the use of natural gas fired compression where there are overall environmental benefits for its use. The environmental effects of defaulting to electric driven compression should be considered by regulators in the permitting process.

Streamlining of the air permitting process could potentially help address some of the timing issues. Actions could include improved coordination between state and federal agencies during the air permit application review process, improved certainty regarding emission control requirements, and improved tools for use in the project evaluation process (e.g., air dispersion model improvements). For projects subject to FERC regulation, improved coordination of the air permitting process and the FERC regulatory review process could also improve project certainty and timelines.

A more streamlined air permitting process, which includes greater regulatory certainty, would allow companies to more fully evaluate both natural gas driven and electric motor driven compression options. Companies could then select the type of equipment best suited for each specific project and location after taking into account factors such as costs, life-cycle emissions, and reliability.

Risk assessments accounting for the region's supply chain vulnerabilities to natural disasters

must be considered as well. In the event of a natural disaster where electricity transmission is impacted, natural gas supplies that in turn power electricity production may be impacted, which in turn impacts the transmission of natural gas. By having a streamlined air permitting and regulatory process that puts both compression options on an equal footing, stakeholders will be able to make better decisions to meet the region's resiliency and reliability needs in a timely manner.

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Emergency Preparedness

ACRONYMS AND ABBREVIATIONS

BTU	British thermal unit	NDRF	National Disaster Recovery Framework
CBOB	conventional blendstock for oxygenate blending (to make gasoline)	NGL	natural gas liquids
CI	critical infrastructure	NICC	National Infrastructure Coordinating Center
DOE	U.S. Department of Energy	NIMS	National Incident Management System
DOE ERT	DOE's Energy Response Team	NOC	National Operations Center
DHS	U.S. Department of Homeland Security	NPREP	National Preparedness Response Exercise Program
EIA	Energy Information Administration	NPC	National Petroleum Council
EOC	Emergency Operations Center	NRCC	National Response Coordination Center
EPA	U.S. Environmental Protection Agency	NRF	National Response Framework
ERT	Energy Response Team (DOE)	O&G	oil and natural gas
ESFs	Emergency Support Functions (part of NRF)	ONG SCC	Oil and Natural Gas Sector Coordinating Council
ESF-12	Emergency Support Function 12 – Energy	PADD	Petroleum Administration for Defense District
FERC	Federal Energy Regulatory Commission	PPD-8	Presidential Policy Directive 8: National Preparedness
GIS	Geographic Information Systems	RBOB	reformulated blendstock for oxygenate blending (to make gasoline)
GCC	Government Coordinating Council	RFA	Request for Assistance (process)
ICS	Incident Command System	RFS2	Renewable Fuel Standard Program (EPA)
JFO	Joint Field Office	RSF	Recovery Support Functions
LDC	local distribution company	RVP	Reid Vapor Pressure
LNG	liquefied natural gas	SCC	Sector Coordinating Council
MACS	Multi-Agency Coordination System		
MMB/D	million barrels per day		