



Supply Chain Resilience Guide

April 2019



Homeland
Security

This page intentionally left blank

Strategic Overview

Disasters disrupt preexisting networks of demand and supply. Quickly reestablishing flows of water, food, pharmaceuticals, medical goods, fuel, and other crucial commodities is almost always in the immediate interest of survivors and longer-term recovery.

When there has been catastrophic damage to critical infrastructure, such as the electrical grid and telecommunications systems, there will be an urgent need to resume—and possibly redirect—preexisting flows of life-preserving resources. In the case of densely populated places, when survivors number in the hundreds of thousands, only preexisting sources of supply have enough volume and potential flow to fulfill demand.

During the disasters in Japan (2011) and Hurricane Maria in Puerto Rico (2017), sources of supply remained sufficient to fulfill survivor needs. But the loss of critical infrastructure, the surge in demand, and limited distribution capabilities (e.g., trucks, truckers, loading locations, and more) seriously complicated existing distribution capacity. If emergency managers can develop an understanding of fundamental network behaviors, they can help avoid unintentionally suppressing supply chain resilience, with the ultimate goal of ensuring emergency managers “do no harm” to surviving capacity.

Delayed and uneven delivery can prompt consumer uncertainty that increases demand and further challenges delivery capabilities. On the worst days, involving large populations of survivors, emergency management can actively facilitate the maximum possible flow of preexisting sources of supply: public water systems; commercial water/beverage bottlers; food, pharmaceutical, and medical goods distributors; fuel providers; and others. To do this effectively requires a level of network understanding and a set of relationships that must be cultivated prior to the extreme event. Ideally, key private and public stakeholders will conceive, test, and refine strategic concepts and operational preparedness through recurring workshops and tabletop exercises. When possible, mitigation measures will be pre-loaded. In this way, private-public and private-private relationships are reinforced through practical problem solving.

Contemporary supply chains share important functional characteristics, but risk and resilience are generally anchored in local-to-regional conditions. What best advances supply chain resilience in Miami will probably share strategic similarities with Seattle, but will be highly differentiated in terms of operations and who is involved.

In recent years the Department of Homeland Security (DHS) and the Federal Emergency Management Agency (FEMA) have engaged with state, local, tribal and territorial partners, private sector, civic sector, and the academic community in a series of innovative interactions to enhance supply chain resilience. This guide reflects the issues explored and the lessons (still being) learned from this process. The guide is designed to help emergency managers at every level think through the challenge and opportunity presented by supply chain resilience. Specific suggestions are made related to research, outreach, and action.

This page intentionally left blank

Table of Contents

INTRODUCTION.....	1
Purpose	1
Background.....	1
Supply Chain Defined.....	2
Supply Chain Resilience	3
Supply Chains and Emergency Management	4
Community Lifelines	5
SUPPLY CHAIN RESILIENCE PROCESS.....	8
Overview.....	8
Phase 1: Research and Mapping	9
Phase 2: Analysis	11
Phase 3: Outreach.....	13
Phase 4: Action	15
Phase 5: Assess and Refine	16
CONNECTION TO LOGISTICS PLANNING.....	19
Overview.....	19
Considerations	19
Supply Source	20
Distribution Points	20
Inventory	21
Access and Re-entry.....	21
Routes	23
Fuel	24
Transportation Operators	24
APPENDIX A. DEFENSE PRODUCTION ACT	25
Requesting DPA Priority Ratings	25
Establishing a Voluntary Agreement.....	26
APPENDIX B. COMMUNITY LIFELINE FRAMEWORK	27
Safety and Security.....	27
Food, Water, Sheltering.....	28
Health and Medical	29
Energy (Power & Fuel)	30
Communications	31
Transportation.....	32
Hazardous Material.....	32
APPENDIX C. SUPPLY CHAIN RESILIENCE ENGAGEMENT CHECKLIST	34
APPENDIX D. COMPLEX SUPPLY CHAIN EXAMPLE	36

This page intentionally left blank

Introduction

Supply Chain Resilience

The most effective way to deliver the needed supplies to a disaster-impacted area is by re-establishing pre-disaster supply chains. Building resilience within, and providing for the rapid restoration of, supply chain systems is key to responding to any catastrophic incident.¹

Purpose

This document provides emergency managers with recommendations on how to analyze supply chains and to work with the private sector to enhance supply chain resilience in support of *Comprehensive Preparedness Guide (CPG) 101: Developing and Maintaining Emergency Operations Plans*.² This document also identifies how the results of the supply chain resilience process can inform logistics planning.

Background

Each day, individuals and families routinely receive critical goods and services such as water, food, pharmaceuticals, medical goods, power, and fuel from healthy, functioning supply chains. However, in times of disaster, even supply chains that were previously functioning well can experience significant disruption, generating acute life-safety challenges and quickly turning a disaster into a catastrophe. Supply chains that effectively adapt to disasters, disruptions, and fluctuating needs greatly benefit the community and can reduce the need for a larger response and recovery operation.

While the private sector operates and maintains the majority of supply chains, emergency managers can play a critical role in enhancing supply chain resilience by fostering awareness and collaboration among key supply chain players and promoting actions to enhance supply chain resilience. They must also be aware of supply chain vulnerabilities and potential impacts to the community so that they can develop effective emergency response plans and operate efficiently in times of disaster. For example, emergency response plans are often based on the assumption of working supply chains. Awareness of vulnerabilities can help emergency managers

understand the potential impacts of disrupted supply chains. In addition, such awareness helps managers to support the private sector in re-establishing supply chains and to take necessary actions to mitigate the impacts (e.g., prioritizing stabilization of critical supply chain

Resilient supply chains are a critical element in protecting community lifelines.

Community lifelines provide indispensable services that (1) enable the continuous operation of critical business and government functions, and (2) are critical to human health and safety or economic security.

Survivors depend on community lifelines, which depend on resilient supply chains, to save and sustain life, ensure public safety, and speed economic recovery.

¹ FEMA Strategic Plan 2018–2022, <https://www.fema.gov/strategic-plan>.

² FEMA, *CPG 101: Developing and Maintaining Emergency Operations Plans*, Version 2.0, (Washington, DC, 2010), <https://www.fema.gov/media-library/assets/documents/25975>.

infrastructure, reviewing stockpile options, and identifying alternate supply chains for emergencies when needed). Integrating the needs of supply chains into mitigation, response, recovery, and resilience planning and actions is key to improving supply chain resilience and ensuring the availability of key goods and services.

To effectively support supply chain resilience and develop response and recovery plans, emergency managers must understand the activities and principles for each local supply chain, similar to the general understanding they have with law enforcement, fire suppression, emergency medical services, and public works. Awareness of supply and demand flows, bottlenecks, interconnections, and interdependencies between supply chains is as important to disaster planning and resilience building as knowledge of the local road networks and floodplains.

The State of Alaska 2012 Evaluation of Supply Chains and Resilience Building

Issue: The supply chains to Alaska primarily come from the mainland United States, either by ship from Seattle, Washington, to Anchorage, Alaska, or by air. As previous disasters have demonstrated, severe winter weather, volcanoes, and earthquakes could cut off Alaska's normal supply chains for several weeks or months. In 1964, Alaska experienced a 9.2-magnitude earthquake and subsequent tsunami that devastated its power infrastructure, shipping, and distribution networks.

Action: In 2012, the State of Alaska assessed the supply chains that provide food, supplies, and fuel to the state.

Result: Based on the assessment, the State of Alaska explored procuring shelf-stable meals for 40,000 survivors for seven days. In addition, the State identified the need to store medical supplies, cold-climate water purification systems, and generators. A significant consideration included food that was culturally and nutritionally appropriate for both the urban city residents and for rural Alaskan diets, such as smoked salmon. Recent catastrophic logistics planning shows that Alaska has seven days of food available following a disruption to the supply chain.

Supply Chain Defined

A supply chain has many definitions. This guide defines a **supply chain** as *the socio-technical network that identifies, targets, and fulfills demand. It is the process of deciding what, when, and how much should move to where.*

Supply chains can be vastly complex, and they can vary significantly from product to product. Appendix D presents a complex example of a supply chain, specific to petroleum. However, all supply chains include the same basic components. As Figure 1 shows, supply chains include the following:

- **Supply Nodes** – Entities that manufacture, process, store, and/or ship goods and services. They generally include raw material providers, suppliers, manufacturers, and distributors. (Also Known As: Origins, Outputs, Vertices, Terminals, Warehouses, Distribution Centers, Cross Docks, Push Places, and more.)
- **Demand Nodes** – Entities that purchase and/or signal for goods and services from supply nodes. They generally include individuals, families, businesses, and governments. (Also Known As: Destinations, Inputs, Vertices, Retailers, Pull Places, and more.)
- **Tiers** – A common way to group nodes and identify upstream and downstream relationships within the supply chain. Tier 1 suppliers provide products or services to the

producer/processor; Tier 2 suppliers provide products or services to Tier 1 suppliers; Tier 3 suppliers provide products or services to Tier 2 suppliers. As the Tier numbers get higher, the further that supplier is from the producer/processor of the finished product.

- **Links** – The physical and functional connections between nodes, such as communication, transport, or transaction connections. Links can also relate to service infrastructure, such as power. (Also Known As: Edges, Arcs, Paths, Tracks, Routes, and more.)

Supply chains involve the movement of products, information, and money. Products flow from supply nodes to demand nodes, while money usually follows the reverse direction. Information sharing occurs among all nodes. Humans are agents within the nodes and links.

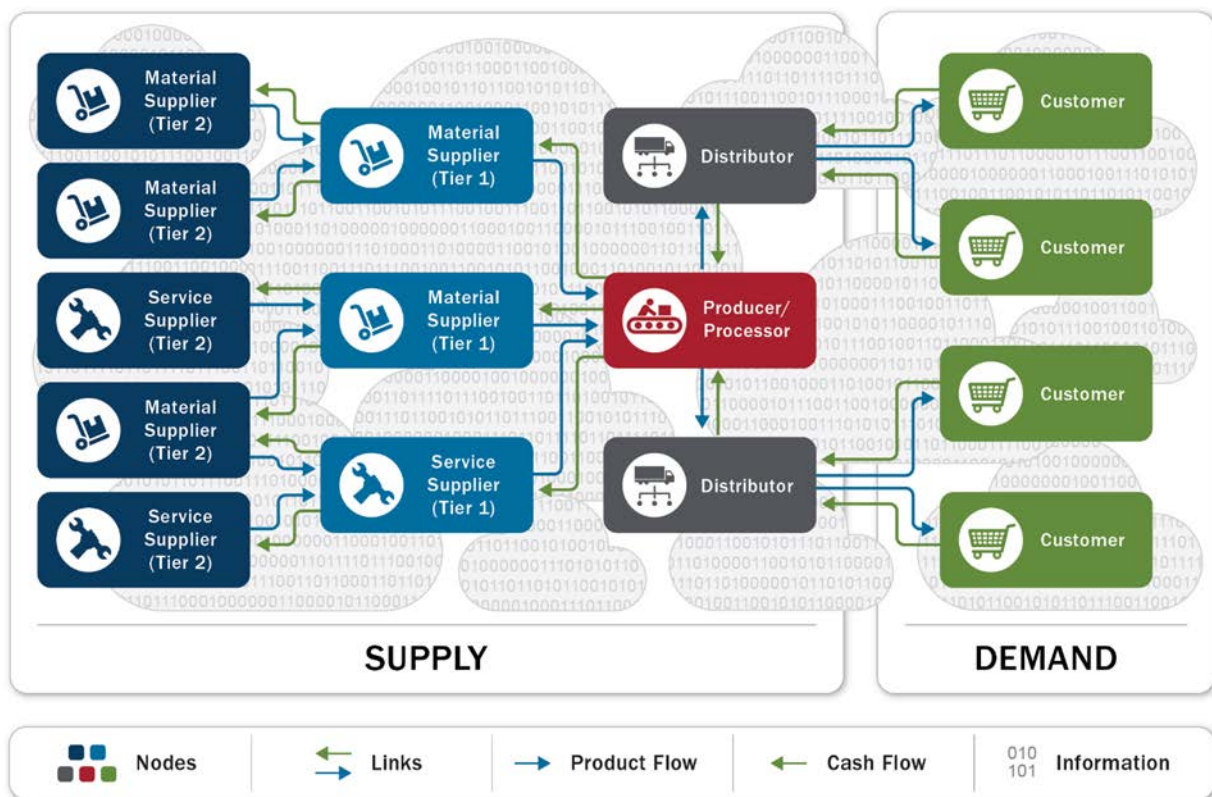


Figure 1: Supply Chain Diagram

Supply Chain Resilience

Supply chains are fundamental to modern life and often fluctuate to address minor disruptions and changes in both supply and demand. However, the common supplemental and gap-filling functions that address minor changes may be insufficient to mitigate significant supply chain disruptions. Disruptions that significantly impede or stop the capability or capacity for a good or service can have a significant impact on communities, particularly in times of disaster.

Supply chain resilience is the ability of a preexisting network of demand and supply to deploy surviving capacity, and/or introduce new capacity, under severe duress. It is the ability of a network, or portion of a network, to continue moving (directing, redirecting, flowing) goods and services even when important elements of the network are no longer operating. For example, the

continued flow of water, food, and fuel while the electric power grid is not operating would be an expression of supply chain resilience.

A meaningful awareness and understanding of preexisting networks, including major players, crucial places, interdependencies, vulnerabilities, and threats, enhances the ability of emergency managers to interact with supply chain owners and operators to support and improve supply chain resilience and post-incident restoration. As is often the case for emergency managers, it is not necessary to have expert knowledge, but there is value in having sufficient awareness and understanding to communicate effectively with experts (and in this case, especially with the owners and operators of the preexisting networks).

All supply chain components, such as the transportation mechanisms between nodes, facilities, people, and communication networks, can impact supply chain resilience. Other examples of attributes that may impact supply chain resilience include:

- Just-in-time inventory practices
- Core reliance on information technology systems and data exchange
- A diverse risk landscape
- Industry consolidation into a small set of large suppliers
- The regulatory environment and constraints on supply chain flexibility.

Supply Chains and Emergency Management

Emergency managers have two primary roles related to supply chain resilience:

- To foster collaboration with and among supply chain partners to promote actions that make supply chains of critical goods and services more resilient.
- To develop an awareness of supply chains and their vulnerabilities and use that information to inform response and recovery planning.

Emergency managers frequently foster collaboration to create and promote resilience efforts across private and public sectors. However, few supply chain players have experience coordinating with emergency managers, and it can be challenging for emergency managers to engage these organizations with disaster planning and resilience-building actions. For example, some regulated public sector and private sector supply chains may require legal actions to build or improve resilience, with an increase in costs transferred to the residents and businesses in the jurisdiction. Other supply chains involve private sector businesses that compete with each other, which can hinder collaboration and hide interdependencies.

As such, emergency managers may need to employ non-traditional approaches to engage some supply chain stakeholders to fully understand the vulnerabilities of the supply chain. For example, one non-traditional approach is to implement seldom-used authorities, such as the Defense Production Act (DPA), to bridge gaps. The DPA has authorities, which Appendix A discusses in detail, that facilitate collaboration by removing barriers between the public and private sectors. The Supply Chain Resilience Process section of this guide includes tips and best practices for engaging supply chain partners in resilience efforts.

The Federal Emergency Management Agency (FEMA) oversees the National Business Emergency Operations Center (NBEOC) to facilitate private sector engagement at the national level. Jurisdictions are encouraged to establish a NBEOC agreement to streamline communications and coordination with private sector members and establish data-sharing agreements.³

One potential way to bolster relationships with supply chain stakeholders is to establish a Business Emergency Operations Center (BEOC) within the jurisdiction's Emergency Operation Center (EOC) and to connect the BEOC to existing private sector EOCs.

To effectively plan for response and recovery operations and support supply chain resilience, emergency managers need an awareness and understanding of the systems that make up a supply chain and the distribution networks that support the jurisdiction.⁴ Emergency managers should also understand the legal constraints that can impact supply chain resilience, such as road and driver restrictions, normal licensing for delivery of medical and food items, restrictions on the movements or storage of medical gases, on-site fuel storage rules, conflicting rules across adjacent jurisdictions, data privacy and availability, and specific legal restraints regarding procurement practices. This knowledge will help emergency managers develop realistic plans and prioritize actions that support supply chain resilience. For example, debris removal is a vital aspect of restoring supply chain functionality. Emergency managers can facilitate public-private sector debris removal plans focused on partnerships with private sector supply chains.

Community Lifelines⁵

Government alone cannot respond to the threats and hazards that affect our communities and citizens. Response is a shared responsibility across multiple stakeholder groups, including governments, the private sector, and non-government entities. Often these groups do not share the same lexicon to facilitate unity of purpose across all stakeholders.

The **community lifelines** construct promotes a response that facilitates unity of purpose and better communication among the whole community (Federal, state, local, tribal, and territorial governments, and private sector and non-governmental entities) to prioritize, sequence, and focus response efforts towards maintaining or restoring the most critical services and infrastructure.

A community lifeline enables the continuous operation of government functions and critical business and is essential to human health and safety or economic security. The seven community lifelines are described below.⁶

³ More information on the NBEOC, including the NBEOC's purpose, operation engagement tools, membership, and commonly asked questions, can be found on the NBEOC fact sheet at <https://www.fema.gov/media-library/assets/documents/28983> or by emailing FEMA-Private-Sector@fema.dhs.gov.

⁴ FEMA *National Mitigation Framework*, Second Edition, June 2016.

⁵ Community Lifelines Toolkit. <https://www.fema.gov/media-library/assets/documents/177222>

⁶ The community lifelines concept is still evolving. Please visit www.fema.gov for more information.



Safety and Security – Supports responder and survivor safety and the continuity of government (including basic services, firefighting, and law enforcement). This lifeline provides critical actions that enable the other lifelines to function.



Food, Water, Sheltering – Supports current and projected community needs for food, water, durable goods, and shelter capacity, as well as evacuations and water and agricultural infrastructure.



Health and Medical – Provides medical care, public health support, pre-hospital care, fatality management services, behavioral health services, and support to the medical industry to ensure life-saving and sustaining services are adequate to meet the needs of the impacted area.



Energy (Power & Fuel) – Provides electric power, gas, and liquid fuel to support the needs of the whole community. It includes electric power generation, transmission, and distribution systems, as well as gas and liquid fuel processing, transportation, and delivery systems. This lifeline supports the whole community's response efforts by enabling all other community lifelines.



Communications – Supports the transmission of information through mechanisms such as broadband internet, ethernet, cellular networks, cable television, and radio broadcast networks. It covers all types of communications necessary to effectively respond to and help survivors, including alerts and warnings, 911 and dispatch, and responder communications. This lifeline supports the whole community's response efforts by enabling all other community lifelines.



Transportation – Enables the movement of goods and services to support the whole community. Transportation infrastructure generally includes highway/roadways, mass transit, rail, aviation, shipping, pipeline, and intermodal systems. This lifeline supports the whole community's response efforts by enabling all other community lifelines.



Hazardous Material – Covers the management (including containment and removal) of all hazardous materials. It focuses on ensuring that hazardous substance facilities, conveyance assets, wastewater systems, and incident debris, pollutants, and contaminants do not require ongoing emergency responses to mitigate imminent or substantial threats to public health and welfare or the environment.

The lifeline construct provides numerous benefits to jurisdictions, such as helping prioritize, sequence, and focus response efforts towards maintaining or restoring the most critical services and infrastructure. In the context of supply chain resilience, lifelines provide jurisdictions with a way to understand and examine complex (multifaceted) supply chains that require cross-sector coordination.

Community lifelines also identify critical focus areas for jurisdictions to consider, as secondary supply chain problems can result from broken lifelines. For example, a break in the power grid can lead to a surge in generator and fuel demand. This in turn impacts local gas prices from surge demand and/or a shortage in generator supply.

Case Study: Resupplying Miami

In the aftermath of Hurricane Irma in 2017, resupply of the Miami metropolitan area was complicated by widespread electrical outages and fuel shortages resulting from mass evacuation. In some cases, resupply of groceries and other key resources into Miami required the resupply of fuel and the restoration of electricity or emergency backup to truck stops along Interstate 95.

Lifelines are often interdependent and widely geographically distributed. When disruption or destruction cascades across multiple critical infrastructures and supply chains simultaneously, timely restoration and possible redirection often benefits from private-public collaboration. In the case of Hurricane Irma, the private and public sectors worked together to expedite restoration of the Energy and Transportation lifelines, including identifying grid connections for truck stops, providing emergency backup generation for truck stops, and delivering fuel to the truck stops. This collaboration also benefitted other lifelines, such as Food, Water, Sheltering.

Supply Chain Resilience Process

Overview

To enhance supply chain resilience, emergency managers should develop a strategic understanding of the current supply chains and engage with relevant stakeholders, such as vendors and industry associations, to foster public-private sector collaboration, cooperation, and planning. This section presents a five-phased cyclical approach to enhance supply chain resilience (see Figure 2).

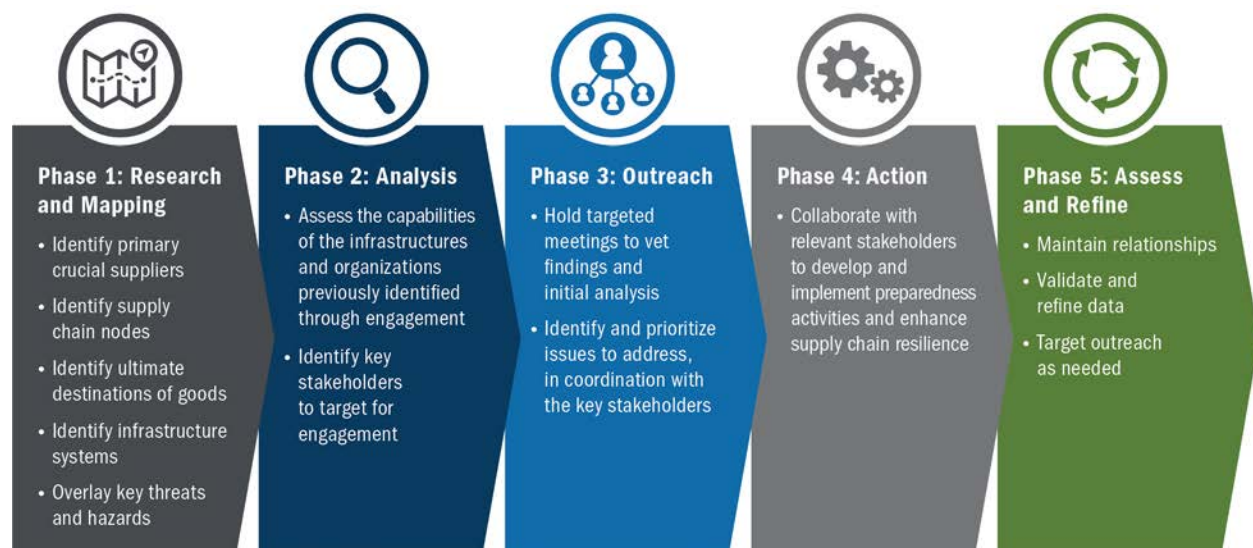


Figure 2: Supply Chain Resilience Phases

Before beginning the five-phase process, emergency managers should identify an initial supply chain to explore. As supply chain networks are complex systems with numerous stakeholders, nodes, and specialized concerns, emergency managers who are just starting to engage supply chain issues may find it helpful to focus on the supply chain for a single good or service, such as groceries or fuel. Developing experience and confidence in one supply chain will often accelerate engagement with multiple supply chains and the interdependencies that supply chains share. As emergency managers become more comfortable with the process, they will find it easier to expand the focus to a community lifeline, which may encompass multiple goods or services (see Appendix B for more information).

The first two phases of the supply chain resilience process, **Phase 1: Research and Mapping** and **Phase 2: Analysis**, use open source data to identify and analyze a supply chain. The goal is to develop a strategic understanding of the supply chain, helping emergency managers identify key stakeholders with which to engage and potentially uncovering supply chain resilience issues.

Phase 3: Outreach engages specific stakeholders to vet the findings from the first two phases and develop collaborative relationships focused on enhancing supply chain resilience.

Phase 4: Action develops and implements preparedness activities, including tabletop exercises, with partners to enhance supply chain resilience. These preparedness activities may include actions that private sector partners can take, either to mitigate disruption of their nodes or links or to create continuity in the event of a disruption. They may also include developing or revising Emergency Operations Plan annexes or logistics plans outlining how the jurisdiction will implement logistics operations in light of potential supply chain issues.

Phase 5: Assess and Refine maintains the effort by refreshing the data and revising the analysis as needed and continuing to collaborate with stakeholders. Supply chains and stakeholders are constantly changing, so an ongoing effort is critical.

The following sections present additional details about each phase of the supply chain resilience process, along with examples of how this process may apply to the fuel sector. Figure 3 on page 17 provides a consolidated graphic of the fuel sector examples.

Phase 1: Research and Mapping

This phase uses readily available data, such as open source information or other available data sets, to identify and map supply chain nodes.⁷ This information, which the emergency manager will analyze in Phase 2, provides important insight into the supply chain's key players. However, given the constantly evolving nature of supply chains, the goal is to develop a *strategic* understanding of the local/regional demand and supply network to identify key supply chain players with whom to engage. A detailed and comprehensive understanding of the global supply chain is not necessary.

To complete this phase, emergency managers should:

- **Identify the primary crucial suppliers for the local community.** Emergency managers may use a variety of sources for this step, such as online searches, local community knowledge, and local economic reports. Strategic plans, Emergency Operations Plans, or other plans and policy documents are also good sources, as they may identify response operational priorities or previously identified supply nodes.
- **Identify supply chain nodes within the scope of the review.** Supply chains are global, so defining a geographic boundary when reviewing each supply chain helps scope the analysis into a manageable size. Boundaries to consider include the state, a region, and/or focusing mainly on “last mile” delivery. It is not practical or necessary to identify all nodes within a supply chain; focus on identifying nodes that serve a large proportion of

Many resources are available to support emergency managers with Research and Mapping (Phase 1) and Analysis (Phase 2). Examples include:

- DHS Infrastructure Protection (IP) partners in the FEMA Regions
- Private sector contractors
- The Regional Resiliency Assessment Program (RRAP) (<https://www.dhs.gov/regional-resiliency-assessment-program>)
- FEMA's Planning Technical Assistance Program (<https://www.fema.gov/fema-technical-assistance-program>).

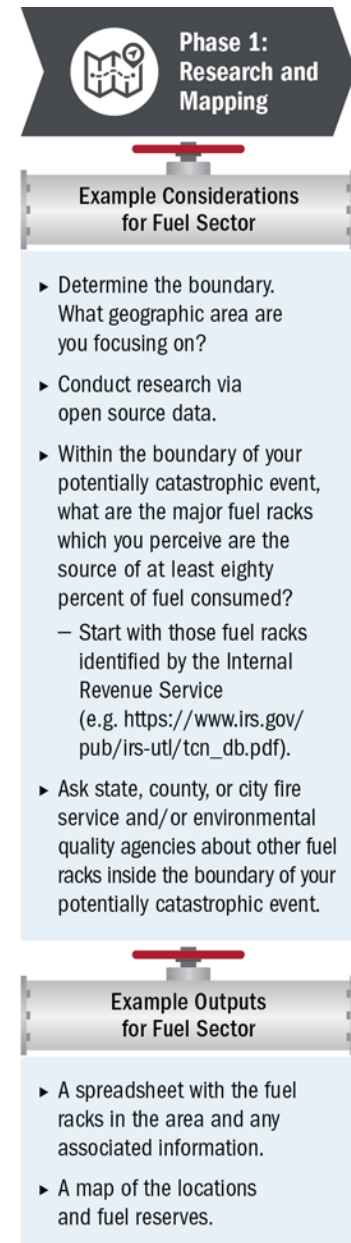
Last mile is the movement of products along the final stretch of the supply chain to deliver products to their final destination, often covering the movement of the product from the distributor to the demand node.

⁷ The NBOEC can assist with establishing data-sharing agreements to support this effort.

demand and/or supply. Concentration occurs in both demand and supply nodes and is especially typical of supply nodes. These points of concentration, such as ports, distribution centers, and fuel terminals/racks, are fundamental to the strategic capacity of the entire supply chain. As long as the point of concentration persists, the capacity to supply the demand is likely to persist. The capacity to supply the demand significantly drops if the point of concentration is destroyed or separated from its network. It is common for 80 percent of key goods and services serving a densely populated area to depend on seven or fewer distribution centers.⁸

- Identify ultimate destinations of goods.** By widening the scope of distribution nodes, emergency managers can obtain a more complete picture of a supply chain. For example, part of supply chain resilience for healthcare goods is knowing the location of healthcare product distribution centers. An expanded understanding of the multitude of end customer sites (such as hospitals, clinics, pharmacies, surgical centers, dialysis centers, and cancer treatment centers) provides information to inform more robust resilience efforts.
- Identify infrastructure systems supporting supply chain operations.** To more fully address supply chain resilience, emergency managers should identify the infrastructure dependencies of key nodes, along with their physical locations. Utility service providers, their geographic service areas, critical utility system nodes, and transportation routes/mechanisms are especially important to rapidly restore normal supply chain operations. Some supply chain infrastructure dependencies are themselves supply chains (e.g., diesel and gasoline fuels) that emergency managers may also need to explore. Electric power, refined fuels, natural gas, water, wastewater, and communications are the infrastructure systems most likely to be dependencies of the various nodes comprising a supply chain, though others will certainly exist.
- Overlay key threats and hazards, and other stressors and disruptors, against the identified primary crucial suppliers.** Hazard Mitigation Plans may provide key threats, hazards, and mitigation strategies for this stage of research. Geographic Information System (GIS) specialists may provide mapping support by overlaying identified hazards across supply chain nodes and known routes.

⁸ The concentrated nature of the wholesale level of the U.S. (and other advanced economies) tends to be referenced sector by sector. In many sectors and for many products, the concentration level is consistently high, but individual players may change from city to city or region to region. Sector-specific articles that support this include [The Pareto rule for frequently purchased packaged goods: an empirical generalization](#), [2018 Top Pharmaceutical Distributors](#), and [Concentration and Mergers in U.S. Wholesale Grocery Markets](#).



Phase 2: Analysis

After identifying and mapping the demand and supply nodes, emergency managers conduct an initial analysis of the supply chain by examining the importance of specific suppliers and nodes previously identified and targeting outreach to these potential stakeholders. In this phase, emergency managers:

- ***Assess the capabilities of the infrastructures and organizations previously identified through engagement.*** Self-assessments may be beneficial in this effort, as stakeholders can self-disclose their capabilities, plans, and partnerships for further planning coordination. Most contemporary demand and supply networks are diverse, dynamic, and very difficult to fully comprehend, but the intent is to think through key questions and identify and document the information available.

Distinguish between the nodes that comprise a supply chain (such as manufacturing facilities and hospitals) and the infrastructure that those nodes depend on (such as electric power, water systems, and transportation). The distinction is important, as the two groups of systems/nodes need analysis from different perspectives. For example, a power company that serves key supply chain nodes may be able to offer anticipated recovery time objectives for service to that area following a disruption. This is a helpful detail for comparison against the supply chain node's on-site backup power capabilities and the length of time that it can operate without refueling. If power restoration recovery time objectives are longer than the length of time that the supply chain node can operate on backup without significant impact to operations, then there is a resilience gap.

Examples of key questions to include in the analysis process:

- Can you determine sources of strategic capacity?
 - Can you identify the *potential downstream flow* of water, food, pharmaceuticals, medical goods, fuel, and other key goods and services?
 - What is the volume and velocity of these flows on most days? What is the regular throughput?
 - How quickly can volume increase and be distributed?
- Based on your research and mapping phase, where is the strategic capacity of preexisting supply chains located?
 - Who owns this strategic capacity?



Phase 2: Analysis

Example Considerations for Fuel Sector

- ▶ Using public records (tax, property, Securities and Exchange Commission, environmental quality, etc.) assess comparative size and probable through-put of racks identified. Focus on the smallest number needed to achieve 80% of fuel consumed.
- ▶ Who are the principal customers (carriers) from the fuel racks? (*This may be unknowable until Phase 3*)
- ▶ Given the nature of your potentially catastrophic event and the location of the fuel racks, what are likely risk consequences for the facilities? What worries you the most?
- ▶ Based on all of this research, determine what key fuel sector partners should be targeted for outreach. Consider:
 - Dependencies or interdependencies that have the broadest impact.
 - External entities that are most important to enhancing fuel supply resilience.
 - Existing relationships.
 - What is the mobile fuel delivery capability?

Example Outputs for Fuel Sector

- ▶ Additional fields filled in on the fuel sector spreadsheet.
- ▶ Potential development of map or graphic that shows the interdependencies with other resources.
- ▶ List of stakeholders to engage.

- What, if any, elements of this strategic capacity are likely to survive your jurisdiction's catastrophic risks?
- Who are the key players? In many cases, capacity has significant concentrations; identify the seven or fewer sources that are likely to generate 70 to 80 percent of total flows.
 - Is current strategic capacity already insufficient in some geographic areas (for example, areas with a lack of grocery stores and food providers)?
 - Are risks especially likely to create particularly troublesome new deficiencies in any geographic areas?
- Are your sources of strategic capacity dependent on or interdependent with critical infrastructure or other key resources?
 - If these dependencies fail, are mitigation strategies and measures in place?
 - What is your professional judgment regarding the survival of sufficient strategic capacity for key resources?

Appendix B provides additional considerations specific to supply chains for all seven community lifelines—Safety and Security; Food, Water, Sheltering; Health and Medical; Energy (Power & Fuel); Communications; Transportation; and Hazardous Material.

- **Identify key stakeholders to target for engagement.** Based on the answers to the previous analytical questions, identify where to focus outreach efforts for Phase 3. Consider the following questions when identifying stakeholders to target:
 - What are the highest priority needs?
 - What are the dependencies or interdependencies that have the broadest impact?
 - Given your risks and your population needs, which element(s) of the supply chain would enhance resilience to serve the highest number of, or perhaps most vulnerable, survivors?
 - What external entities are most important to enhancing supply chain resilience?
 - What functions or roles are most important?
 - Among these priorities, where or with whom do you already have trusted relationships?
 - Is the trusted relationship with a supply chain professional? If not, can the trusted party provide an appropriate introduction?

Phase 3: Outreach

After analyzing the supply chain, emergency managers can engage with key stakeholders, including private sector organizations, relevant jurisdictions, and other community partners, to vet their findings and begin the collaboration process. Whenever possible, outreach should involve supply chain professionals, including distribution center managers, procurement managers, and transportation managers. However, in some organizations, supply chain professionals may be difficult to engage and are often introduced through contacts with safety, security, and external relations professionals. Successful outreach often depends on finding at least one internal champion. The champion is not always a supply chain professional but is someone who can ensure the direct participation of supply chain professionals. In some contexts, supply chain resilience problems and opportunities require involvement of senior executives. In this case, it may be necessary for senior emergency management or political leadership to reach out. However, this should be done in close communication with the supply chain and other professionals already engaged.

In this phase, emergency managers:

- ***Hold targeted meetings to vet findings and initial analysis.***
Reach out to the identified stakeholders to initiate discussions about current priorities, concerns, and knowledge of supply chain resilience. The organizations involved with supply chains are predominantly private sector entities. These partners may already have emergency management considerations in company plans, trainings, and experience. Consider these best practices when initiating and holding discussions with supply chain stakeholders:
 - When opening a new relationship, it may be helpful to visit the other party's place of business for a one-on-one informal discussion. This approach can help build rapport and trust, which is critical to the success of the effort.
 - Consider asking for a tour of their facilities. This is often a good starting point, as the organization may enjoy showing off their facility, and it provides you with the opportunity to ask naturally occurring questions about how they operate, which will often serve to confirm or deny aspects of your Phase 2 analysis.
 - A discussion, and cultivating trust, is more likely to emerge from asking questions than from making



Phase 3: Outreach

Example Considerations for Fuel Sector

- ▶ Hold targeted meetings with fuel sector partners.
- ▶ Provide a brief presentation on catastrophic risk profiles and ask the partners how and where the risk profile has the most potential impact on their supply chains.
- ▶ Outline the desired end state, get their feedback, and be flexible to adjusting your goal.

Questions for Key Partners:

- ▶ What can we do for you/ what do you hope to get from this partnership?
- ▶ What types of fuel issues do you want us to prioritize?
- ▶ Are there any pre-existing relationships/agreements between the fuel company and other private sector companies or the public sector?
 - Do they use facilities of other companies?
- ▶ Do these fuel companies subcontract? If so, to who?
- ▶ Repeat questions from Phase 2 and review/verify research from Phase 1.

Example Outputs for Fuel Sector

- ▶ Data in the fuel sector spreadsheet is supplemented and verified.
- ▶ List of prioritized issues for future meetings/collaboration.
- ▶ Revised outline/description of end-state goal.

statements. The same sort of questions asked in the prior analysis phase can be a good place to begin.

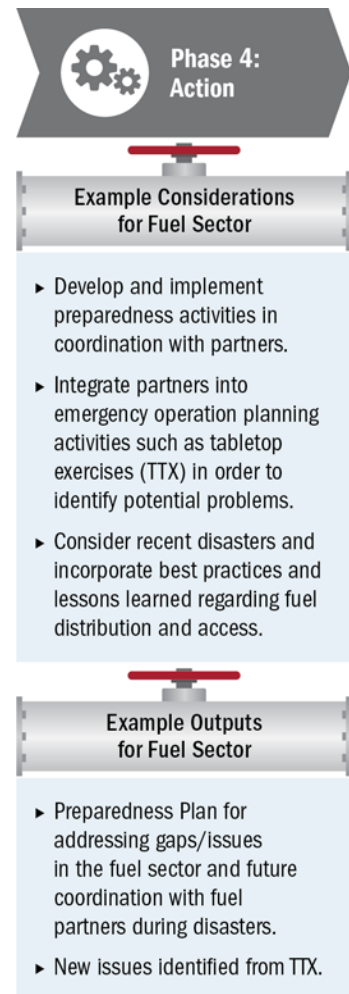
- Consider asking how you can support the private sector in building more resilient supply chains.
 - Explain your concept for catastrophe preparedness and outline the desired end state. Emphasize the importance of their organization to the effort.
 - Some private sector entities are not familiar with catastrophic risk profiles. After a brief presentation, ask the individual(s) how and where the risk profile has the most potential impact on their supply chains.
 - Meaningfully vet the outcomes of your analysis, and assess the collaborative readiness of a supply chain owner/operator. In two or three one-on-one (or small group) meetings. In many cases, finding one or two market leaders ready to collaborate will help encourage others to participate. Typically, at the point you perceive that at least three entities constituting at least fifty percent of your jurisdiction's strategic capacity are ready to collaborate, a more group-oriented process may be productive. A checklist for the group process is in Appendix C.
 - Consider meeting with both the private sector organization's operational leaders and the public relations staff to clarify roles/responsibilities as they relate to either operational requirements and/or messaging.
- ***Identify and prioritize issues to address, in coordination with the key stakeholders.*** This process may take various forms depending on the preferences of the participants. One common approach is to use tabletop exercises to identify critical issues. As the exercises identify issues, emergency managers and stakeholders can work together to prioritize them. The criteria for prioritization will vary from group to group, but consider the criticality of the issue and the feasibility of developing an economical approach to mitigating or resolving the issue.

Phase 4: Action

After engaging with key stakeholders and identifying/prioritizing issues to address, emergency managers can ***collaborate with relevant stakeholders to develop and implement preparedness activities and enhance supply chain resilience.***

Supply chain resilience is a still-developing discipline of emergency management. Depending on purposes, private-public relationships, and priorities emerging from the research and outreach phases, different jurisdictions will deploy different actions. In many of the most mature examples of action taken to enhance supply chain resilience, tabletop exercises (TTXs) have been especially helpful. Private sector entities seem to value the ability of emergency management professionals to convene various stakeholders, frame supply chain risks, design and execute realistic TTXs, facilitate action-oriented discussion, and deliver After Action Reports that drive future collaboration and follow-on exercises.

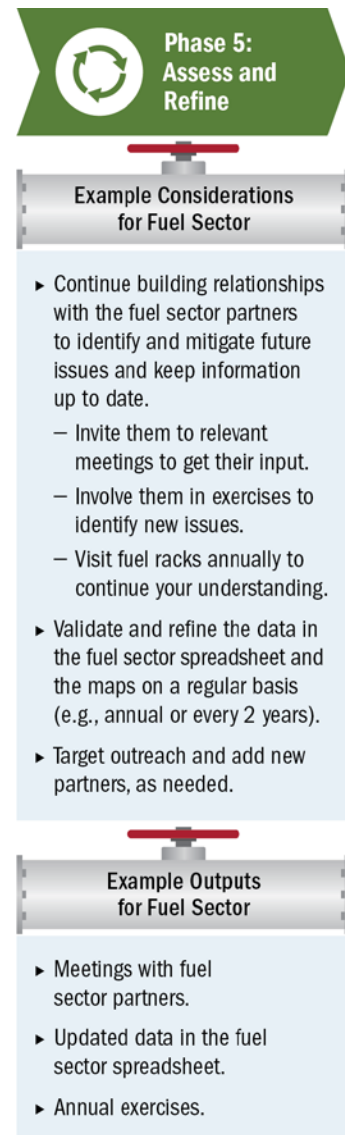
In some cases, a recurring calendar of private-public workshops and TTXs is hosted by a civic sector organization (professional or academic entity) that serves as a helpful broker between private and public, a source of operational continuity, and a safe place for very different stakeholders to interact.



Phase 5: Assess and Refine

After reviewing a supply chain, creating partnerships, and developing a resilience plan, maintenance begins. Supply chains evolve so rapidly that resilience requires continuous collaboration with stakeholders and reviewing and refining data, analysis, and plans. In this phase, emergency managers:

- **Maintain relationships.** It is essential to maintain the relationships built through this process. Some ways include holding annual reviews and recurring discussions with stakeholders and engaging stakeholders in relevant exercises throughout the year.
- **Validate and refine data.** The constantly evolving nature of supply chains means the data collected throughout this process can change quickly. While it is not necessary to constantly monitor and update every detail, it is important to frequently review and refine the data. This may include independent research by emergency managers, as well as regular conversations with key stakeholders to identify changes. Training and exercises can also support this step. Incorporate identified changes to refine plans or develop new plans to enhance supply chain resilience.
- **Target outreach as needed.** While maintaining the relationships developed through this process is crucial, it is also important to identify other important stakeholders and target outreach to them, as needed. For example, as supply chains evolve, emergency managers may identify new crucial suppliers, whom they should then engage in the supply chain resilience process.



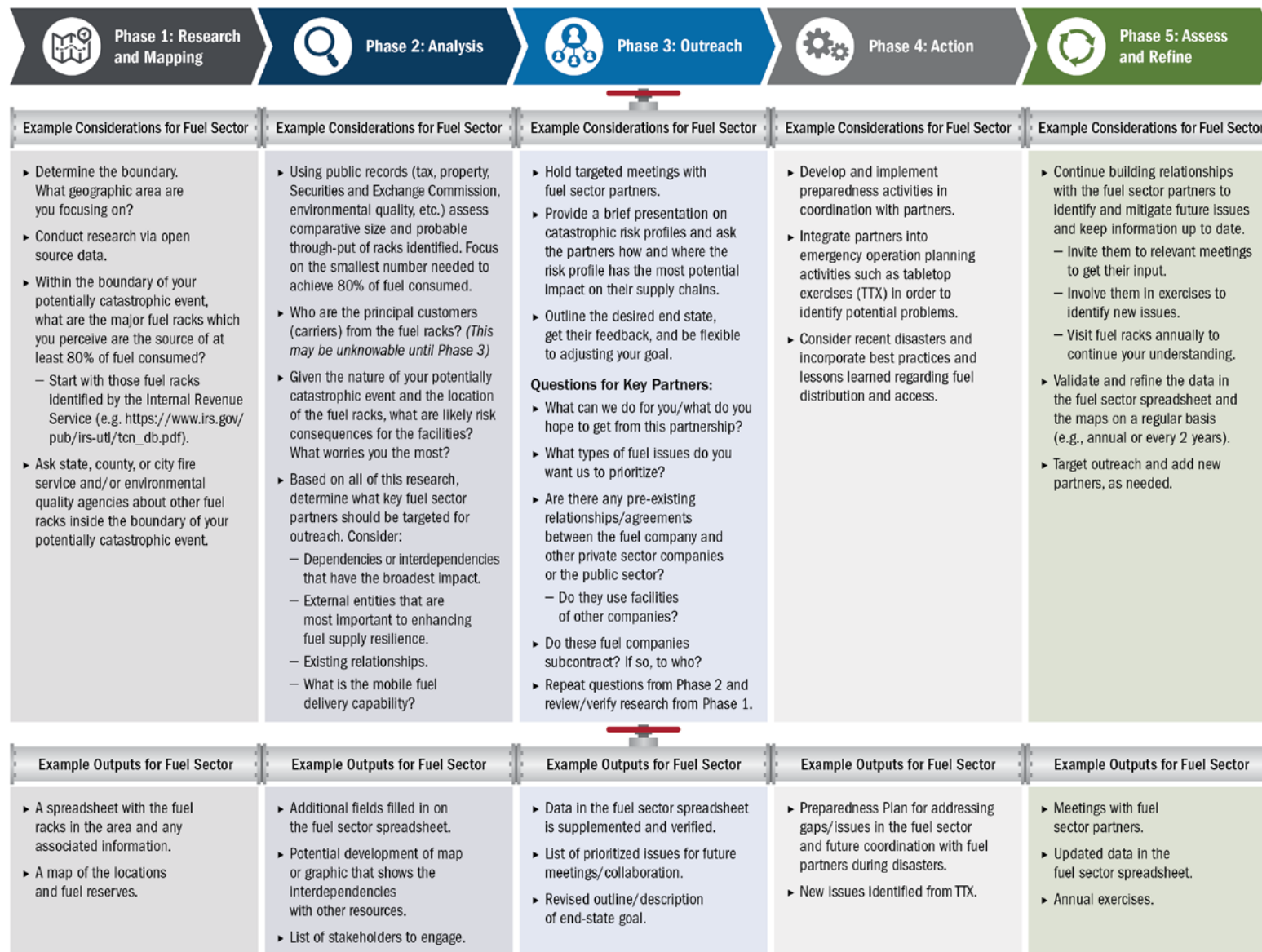


Figure 3: Supply Chain Resilience Process – Fuel Sector Example

This page intentionally left blank

Connection to Logistics Planning

Overview

The supply chain resilience process described in the previous section focuses on understanding supply chain vulnerabilities and identifying actions to enhance resilience. However, in extreme events, supply chains will not always be resilient. For example, disasters can destroy nodes, separate demand from sources of supply, destroy road networks, or create long-term disruption. While many impediments are possible, some are predictable.

The results of the five-phased supply chain resilience process provide emergency managers with valuable information to inform actions to restore supply chains and priorities for logistics planning. It yields an understanding of key supply chain stakeholders, vulnerabilities, and challenges and identifies actions emergency managers may need to take in the event of supply chain disruption. Emergency managers should use this information to develop or refine logistics plans or annexes, following the six-step planning process described in *CPG 101* (see Figure 4).⁹



Figure 4: Six-Step Planning Process from CPG 101

For example, identifying key supply chain stakeholders through the supply chain resilience process provides emergency managers with critical potential members for the Collaborative Planning Team (Step 1). Additionally, emergency managers can apply the outcomes from the supply chain resilience process to understand the situation (Step 2), as well as to establish or refine operational priorities and develop goals and objectives (Step 3).

Considerations

This section presents additional considerations that emergency managers may want to explore to develop a unified approach to restoring community lifelines: restoring private sector supply chains and public sector logistics planning. Emergency managers may have uncovered some of these answers during the supply chain resilience process or may need to conduct additional analysis efforts to identify necessary details.

To effectively inform logistics planning, emergency managers should examine known and potential hazards plotted along the supply chain, alternate routes, alternate methods of transportation, and any known restrictions of storage, handling, and/or transportation. Their analysis should address both the supply chain nodes (e.g., manufacturing sites, storage facilities, distribution facilities, customers' receiving sites), as well as the infrastructure on which these nodes depend. For example, it is important to include the power infrastructure that provides service to a key tunnel along a main supply route, as without power the tunnel may need to be closed due to inoperable ventilation systems.

⁹ FEMA, *CPG 101: Developing and Maintaining Emergency Operations Plans, Version 2.0*, (Washington, DC, 2010), <https://www.fema.gov/media-library/assets/documents/25975>.

Supply Source

Supply nodes may be overseas, across the country, or in a hazardous area. Consider what potential events may impact supplier production (e.g., extreme weather or natural disasters, political upheaval, national holidays). Steps include:

- Identify the origin of supplies, tracing the supply chain as far upstream as practical.
- Review relevant foreign customs and holidays.
 - Some countries shut down factory work for several days, even weeks, each year to celebrate holidays.
- Consider alternative supply sources.
 - To what extent do customers have secondary contracts? How easily could customers turn to new sources in a major event?
 - What plans and capabilities do suppliers have as part of their business continuity plans? Are they likely to fill a gap with limited or no direct involvement by government?

Distribution Points

Emergency managers should review the distribution points for the supply chain within the network under review. Multiple distribution points may help reroute supplies to other distribution centers to alleviate some local distribution strain during disasters.

Reviewing multiple modes of distribution may help planning teams identify stakeholders to include in planning efforts. Steps include:

- Review distribution points:
 - Determine the need to prioritize route clearances, restore power, water, and communication, and provide staff access.
 - Coordinate with other jurisdictions to inform them of the importance of distribution points if they are located outside of your jurisdiction.
 - Identify legal/regulatory restrictions that could impede an easy transfer to another distribution location (e.g., required licensing to service a given destination, such as with certain pharmaceuticals).
 - Identify specialized capabilities or needs of certain distribution points (e.g., cold chain/refrigeration, reliance on automation and information technology).
 - Identify the second- and third-tier backup sites for the primary points of distribution, and determine potential delays, cost increases, or transport options.
 - Identify alternative facilities that can be used to reroute supplies.
 - Consider multiple modes of distribution.
- Consider door-to-door delivery service, such as how the Postal Service delivers medication.
- Include supply chain distribution points in logistics planning to provide community lifeline support.

Inventory

Supply chains provide community lifeline goods and services to the jurisdiction pre-disaster. Post-disaster, the jurisdiction may need to augment a community lifeline that supply chains temporarily cannot provide. During logistics planning, emergency managers should review standard inventory supply, resupply intervals, storage facilities or compartments and their power requirements, and Just-In-Time restock options during emergency scenarios. Just-In-Time resupply adaptability may mitigate short-term breaks in the supply chain.

Additional steps include:

- Consider the process to invoke government-managed emergency stockpiles for food, water, and healthcare.
 - Will this help or harm recovery of supply chains?
- Determine if the capability and capacity of supply chains' inventory status is available to emergency managers.
 - Are companies likely to provide detailed data, and could anti-competitive/legal concerns arise?
 - Consider how purely commercial interests may adversely harm restoration of the normal supply chain (e.g., hoarding supplies out of concern for shortages, exacerbating the shortages).
- Review standard inventory supply.
 - Review resupply intervals.
 - Review Just-In-Time restock opportunities.
 - Consider seasonal influxes.
 - Consider temperature-sensitive stock.
- Review secondary power source options.
 - Backup generators.
 - Fuel for the generators.
 - Consider additional equipment, such as cables, hookups adaptors, and batteries.

Access and Re-entry¹⁰

Supply chain logistics, partnerships, and memoranda of understanding (MOUs) should consider route security and escort needs. Local police departments and military units may be sources of security during emergency events. Restricted area access and security at the point of distribution may require additional communication. To prevent denial of entry, personnel stationed at the checkpoints along the route, at barriers, and/or at the facility need to be aware of what is in the

¹⁰ The *Crisis Event Response and Recovery Access (CERRA) Framework*, developed by the DHS Office of Infrastructure Protection, outlines a common approach to manage access to affected areas during and after an incident. For more information, visit <https://www.dhs.gov/sites/default/files/publications/Crisis%20Event%20Response%20and%20Recovery%20Access%20%28CERRA%29%20Framework.pdf>.

shipment and the destination. Planning teams should consider procedures for clearance, checkpoint access, and facility access. Steps include:

- Determine who is responsible for granting access.
- Coordinate communication approaches, including who will send what message and through which pathways.
- Develop message templates for resuming operation of supply chain nodes, activating emergency supply chain routes, and/or providing route security.
- Determine if supply chain stakeholders/product transporters are aware of, and enrolled in, local emergency access programs.
 - What gaps/inadequacies exist with these programs that may exclude critical organizations (e.g., private medical product suppliers that are often not considered emergency-access-eligible)?

Access Case Study: Impact to Community Water and Wastewater Services¹¹
Excerpts from *Crisis Event Response and Recovery Access (CERRA) Framework Case Study*

Challenge: Coordinating access management and control during emergencies to support community water and wastewater services.

Scenario Summary: A significant, geographically widespread incident has occurred that has affected public drinking water and wastewater treatment operations, as well as distribution and collection systems. Local authorities have established checkpoints to restrict access to emergency zones across multiple jurisdictions, many of which contain water and wastewater utility assets that must be immediately assessed for damage or repaired to maintain water and wastewater services for critical infrastructure facilities, response and recovery operations, and public consumption requirements.

Access Challenges:

- During emergencies, water and wastewater utility personnel may need the same degree of access as other first responders to enable emergency response operations or to maintain municipal and community lifelines (e.g., water and wastewater utility personnel often require prompt access to damaged assets both at the treatment facility and within the distribution or collection systems [e.g., pump or lift stations, damaged water lines], even though they may not be directly involved in the lifesaving portion of the incident).
- Local access program managers may need to coordinate access requirements with neighboring jurisdictions for water and wastewater utility assets dispersed across large areas, with additional support from state or Federal entities during large-scale incidents.
- Ensuring the ability to identify and support access by water and wastewater utility chemical suppliers, fuel delivery, and mutual assistance assets (e.g., assistance provided through the Emergency Management Assistance Compact) may be difficult if they are not pre-registered in the local access program or known to local authorities.

¹¹ DHS *Crisis Event Response and Recovery Access (CERRA) Framework*, March 2018, <https://www.dhs.gov/publication/crisis-event-response-and-recovery-access>.

- Pre-plan to contend with multiple access and reentry rules as a single supplier passes through different jurisdictions (for example, when the end destination allows reentry, but outer jurisdictions that must be traversed do not).
 - Review initial access procedures to emergency supply chain nodes.
 - Review re-entry access procedures to emergency supply chain nodes.
 - Are there differences between initial access and re-entry?
 - Identify communication procedures:
 - When supply nodes resume operation.
 - For emergency routes.
 - When providing route security and/or escorts.
 - Review route security and/or escort procedures.
 - Clearances for transportation, supply and distribution nodes.
 - Checkpoint access along emergency route.
 - Facility access.
 - Consider Restricted Areas access and procedures.
- Consider waivers.

Routes

One way to analyze a supply chain is to review the normal means of transportation and the normal routes. Supply chain logistic plans should identify main supply routes and alternative routes. Following a disaster, jurisdictions may waive special considerations such as weight and noise restrictions on routes (other restrictions, such as height for roads under bridges, and hazardous or flammable materials, may not be waived). Planning teams should consider debris management plans (who will clear which roads first, and where the debris will go). Steps include:

- Review normal transportation.
- Review normal routes.
- Identify main and alternative routes.
- Review special considerations on route restrictions.
- Consider waivers.
- Consider varying modes, including the delivery of supplies into the region/jurisdiction by rail, marine, air.
 - What options exist to alter modes to continue product deliveries (e.g., switch to barge when bridge/tunnel access to a water-bound city is impeded)?
- Consider debris management.
 - Partner with the private sector. Consider if local entities can clear debris on their property to expedite supply chain recovery.

Fuel

Consider vehicle type and fuel in supply chain logistics, as different supply vehicles may require different types of fuel. Diesel is common, as well as gasoline and flex-fuel vehicles.

Fuel access, stockpile, and re-supply procedures are crucial for supply chain recovery. Steps include:

- Identify the vehicle fuel types required.
- Identify all support requirements needed to operate the fuel supply chain (e.g., backup generators, security).
- Consider access to fuel at distribution centers.
- Determine normal fuel operations.
- Consider stockpiling emergency fuel.
 - Identify when, how, and who will receive emergency fuel.

Transportation Operators

Supply chains function across air, land, and sea. Authorization and availability of pilots, drivers, and captains may require specific considerations for various supply chains. For example, in healthcare supply chains, strict rules relate to who may transport certain products and the tracking and accountability of these products. Requirements for temperature and environmental controls may limit the transporters that can provide the service.

Transportation operators often rely heavily on information technology and communications to direct their movements and deliveries. Consider what, if any, plans exist to address loss of these normal capabilities.

Large-scale disasters can significantly diminish available transport staff, drivers, and dispatchers. Union member operators and volunteer operators may have different regulations for operation than other private or public operators. Pre-standing MOUs with unions, volunteer organizations, and private/public sector entities may alleviate a lack of authorized drivers in an emergency.

Transportation operators may need clearances to transport materials and/or enter facilities. Personnel entering secure areas of maritime facilities and vessels require the Transportation Worker Identification Credential (TWIC)¹² and fuel truck drivers require site-specific certifications before they can receive fuel at individual distribution terminals.

Steps include:

- Review transportation operators' regulations:
 - Union members.
 - Volunteers.
 - Clearances required, including TWIC.

¹² Transportation Security Administration TWIC website, <https://www.tsa.gov/for-industry/twic>.

Appendix A. Defense Production Act

The Defense Production Act (DPA)¹³ is the primary source of Presidential authorities to expedite and expand the supply of critical resources from the United States private sector to support national defense. The DPA broadly defines national defense to include emergency management preparedness, response, and recovery activities. Emergency preparedness activities, which are a component of national defense, include measures designed or undertaken to:

- Prepare for or minimize the effects of a hazard upon the civilian population;
- Deal with the immediate emergency conditions, which the hazard would create; and
- Effectuate emergency repairs to, or the emergency restoration of, vital utilities and facilities that the hazard destroyed or damaged.

DPA is a Federal authority that states, localities, tribes, and territories can petition to use, and approval is considered on a case-by-case basis. Private sector critical infrastructure owners can also petition for DPA use to protect and restore their critical infrastructure.

DPA is primarily used for prioritizing resources both in the planning process and in response and recovery activities. The contracting process executes DPA priority ratings. DPA priority-rated contracts receive preferential treatment from contractors and supporting subcontractors and suppliers to meet delivery dates and quantities. This authority, in effect, places these rated contracts at the head of the line, in front of all other unrated contracts.

DPA encompasses the term “critical infrastructure protection and restoration” in its definition of national defense. The DPA defines “critical infrastructure” to mean “any systems and assets, whether physical or cyber-based, so vital to the United States that the degradation or destruction of such systems and assets would have a debilitating impact on national security, including, but not limited to, national economic security and national public health or safety.”

Requesting DPA Priority Ratings

The process starts with a request from a state, local, tribal, or territorial government or owners/operators of private sector critical infrastructure for a priority rating. DPA requests can go to different organizations in various ways, but during Presidentially declared disasters, requests should go to the Federal Coordinating Officer at the Joint Field Office. The Federal Coordinating Officer will determine whether to support the request and initiate coordination accordingly. Outside of a disaster, such as preparedness planning, the state, local, tribal, and territorial governments should refer to the FEMA Regional staff to initiate coordination.

¹³ The Defense Production Act of 1950, as Amended (50 U.S.C. App. 2061 et seq.) <https://www.fema.gov/media-library/assets/documents/108022#>.

- **Step 1 (Request)** – The Federal Coordinating Officer should notify the supporting FEMA Region and the National Response Coordination Center (NRCC) of the request and provide comments on whether to approve the request or not.
- **Step 2 (Operational Priority)** – The Resource Support Section Chief in the NRCC identifies the stakeholders who should work together to determine if this should be an operational priority. In conjunction with these stakeholders, the Federal Coordinating Officer, and the supporting FEMA Region, the Resource Support Section Chief will determine if this request is an operational priority and whether to support the request.
- **Step 3 (Approval)** – If the request is approved, FEMA works with the appropriate Federal department to obtain a priority rating. The Federal Coordinating Officer will provide the rating to the jurisdiction or private sector organization requesting the priority rating.
- **Step 4 (Implementation)** – The private sector organization or jurisdiction places the priority rating in its contracts in accordance with the applicable Federal statutes and regulations.

Establishing a Voluntary Agreement

Voluntary agreements allow key business sectors that are likely to be severely impacted by catastrophic disasters, or suppliers of critical materials or services for disaster response and recovery, to coordinate emergency preparedness plans and actions. A voluntary agreement allows cooperation among what otherwise may be business competitors to expedite or expand the supply of critical materials or services to meet national defense needs, including emergency preparedness, response, recovery, and mitigation activities and critical infrastructure protection and restoration. Sectors that could respond more effectively with coordinated emergency response plans might include, for example, data processing and storage for financial and other vital business records and construction for repair and rebuilding of damaged infrastructure.

The steps to establish a voluntary agreement include:

- **Step 1 (Request)** – Forward request for voluntary agreements to the Federal Coordinating Officer, the primary Federal interface with jurisdictions and private sector owner/operators of critical infrastructure. The Federal Coordinating Officer should notify the supporting FEMA Region and the Resource Support Section in the NRCC of the request and comment on whether to approve the request.
- **Step 2 (Sponsor)** – The process for establishing a voluntary agreement starts with identifying a Federal sponsor for the private sector organizations that the agreement will represent. Contact the FEMA DPA Program Division at FEMA-OPPA-DPA@fema.dhs.gov or (202) 212-3441 for assistance finding a sponsor.
- **Step 3 (Initial Approval)** – FEMA coordinates with the Department of Justice to obtain the initial approval from the Attorney General. This approval allows the sponsor to consult with private interests about establishing an agreement.
- **Step 4 (Meetings)** – Conduct publicly announced meetings to establish the agreement.
- **Step 5 (Final Approval)** – The Attorney General provides final approval to implement the agreement, along with a finding that a voluntary agreement is needed (See 44 CFR 332.2 for more details).

Appendix B. Community Lifeline Framework

Community lifelines provide a common lexicon to facilitate unity of purpose among the whole community (Federal, state, local, tribal, and territorial governments, and private sector and non-governmental entities) to prioritize, sequence, and focus response efforts towards maintaining or restoring the most critical services and infrastructure. In the context of supply chain resilience, community lifelines identify critical focus areas for jurisdictions to consider. Community lifelines also provide jurisdictions with a way to understand and examine complex (multifaceted) supply chains that require cross-sector coordination.

This section presents questions and examples that may be helpful in jumpstarting a jurisdiction's identification of the nodes, links, and flow related to the seven community lifelines:

- Safety and Security
- Food, Water, Sheltering
- Health and Medical
- Energy (Power & Fuel)
- Communications
- Transportation
- Hazardous Material.



Safety and Security

The Safety and Security lifeline supports responder and survivor safety and the continuity of government (including basic services, firefighting, and law enforcement). This community lifeline provides critical actions that enable the other lifelines to function.

- What goods or services are essential to provide this lifeline? Examples:
 - Emergency medical transportation, high-water vehicles, rescue rafts
 - 911 Call Center operations, public safety communications network
 - Fuel for public safety transportation and backup generation
- Where do these goods or services originate (where are the supply nodes)? Examples:
 - 911 Call Centers
 - Police precincts, fire stations
- Where are these goods or services stored or deployed (where are the demand nodes)? Examples:
 - Police cruisers, fire suppression vehicles, ambulances, incident command post, base, and staging areas

- Neighborhoods, private homes, schools, commercial properties, hospitals, clinics
- Forward-deployed professional safety and security personnel
- Disaster response and recovery shipments
- Access and re-entry points
- How are these goods or services delivered? (Where are the links? How is demand expressed? How do goods or services move from supply nodes to demand nodes? What is minimally needed to start the flow? What is minimally needed to sustain the flow?) Examples:
 - Surface transportation network, trucking, fueling, and related
 - Demand is typically expressed through telecommunications
 - Telecommunications dispatch is usually needed to sustain the flow



Food, Water, Sheltering

The Food, Water, Sheltering lifeline supports current and projected community needs for food, water, durable goods, and shelter capacity, as well as evacuations and water and agricultural infrastructure.

- What goods or services are essential to provide this lifeline? Examples:
 - Fresh food, consumer packaged goods, other groceries
 - Prepared food, bottled water, bulk water, other beverages
 - Foods for infants and young children
 - Residential housing market: builders, brokers, lenders, information resources
 - Emergency shelters
- Where do these goods or services originate (where are the supply nodes)? Examples:
 - Grocery distribution centers, wholesalers, food processing facilities
 - Institutional and commercial food distribution centers
 - Preexisting houses, condominiums, and multifamily housing complexes
- Where are these goods or services stored or deployed (where are the demand nodes)? Examples:
 - Grocery stores, convenience stores, bodegas, and other food retailers
 - Restaurants, fast-food outlets
 - Shelters, feeding stations, commodity points of distribution (PODs)
 - Real estate brokers, rental housing centers, online search providers
- How are these goods or services delivered? (Where are the links? How is demand expressed? How do goods or services move from supply nodes to demand nodes? What is minimally needed to start the flow? What is minimally needed to sustain the flow?) Examples:
 - Surface transportation network, trucking, fueling, and related

- Cash, credit card, and Electronic Benefit Transfer (EBT) card transactions¹⁴
- Readiness to receive, especially related to on-site electricity and personnel
- Readiness to receive commodities (e.g., bottled drinking water, packaged food), stage, and deliver to commodity PODs and end users



Health and Medical

The Health and Medical lifeline provides medical care, public health support, pre-hospital care, fatality management services, behavioral health services, and support to the medical industry to ensure life-saving and sustaining services are adequate to meet the needs of the impacted area.

- What goods or services are essential to provide this lifeline? Examples:
 - Medical goods
 - Pharmaceuticals
 - Medical gases
 - Medical professionals
- Where do these goods or services originate (where are the supply nodes)? Examples:
 - Medical goods and pharmaceutical distribution centers, corporate supply centers, warehouses, and refrigerated storage
 - Hospital and other pharmacies
 - Clinics and expeditionary emergency facilities
 - Home healthcare providers
- Where are these goods or services stored or deployed (where are the demand nodes)? Examples:
 - Ambulances, incident command post, base, and staging areas
 - Hospitals, clinics, nursing homes, specialty treatment centers, home healthcare providers
 - Emergency shelters, points of dispensing
- How are these goods or services delivered? (Where are the links? How is demand expressed? How do goods or services move from supply nodes to demand nodes? What is minimally needed to start the flow? What is minimally needed to sustain the flow?) Examples:
 - Demand is typically expressed by telecommunications or by those in need physically presenting themselves at a demand node (e.g., hospital or clinic)
 - Delivery requires medical professionals with diagnostic and treatment assets
 - Sustained flow requires resupply of diagnostic and treatment assets (especially pharmaceuticals and medical goods), pure water, a clean physical environment, and some source of electricity, especially for diagnostic equipment

¹⁴ EBT is an electronic system that allows a recipient to authorize transfer of their government benefits from a Federal account to a retailer account to pay for products received. See <https://www.fns.usda.gov/snap/what-electronic-benefits-transfer-ebt>.

- Delivery mode may include maritime, aviation, freight rail, and trucking fleet (independent drivers or corporate transportation company, truck yards)



Energy (Power & Fuel)

The Energy lifeline provides electric power, gas, and liquid fuel to support the needs of the whole community. It includes electric power generation, transmission, and distribution systems, as well as gas and liquid fuel processing, transportation, and delivery systems. This lifeline supports the whole community's response efforts by enabling all other community lifelines.

- What goods or services are essential to provide this lifeline? Examples:
 - Grid continuity or rapid repair, utility mutual aid, transformers, powerlines
 - Backup generation pre-wired or in place
 - Flow of fuel
- Where do these goods or services originate (where are the supply nodes)? Examples:
 - Fuel terminals, refineries, pipelines, racks
 - Propane distributors, truck stops and other fuel retailers
 - Electric utility mutual aid agreements, personnel, equipment, and processes
- Where are these goods or services stored or deployed (where are the demand nodes)? Examples:
 - Gas stations
 - Federal, state, or private enterprise fuel depots
 - Distribution substations
 - NOTE: While substation location is important, its associated service area is a far more effective piece of information for the purposes of dependency analysis and planning. Attempting to identify specific service lines connecting an asset to a particular substation has value in certain cases (for example, when a single service line to a key facility identifies a single point of failure), but that can be a challenging proposition when dealing with multiple facilities.
- How are these goods or services delivered? (Where are the links? How is demand expressed? How do goods or services move from supply nodes to demand nodes? What is minimally needed to start the flow? What is minimally needed to sustain the flow?) Examples:
 - Surface transportation network, trucking, fueling, and related
 - Pipelines
 - Demand is typically expressed through telecommunications
 - Professional electricians, utility personnel, dispatch personnel



Communications

The Communications lifeline supports the transmission of information through mechanisms such as broadband internet, ethernet, cellular networks, cable television, and radio broadcast networks. It covers all types of communications necessary to effectively respond to and help survivors, including alerts and warnings, 911 and dispatch, and responder communications. This lifeline supports the whole community's response efforts by enabling all other community lifelines.

- What goods or services are essential to provide this lifeline? Examples:
 - Grid continuity, rapid repair, or backup generation with refueling
 - Cell On Wheels (COW), Cell On Truck (COT), or cellular airframes (e.g., blimps)
 - Fuel tankers with drivers, telecommunications repair personnel and trucks
- Where do these goods or services originate (where are the supply nodes)? Examples:
 - Public Switched Telephone Network (PSTN) facilities
 - Internet Service Providers
 - Data Centers and server farms
 - NOTE: This is challenging data to obtain and is of greatest value only when the location of the critical data to support infrastructure or supply chain operations is known. For example, a jurisdiction cannot prioritize restoration of a commercial cargo port's cloud-based terminal operating system unless they know the data center that stores it. Not all infrastructure owners know where their offsite data physically resides.
- Where are these goods or services stored or deployed (where are the demand nodes)? Examples:
 - Credit, debit, and EBT point-of-sale terminals at retailers
 - 911 Call Centers
 - Transportation dispatch and broker operations
- How are these goods or services delivered? (Where are the links? How is demand expressed? How do goods or services move from supply nodes to demand nodes? What is minimally needed to start the flow? What is minimally needed to sustain the flow?) Examples:
 - High-speed fiber and wireless connections
 - NOTE: Fiber line routes are notoriously difficult to obtain with any accuracy; certain owners are more forthcoming than others.
 - Cellular telephone provider cell sites
 - NOTE: While cell site location is important, its associated coverage area is most useful for dependency analysis.
 - Widely distributed consumer demand
 - Access to some source of electricity across the flow of demand and supply



Transportation

The Transportation lifeline enables the movement of goods and services to support the whole community. Transportation infrastructure generally includes highway/roadways, mass transit, rail, aviation, shipping, pipeline, and intermodal systems. This lifeline supports the whole community's response efforts by enabling all other community lifelines.

- What goods or services are essential to provide this lifeline? Examples:
 - Trucks and truckers
 - Truck stops and other fuel providers
 - Surface transportation network, including roads, rail, bridges, ports
- Where do these goods or services originate (where are the supply nodes)? Examples:
 - Transportation companies: wholly owned, dedicated fleets, third-party logistics (3PL) providers, package delivery, U.S. Mail
 - Freight yards, staging lots, community of independent truckers
 - Ports, intermodal facilities, wherever there is concentration of flow
- Where are these goods or services stored or deployed (where are the demand nodes)? Examples:
 - Food processing facilities
 - Distribution centers
 - Fuel retailers
- How are these goods or services delivered? (Where are the links? How is demand expressed? How do goods or services move from supply nodes to demand nodes? What is minimally needed to start the flow? What is minimally needed to sustain the flow?) Examples:
 - Surface, maritime, and air transportation networks
 - Preexisting delivery contracts, spot-market calls, transportation brokers
 - Refueling vehicles and vessels is essential to sustaining the flow



Hazardous Material

The Hazardous Material lifeline covers the management (including containment and removal) of all hazardous materials. It focuses on ensuring that hazardous substance facilities, conveyance assets, wastewater systems, and incident debris, pollution, and contaminants do not require ongoing emergency responses to mitigate imminent or substantial threats to public health and welfare or the environment.

- What goods or services are essential to provide this lifeline? Examples:
 - Biochemical treatment and containment products
 - Backup power generation and fuel

- Pre-identification of hazardous substance facilities
- Where do these goods or services originate (where are the supply nodes)? Examples:
 - Hazardous materials teams (local, state, Federal and private sector)
 - Occupational and material safety professionals, both public and private sector
 - Biochemical suppliers, heavy equipment sources, specialty extraction providers
- Where are these goods or services stored or deployed (where are the demand nodes)? Examples:
 - Treatment facilities (e.g., water, sewage)
 - Hazardous waste storage facilities (e.g., coal ash, nuclear spent fuel pool)
 - Biochemical production and processing facilities compromised by extreme events
- How are these goods or services delivered? (Where are the links? How is demand expressed? How do goods or services move from supply nodes to demand nodes? What is minimally needed to start the flow? What is minimally needed to sustain the flow?) Examples:
 - Surface transportation, maritime, and air may all be involved
 - Demand is typically expressed by telecommunications
 - Effective flow typically requires pre-identification, active monitoring, extensive mitigation, and rapid response facilitated by research, outreach, and exercises

Appendix C. Supply Chain Resilience Engagement Checklist

The following recommended actions help emergency managers foster long-term collaboration between the public and private sector stakeholders to support supply chain resilience.

- ☐ Identify perceived or known issues/obstacles that hinder the private sector from engaging in response and recovery efforts in coordination with the public sector.
 - Identify issues per individual company (if not done so previously).
 - Identify trends across the sector within community and/or region (if not done so previously).
- ☐ Based on information gleaned from the Action Phase, form a “Task Force” of appropriate Private Sector Representatives.
 - Identify representatives from each private sector company – if possible, ensure representation of both operators and decisions makers.
 - Consider representatives from trade associations, Federal agencies, tribes, state agencies, county agencies, and city agencies.
- ☐ Develop a “Task Force” Concept of Operations (CONOPS) or Charter outlining agreed-upon parameters for engagement during steady state operations and response or disaster operations. The CONOPS/Charter could include:

– Overview	– Subcommittees (if applicable)	– Roles & Responsibilities
– Vision	– Objectives	– Elections
– Mission Statement	– Timeframe for Objectives	– Quorum
– Area of Operation/ Geography	– Membership & Meeting Schedule	– Communications/ Reporting Structure
– Purpose and Scope		– Decision Process.
- ☐ Leverage the Task Force for information planning and assumption development.
- ☐ Conduct a workshop with the Task Force to determine public and private sector priorities.
 - Determine ownership of priorities and potential solutions.
- ☐ Host workshops/seminars, potentially with cross-sector representation, to address identified priorities.
 - Develop products to facilitate inclusive response and recovery efforts.
 - Develop tactics and MOUs/Memoranda of Agreement (MOAs) to facilitate inclusive response and recovery efforts.

- Network Sector Task Force members with other Sector Task Force members to develop innovative options to address identified issues and priorities, as well as share lessons learned and best practices.
- ☐ Host exercises to validate products, tactics, and agreements developed from workshops.
- ☐ Provide training/outreach informing the private sector on the different opportunities and requirements to conduct business with the appropriate state agencies.
- ☐ Continue to facilitate the resilience-building actions developed from the Task Force.
 - Host exercises (discussion- and operations-based).
 - Host conferences and/or seminars.
 - Provide/Host networking opportunities.

Appendix D. Complex Supply Chain Example

Demand and supply networks can be highly differentiated by product, region, and enterprise. Figure 5 shows a representation of the petroleum product supply chain. In this representation, sourcing starts on the left, with inputs flowing toward outputs on the right (other terminology is sometimes used, for example “origins” are connected to “destinations,” or supply is “pulled” to demand, etc.).

In the figure, several major production processes are given particular attention (e.g., refining) and multiple distribution options are highlighted (e.g., pipelines, maritime barge, tanker truck, rail). These process steps are often said to represent specific “tiers” in the supply chain. Further dis-aggregation of flow is possible that can help identify “hidden” participants and anticipate potential bottlenecks in supply.

It can be helpful for emergency managers to know where the key supply chain functions serving their jurisdiction are located and who owns/operates these functions. They should ask:

- How many of these functions are located in your jurisdiction or your region?
- To what extent – and how – does your jurisdiction depend on sources outside your region?

As emergency managers especially know, maps are very helpful. However, a map is not the territory. Every helpful visualization of a supply chain tends to be over-simplified. For example, this visualization does not highlight dependencies (e.g., necessary electric power, chemical, and workforce inputs). Demand signals, including financial flows, are not shown. In supply chain resilience, it can be very helpful to work with stakeholders to conceive and deploy models and maps that key participants agree represent an accurate representation of local/regional reality.

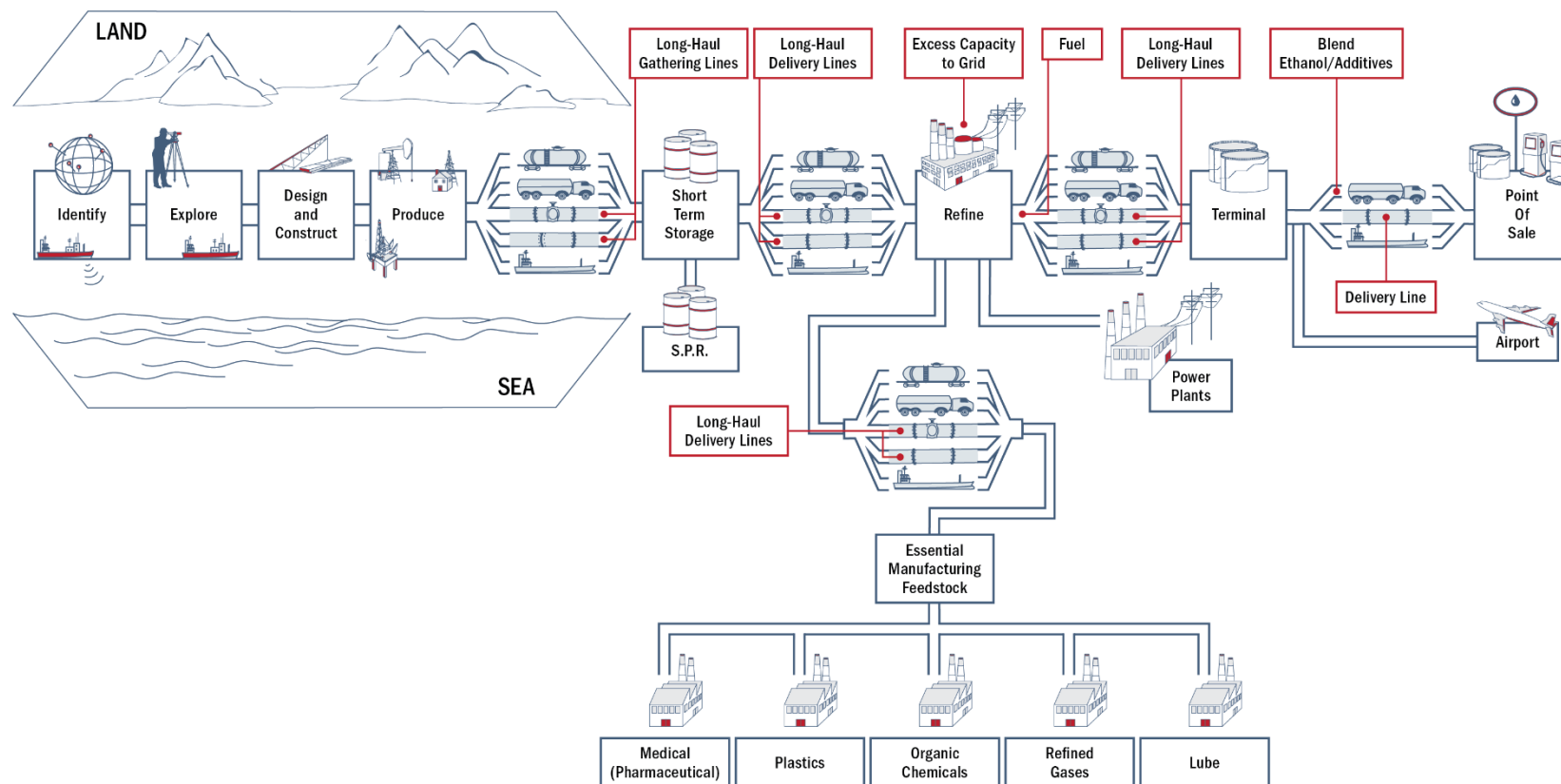


Figure 5: Representation of a Petroleum Supply Chain

This page intentionally left blank.