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ASSUMPTION AND ADAPTATION IN EMERGENCY RESPONSE: EVALUATING THE STRATEGIC APPROACH OF THE NATIONAL INCIDENT MANAGEMENT SYSTEM

by

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The National Incident Management System (NIMS) guidance strategy influences local public safety organizations and jurisdictions with emergency response obligations to develop and adopt all-hazards emergency response plans to prepare for critical incidents and natural disasters. Plan developers use assumption-based planning to imagine disaster scenarios and cultivate response options, but there are inherent problems with using such an approach for emergency preparedness. This thesis reviews the literature regarding NIMS strategy for incident response, assumption-based and adaptive planning processes, complexity and decision-making, and response implementation to determine whether a shift in policy could benefit local responders. It also covers four response case after-action reports to determine whether pre-incident plans were beneficial to responders and if jurisdictions had sufficient resources to respond to their incidents. The review illustrates that assumption-based planning is not the best tool for developing new plans but is better suited to review existing procedures or as a training tool for responders. This thesis shows that pre-selected and trained incident management teams provide superior preparedness for response and, when combined with a decision-making framework, are a dynamic, efficient tool. This thesis recommends changing the national strategy to influence local authorities in the development and implementation of coordinated local incident response teams.

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ABSTRACT

The National Incident Management System (NIMS) guidance strategy influences local public safety organizations and jurisdictions with emergency response obligations to develop and adopt all-hazards emergency response plans to prepare for critical incidents and natural disasters. Plan developers use assumption-based planning to imagine disaster scenarios and cultivate response options, but there are inherent problems with using such an approach for emergency preparedness. This thesis reviews the literature regarding NIMS strategy for incident response, assumption-based and adaptive planning processes, complexity and decision-making, and response implementation to determine whether a shift in policy could benefit local responders. It also covers four response case after-action reports to determine whether pre-incident plans were beneficial to responders and if jurisdictions had sufficient resources to respond to their incidents. The review illustrates that assumption-based planning is not the best tool for developing new plans but is better suited to review existing procedures or as a training tool for responders. This thesis shows that pre-selected and trained incident management teams provide superior preparedness for response and, when combined with a decision-making framework, are a dynamic, efficient tool. This thesis recommends changing the national strategy to influence local authorities in the development and implementation of coordinated local incident response teams.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAR	after-action review/report
ABP	assumption-based planning
AW	Austin Water
BWN	boil water notice
CAP	corrective action plan
CPG	*Comprehensive Preparedness Guide*
DHS	Department of Homeland Security
DOC	Department Operations Center
EMC	emergency management coordinator
EMS	emergency medical services
EOC	Emergency Operations Center
ERP	emergency response plan
FEMA	Federal Emergency Management Agency
IAP	incident action plan
IC	incident commander
ICS	Incident Command System
IMT	incident management team
NIMS	National Incident Management System
OSC	operations section chief
POD	point of distribution
SMART	specific, measurable, action, realistic, timely
SOP	standard operating procedure

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EXECUTIVE SUMMARY

This thesis presents a qualitative analysis of the current state of guidance provided by the federal government to state and local emergency response jurisdictions. The federal government drives a national incident management strategy by defining several categories that address response expectations for stakeholders: incident management, legal authority, funding, recovery, plans, policies, and procedures, among others. The national strategy, which comprises several documents, consolidates many plans, policies, and directives to influence local and state-level decision-makers through grant funding and post-disaster reimbursement. The federal funding process motivates jurisdictions to comply, and some specific sectors, such as critical infrastructure, dictate compliance through legislation.

The National Incident Management System's strategy influences local organizations and jurisdictions with emergency response obligations to develop and adopt all-hazards emergency response plans to prepare for critical incidents and natural disaster responses. Plan developers use an assumption-based planning approach to imagine catastrophic scenarios and cultivate response options, but there are inherent problems with such an approach for emergency response.

This thesis reviews the literature regarding the national incident management strategy for incident response, assumption-based and adaptive planning processes, complexity and decision-making, and response implementation to determine whether a shift in the national policy could benefit local responders. The literature review ultimately illustrates that assumption-based planning is not an appropriate tool for developing new plans but is better suited to review existing procedures or as a training tool for responders.

This thesis also presents four response case after-action reports to determine whether pre-incident plans were beneficial to responders and jurisdictions had sufficient resources to respond to their incidents. The research design followed the model described by Kathleen Eisenhardt in her 1989 journal article, "Building Theories from Case Study

Research."[1] Each case selected was analyzed through the lenses of federal guidance, planning, complexity and decision-making, and implementation of the response. The study was conducted in a structured educational environment to satisfy the requirements of a master's degree program.

The case studies indicate that pre-incident plans had little effect on the outcomes of each situation—although a team of responders was required to manage impacts and find solutions. In the City of Austin's case, the emergency operations plan provided no response direction, and the one pre-existing plan, for point-of-distribution operations, remained unused. For Austin Water and the City of Evans, an incident management team (IMT) provided direct response coordination and managed overall response operations. For the City of Westport, responders acted as an ad hoc IMT.

The cases reviewed do not, however, refute all value attributed to pre-incident planning. Jurisdictions should conduct assumption-based planning for understanding the potential risks associated with their locations and services. All-hazards pre-incident plans aid the development of their response capabilities and should be used for training and exercising coordinated response teams. Teams can use scenario-based procedures as learning tools, exercising responses to simulated disaster conditions.

This thesis shows that pre-selected and pre-trained IMTs provide superior preparedness for disaster response and, when combined with a decision-making framework, are a dynamic, efficient tool. The analysis is an amalgam of the author's experiences and theories, shaped by the reviews of current literature and case studies.

A change in the national strategy, from a focus on assumption-based planning to advocate for the development of local IMTs, would provide a mechanism for agencies and jurisdictions to respond. Local response teams that train and exercise together would provide the foundation for improved response efforts. The goal is not to eliminate pre-incident planning but to synthesize it with established local response teams—preferably,

[1] Kathleen M. Eisenhardt, "Building Theories from Case Study Research," *Academy of Management Review* 14, no. 4 (1989): 532–50, https://doi.org/10.2307/258557.

teams that have a working understanding of complex problem-solving, as presented within the Cynefin framework.

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We all serve to ensure the defense and security of the United States of America, and have fostered new relationships, learned new skills, and sharpened our edge in the CHDS forge. I will forever be grateful for this experience and pray God’s blessings upon us all.

I. INTRODUCTION

Public safety and emergency response agencies across the country must ready themselves for disaster response. Fifty states and some sixteen non-state territories—comprising more than 3,000 counties and 600+ cities with populations higher than 50,000—make up the United States.[1] Residents in each of those locations generally expect their local, state, and federal governments to react quickly and effectively in response to threats, crises, and disasters. Many governmental entities, including typical public safety organizations such as police, fire, and emergency medical services, respond during those emergencies; however, others such as emergency management agencies, public utilities, public health agencies, volunteer groups, and other vital partners with service responsibilities also play a role. The overarching strategy that guides response efforts is the National Incident Management System's "whole of community" concept.[2]

The federal government drives a national incident management strategy by defining several categories that address response expectations for stakeholders: incident management, legal authority, funding, recovery, plans, policies, and procedures, among others. The national strategy, which comprises several documents, consolidates many plans, policies, and directives to influence local and state-level decision-makers through grant funding and post-disaster reimbursement. The federal funding process motivates jurisdictions to comply, and some specific sectors, such as critical infrastructure, dictate compliance through legislation.

The preparedness strategy of developing assumption-based all-hazards emergency response plans, as strategic guidance for response stakeholders, does not adequately ensure a capacity to respond. These plans provide pre-identified response options that direct

[1] "Population, Population Change, and Estimated Components of Population Change: April 1, 2010, to July 1, 2018," U.S. Census Bureau, accessed October 30, 2020, https://www.census.gov/data/datasets/time-series/demo/popest/2010s-counties-total.html.

[2] Department of Homeland Security, *National Prevention Framework*, 2nd ed. (Washington, DC: Department of Homeland Security, 2016), 22, https://www.fema.gov/media-library-data/1466017209279-83b72d5959787995794c0874095500b1/National_Prevention_Framework2nd.pdf.

emergency responders in real situations and use hypothetical conditions or facts from past incidents to direct future decisions. The Federal Emergency Management Agency (FEMA) pre-identifies threat conditions for which stakeholders develop ERPs, such as floods, wildfires, tornadoes, or terrorist attacks. However, it does not ensure that all response agencies are well coordinated or experienced in working together to resolve issues. Moreover, mandatory assumption-based plans cannot verify a given jurisdiction's capacity to implement such specific incident response.

The ERP strategy may also overestimate the value of assumption-based plans as effective guidance, and it fails to provide a mechanism to implement any given plan. The planning principles used to develop an ERP assume the parameters of a hypothetical scenario and provide detailed narrative response strategies based on those assumptions. The imagined scenarios rarely occur as planned during actual incidents, and in my experience, few responders ever refer to pre-written plans during a response. Long-term strategic planning for conditions divorced from reality fails to provide sufficient answers for complex incidents and generates motivational slogans more effectively than it does direct response efforts. Completing required pre-incident plans seems more effective at checking a regulatory box than it does for providing competent response guidance.

The overall value of ERPs rests, more heavily, in their ability to train and exercise response teams in preparation for disasters. I am not aware of any reliable metrics currently available to measure a selected jurisdiction's ability to implement a particular plan in any given situation. The generally accepted mark is something akin to declaring the jurisdiction has or has not developed an ERP. The pre-incident, hypothetical planning approach cannot possibly account for every condition that responders may encounter during an emergency. Even if a plan contained all of the appropriate response options, a given jurisdiction might not have enough experienced personnel, the proper equipment, or any number of other resources necessary to accomplish the plan as imagined before the incident.

Applying pre-defined best-practice solutions can create problems in situations where "good" or "novel" approaches, as discussed later, may be superior. Pre-written plans can become ineffective as specific scenario conditions change, or if response leaders fail to review them during a response. The plans themselves rarely offer contingencies or

guidance on how to assess the many situational variances typically encountered. Responders must weigh actual conditions and apply strategies based on their own experiences and capabilities.

More flexible and adaptive strategies—combined with a mechanism for implementation and sound decision-making principles—may offer significant positive impacts and improvements for stakeholders with emergency services responsibilities. This thesis analyzes the National Incident Management System (NIMS) and assumption-based strategic planning principles to determine the proper value of all-hazards pre-incident planning, identify improvements in response capabilities, and make policy recommendations for future consideration.

A. PROBLEM STATEMENT

In my more than three decades of emergency response experience, I have never searched for the written plan during an emergency response. Only when I worked with nuclear weapons did I serve in an organization that committed sufficient time and resources to training and drills, using pre-incident processes for a response. In my law enforcement and nursing practice, responders needed to be flexible and must have response strategies in mind. When lives are on the line, there is little time to consult the rule book.

The players of every sport must know the rules before they play, but do not carry the rules with them on the field. Plays develop quickly, and players react with the skills they have learned well before the game starts. Coaches and managers develop strategies to win in the off-season, and then implement those concepts during actual games. My experience has led me to the theory that the implied approach of NIMS relies too heavily on assumption-based, pre-incident planning for the basis of actual emergency response—that an extensive, detailed plan based on assumptions does not adequately prepare jurisdictions to respond. It is as if the system relies more heavily on the book of plays than on having an organized team of players.

I also believe the strategy does not ask jurisdictions to have a structured mechanism for implementing coordinated, multi-agency, or multi-jurisdictional plans. It does not tell jurisdictions or departments to form a team. It assumes that response stakeholders will

come together during chaotic and stressful emergencies and synthesize effectively. Local law enforcement, fire, emergency medical services, public works, public health, and other agencies are not required to develop coordinated mechanisms capable of implementing detailed, integrated critical incident response plans across agency lines. This thesis attempts to determine how federal guidance affects preparedness and the ability of local jurisdictions to respond and seeks to identify a strategy that could enhance local response capabilities.

B. RESEARCH QUESTIONS

1. How does federal guidance for crisis response planning influence local and state preparedness?
2. Can a shift in planning strategy improve crisis response preparedness?

C. RESEARCH DESIGN

This thesis presents a qualitative review of case studies, utilizing both a participant-observer viewpoint and analysis of archival reports. To conduct this study, I reviewed current literature, governmental policies and directives, and federal law influencing and directing the use of all-hazard ERPs, as well as after-action reports from natural disaster incidents for comparative analysis. The research design followed the model described by Kathleen Eisenhardt in her 1989 journal article, "Building Theories from Case Study Research."[3] Each case selected was analyzed through the lenses of federal guidance, planning, complexity and decision-making, and implementation of the response. The study was conducted in a structured educational environment to satisfy the requirements of a master's degree program.

Based on my own experiences, I selected three cases for review, one having two respondent perspectives from the same flooding incident, which I believe provided relevant comparative value. In full disclosure, I participated in the episode reviewed in that case, serving as the emergency management coordinator for Austin Water during the 2018 Colorado River flood. Given the potential for bias in evaluating these incidents, I strove to

[3] Kathleen M. Eisenhardt, "Building Theories from Case Study Research," *Academy of Management Review* 14, no. 4 (1989): 532–50, https://doi.org/10.2307/258557.

remain as objective as possible in this review. I also selected two other archival reports from incidents outside my personal experience, from different geographical locations in the United States, involving weather-related disasters that had publicly available after-action reviews.

This thesis is limited to the written documents available for analysis. I have not conducted personal interviews or surveys, and all observations I make are recalled from memory of the events as they happened. I use the literature reviewed as a schema for analyzing each incident. The purpose of the literature review, in Chapter II, is to determine how federal guidance affects state and local preparedness, and whether additional guidance might improve response capabilities.

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II. LITERATURE REVIEW

This literature review addresses four areas of research related to the national incident management strategy. The first section addresses research on federal policies and other literature, which influence and guide emergency management and incident response. The second section compares assumption-based planning with adaptive planning principles, contrasting the two perspectives used commonly for preparedness and response. The third section covers complexity and decision-making in incident management and defines operational domains in which leaders make decisions. The final field examines incident management teams as the mechanism for implementing plans during critical incident response, distinguishing incident management teams as the benchmark for response application. These four areas were selected because they are foundational in addressing the challenges faced during consequential disasters. The four research areas affect all critical incidents, whether deliberate acts or natural occurrences, encompassing preparedness, planning, decision-making, and implementation.

A. FEDERAL GUIDANCE

According to an October 10, 2017, memorandum from acting Secretary of Homeland Security Elaine C. Duke, NIMS arose from a desire to provide a national response template for all stakeholders with emergency service responsibilities, considering neither the cause nor complexity of the incident nor the size and location of the organization.[4] Promulgated by FEMA, NIMS represents the overarching guidance for all event and incident planning but does not constitute a response plan in itself. The NIMS approach is broad guidance that applies to all governmental, non-governmental, and private entities involved with emergency planning and response.[5]

[4] Federal Emergency Management Agency, *National Incident Management System*, 3rd ed. (Washington, DC: Department of Homeland Security, 2017), 133, https://www.fema.gov/media-library-data/1508151197225-ced8c60378c3936adb92c1a3ee6f6564/FINAL_NIMS_2017.pdf.

[5] Federal Emergency Management Agency, 1.

A set of principles within the system directs the actions of emergency mitigation, preparation, response, and recovery. The doctrine includes situational flexibility, standardization of terms and structures, unity of effort toward a common set of goals, command and coordination during activations, resource management, express information sharing, and pre-incident response planning. NIMS propositions allow for variances in the scale of operations and adaptations to specific conditions within a given incident or event.[6]

NIMS builds on the foundation of several relevant laws and supporting documents. Key among them include the Homeland Security Act of 2002; Homeland Security Presidential Directive 5, *Management of Domestic Incidents*; Homeland Security Presidential Directive 7, *Critical Infrastructure Identification, Prioritization, and Protection*; Presidential Policy Directive 8, *National Preparedness*; America's Water Infrastructure Act of 2018; the *Comprehensive Preparedness Guide* (*CPG*) *101*; and *Introduction to the Incident Command System*.

State, local, and tribal reliance on federal funding—in the form of either pre-incident grants or post-incident reimbursements—spurs compliance with NIMS. The Emergency Management Performance Grant, the Emergency Operations Center (EOC) Grant Program, and the Urban Area Security Initiative grants represent just a few of the many awards available to qualified entities that follow the recommendations of the national incident management strategy.[7]

Through grants, a national infrastructure protection plan, and specific U.S. laws, the Department of Homeland Security (DHS) directs the national incident management strategy.[8] One such code is the America's Water Infrastructure Act of 2018, which requires that all producers of potable drinking water within the United States conduct vulnerability assessments for natural and human made threats and then develop all-hazards ERPs on or

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[6] Federal Emergency Management Agency.

[7] George D. Haddow, Jane A. Bullock, and Damon P. Coppola, *Introduction to Emergency Management*, 4th ed. (Burlington, MA: Butterworth Heinemann, 2011).

[8] James Jay Carafano and Weitz, Richard, "Complex Systems Analysis—A Necessary Tool for Homeland Security," *Backgrounder*, no. 2261 (April 16, 2009): 4, https://pdfs.semanticscholar.org/5beb/3f8ea626889e23f05452f24c5fb7dd84272e.pdf.

before September 30, 2020.[9] Some deliverable dates have changed based on the size of the utility and the number of customers it serves; however, the September 2020 deadline is the stated target date.

The Act's language states that utilities must integrate the findings they produce from completed vulnerability assessments, and all plans shall include the following:

> (1) strategies and resources to improve the resilience of the system, including the physical security and cybersecurity of the system;
>
> (2) plans and procedures that can be implemented, and identification of equipment that can be utilized, in the event of a malevolent act or natural hazard that threatens the ability of the community water system to deliver safe drinking water;
>
> (3) actions, procedures, and equipment which can obviate or significantly lessen the impact of a malevolent act or natural hazard on the public health and the safety and supply of drinking water provided to communities and individuals, including the development of alternative source water options, relocation of water intakes, and construction of flood protection barriers; and
>
> (4) . . . strategies that can be used to aid in the detection of malevolent acts or natural hazards that threaten the security or resilience of the system.[10]

This law also directs utilities to coordinate with local emergency planning committees when developing their ERPs and requires operators to certify their plans upon completion. Following initial certification, plans are reviewed, revised as necessary, and re-certified every five years.[11] The Environmental Protection Agency provides a template for plan development, consistent with guidance from the *CPG 101*.

Other guiding laws include the Homeland Security Act of 2002, which designates DHS as a stand-alone, cabinet-level agency with specific homeland security duties.[12]

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[9] America's Water Infrastructure Act of 2018, Pub. L. No. 115–270, 132 Stat. 3765 (2018), https://www.congress.gov/bill/115th-congress/senate-bill/3021/text.

[10] America's Water Infrastructure Act of 2018, Pub. L. No. 115–270, 132 Stat. 3852.

[11] America's Water Infrastructure Act of 2018, Pub. L. No. 115–270, 132 Stat. 3850.

[12] "Creation of the Department of Homeland Security," Department of Homeland Security, September 24, 2015, https://www.dhs.gov/creation-department-homeland-security.

Homeland Security Presidential Directive 5 establishes NIMS as the federal standard for domestic incident response and designates DHS as the agency responsible for administering NIMS.[13]

The *CPG 101* provides general and detailed guidance for all stakeholders having planning responsibilities. The guide identifies risk-informed planning and a routine, generally accepted planning practice as core functions.[14] Whole-community planning—or the integration of participants including first responders, non-governmental partners, utilities, volunteers, and others—is a leading concept of pre-incident planning. However, this guide offers no mechanism for implementing developed plans other than communicating the need for collaboration. Furthermore, it does not compel local authorities, law enforcement, fire departments, emergency medical service (EMS) agencies, public health departments, and other stakeholders to develop coordinated response teams. Even in normal responses, some jurisdictions work poorly together.[15] In other areas, response partners can cultivate well-integrated relationships.

The *CPG 101* advocates planning based on risk analysis.[16] Assumption-based planning (ABP) is a process whereby plan developers assume a potential risk for the express purpose of developing response options.[17] In ABP, planners identify potential hazards by consulting lists of possible and probable threats and then assuming threat

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[13] George W. Bush, *Management of Domestic Incidents*, Homeland Security Presidential Directive 5 (Washington, DC: White House, 2003), https://www.dhs.gov/publication/homeland-security-presidential-directive-5.

[14] Federal Emergency Management Agency, *Developing and Maintaining Emergency Operations Plans: Comprehensive Preparedness Guide 101*, version 2.0 (Washington, DC: Department of Homeland Security, 2010), intro-1, https://www.ready.gov/sites/default/files/2019-06/comprehensive_preparedness_guide_developing_and_maintaining_emergency_operations_plans.pdf.

[15] Gregoire v. Cal. Highway Patrol, No. 14CV1749-GPC(DHB) (S.D. Cal. Feb. 16, 2016), https://www.leagle.com/decision/infdco20160218a18.

[16] Federal Emergency Management Agency, *Comprehensive Preparedness Guide 101*, 1.

[17] James A. Dewar, *Assumption-Based Planning: A Tool for Reducing Avoidable Surprises*, RAND Studies in Policy Analysis (Cambridge: Cambridge University Press, 2002), xiii.

conditions exist for plan development. Planners conduct vulnerability assessments based on the assumption of the risk and plan response activities accordingly (see Table 1).[18]

Table 1. Sample Hazards List[19]

Natural Hazard	Tech Hazard	Human made Hazard
• Avalanche • Drought • Earthquake • Disease epidemic • Flood • Hurricane • Tornado • Tsunami • Volcanic eruption • Wildfire • Winter storm	• Airplane crash • Dam/levee failure • Hazmat release • Power failure • Radiological release • Train derailment • Urban wildfire	• Civil disturbance • Cyber attack • Terrorist act • Sabotage • Active shooter

Planners advance scenarios to identify risks associated with the general hazard and anticipate implications for the planning entity. By creating assumptions, situations present different challenges that specific response options address.

B. PLANNING

Thorough, systematic planning, while historically associated with military engagements, is ever more common in business and governmental endeavors, referred to as strategic planning. Although heavily used in the private sector for decades, strategic planning in the public sector of government became mainstream in the 1980s.[20] Organizations embraced strategic planning to drive their decision-making, specifically concerning the mission, motive, and method of achieving established goals. Bryson, Edwards, and Van Slyke detail the forms of strategic planning, which takes one of two approaches: root or branch. They point out, "Strategic planning is not a single thing, but

[18] Dewar, 1.

[19] Source: Federal Emergency Management Agency, *Comprehensive Preparedness Guide 101*, 4–10.

[20] John M. Bryson, Lauren Hamilton Edwards, and David M. Van Slyke, "Getting Strategic about Strategic Planning Research," *Public Management Review* 20, no. 3 (2018): 317–39, https://doi.org/10.1080/14719037.2017.1285111.

instead consists of a set of concepts, procedures, tools, and practices that combine in different manners to create a variety of *approaches* to being strategic" (original emphasis).[21] Although many approaches to strategic planning exist, the homeland security practice has generally adopted the assumption-based path.

Developed in 1987 by James A. Dewar and Morlie H. Levin at RAND Corporation, ABP set out to help the U.S. Army with its strategic planning process during quickly evolving times.[22] ABP enhanced accountability and encouraged iteration in plan development. It assumed conditions in specific scenarios and cultivated alternative outcomes by applying various response actions.

Dewar describes five basic steps in applying the ABP approach to the planning process.[23] First, identify assumptions in existing plans or plans in the development process. Then, identify the "load-bearing" assumptions or those assumptions with the most significant ability to impact success or defeat. Third, identify "sign-posts" that indicate a broken or weak belief. Sign-posts are events or thresholds that, if detected, alert the planner to potential failure. In the fourth step, the planner develops alternative and optional actions to influence the course of events. Dewar calls these "shaping-actions," defining them as those which induce a particular outcome. The final step is developing "hedging-actions." Such contingency actions move the scenario in a completely different direction (see Figure 1). Essentially, this process leads the planner through a series of "if this, then this" algorithms that explore endless possibilities of conditional variables.

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[21] Bryson, Edwards, and Van Slyke, 320.

[22] Dewar, *Assumption-Based Planning*, xiii.

[23] Dewar, 2–3.

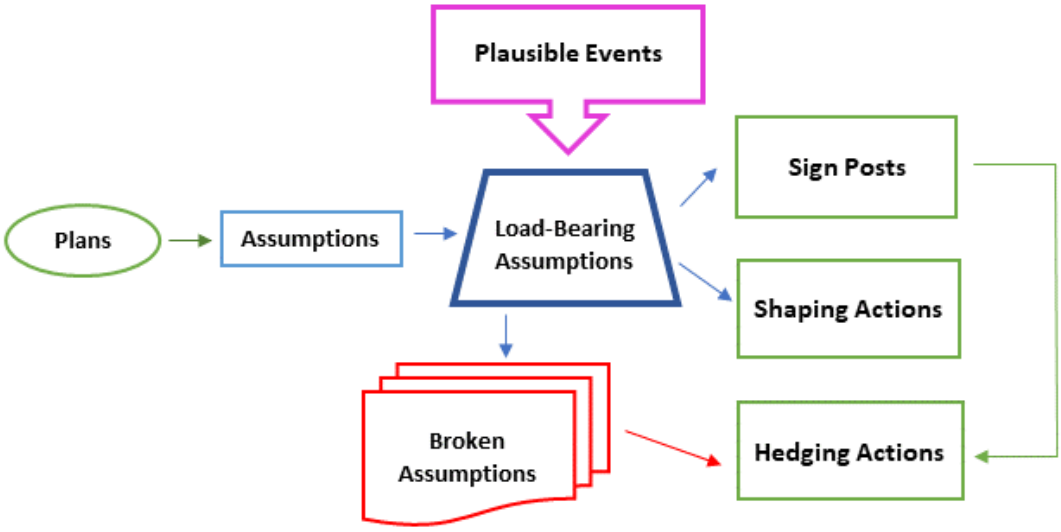

Figure 1. Steps in Assumption-Based Planning[24]

The five-step process seems to present some challenges for the planning practitioner. Although I have been involved in emergency planning for more than three decades, I only discovered these detailed instructions while researching this thesis. Most practitioners, one might presume, could not define these five steps, nor the detail involved in determining specificities such as load-bearing assumptions, sign-posts, shaping-actions, and hedging-actions. The formality of the process makes it a challenging endeavor to prescribe as a nationwide strategy and might be a detractor for ABP.

Dewar describes many strengths in the ABP process. The system addresses threats effectively and systematically spawns alternative scenarios for consideration, but its chief advantage lies in *iteration* when planning for uncertainty.[25] It encourages practicing scenario problem-solving again and again, over time. He submits that unpredictability and uncertainty require flexibility in planning; however, he cautions that this process may be a net weakness because considering the infinite possibilities in disaster and emergency

[24] Source: Dewar, *Assumption-Based Planning*, 11.

[25] Dewar, *Assumption-Based Planning*, 10.

response seems unwieldy, if not impossible. By asserting that scenario development is systematic and that ABP ties actions directly to assumptions, he also suggests this process tends to create fragmented options more than complete plans. Thus, this technique is likely better for reviewing existing plans and enhancing training and exercises than as an engine for final resolution. I believe this is a crucial mistake made by homeland security and incident response planners: they accept the shaping-actions of ABP as actual response actions for a given disaster instead of viewing them as training tools. Moreover, ABP is not particularly helpful in developing plans from scratch.[26] It favors the review and revision of existing plans over the creation of new ones. The planning process stands apart from the end product. Although it may seem minor, this distinction is crucial because it addresses testing versus development.

In 1957, speaking at a national conference, President Dwight Eisenhower said, "Plans are worthless, but planning is everything."[27] The process of planning, reviewing situations, and potential circumstances have tremendous value, but the significance of the plans themselves are undetermined until an outcome is known. According to Dewar, few evaluative systems allow for reviewing the effectiveness of strategic plans.[28] Bryson, Edwards, and Van Slyke also note that studies of strategic planning tend to show a correlation between planning and achieved outcomes. However, that correlation leans toward being perceptual because of the difficulties associated with evaluating public-sector performance.[29]

In his 1994 *Harvard Business Review* article, "The Fall and Rise of Strategic Planning," Henry Mintzberg highlights the fallacies associated with strategic planning.[30] Prediction is difficult when complexity creates incalculable outcomes. Even if a given

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[26] Dewar, 11.

[27] "The Eisenhowers: Quotes," Eisenhower Presidential Library, accessed October 30, 2020, https://www.eisenhowerlibrary.gov/eisenhowers/quotes.

[28] Dewar, *Assumption-Based Planning*, 11.

[29] Bryson, Edwards, and Van Slyke, "Getting Strategic about Strategic Planning Research," 330.

[30] Henry Mintzberg, "The Fall and Rise of Strategic Planning," *Harvard Business Review*, January–February 1994, 110.

situation can be assumed, which is arduous in the all-hazards framework of emergency response planning, the timing, location, and magnitude of an incident are impossible to guess accurately. Planners fall prey to availability bias, when they can only perceive the worst thing they have ever experienced.[31] The range of possible outcomes covers only what is known, making it very difficult to imagine an actual worst-case scenario. The bias does not merely apply to planners either. Decision- and policy-makers who review and approve plans and responses do so only within the possibilities available to them through their own experiences.

Mintzberg also discusses the fallacy of formalization. He claims that little proof exists that structured systems produce better results than do human beings, because systems cannot take in, comprehend, and synthesize information.[32] Furthermore, he says, "In a literal sense, planning cannot learn."[33] An all-hazards plan is not capable of adapting to the varied conditions experienced in dynamic critical incidents. The effectiveness of a plan lies in its ability to guide performance, but it cannot become so large and unwieldy that its use during a response becomes unlikely. This concept seems to suggest, again, that the best use of ABP is as a tool for teaching and exercising responders' capabilities.

Strategic planners typically use a calculating style of management, as opposed to a committing style.[34] Henry Mintzberg writes in his classic article that the committed style leads people on a journey where leadership guides the process, raising the enthusiasm of employees as all proceed. Calculation fixates on destination or outcome without concern for variables like preference or capability, which inherently diminishes the value of that style of planning.[35] Are there different approaches, then, that might be better suited for the needs associated with incident and disaster response? Innovative planning practices have flourished in the fast-paced environment of business and technology.

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[31] Daniel Kahneman, *Thinking, Fast and Slow* (New York: Farrar, Straus and Giroux, 2011), 135.

[32] Mintzberg, "The Fall and Rise of Strategic Planning," 111.

[33] Mintzberg, 111.

[34] Mintzberg, 109.

[35] Mintzberg, 109.

Lean principles—flexible and rapidly adaptive techniques for addressing unknowns—drive start-ups, top-performing companies, and organizations worldwide. "A start-up is a human institution designed to create a new product or service under conditions of extreme uncertainty," writes Eric Ries.[36] The lean principles discussed in his book offer an alternative approach to the historically accepted practices of long-term strategic business planning. "Lean" now signifies the entrepreneurial approach to business management and describes a process for innovation and disruption in markets, be they business, non-profits, or government.[37] Lean relies on a doctrine of "build-measure-learn" to promote situational awareness, flexibility, and adaptability as a tenet for successful management. Emergency management and public safety leaders are very much like entrepreneurs—managing the unknowns associated with incident and disaster response—and, as such, should consider the lean approach. However, how does lean apply to homeland security?

Lean start-up identifies fundamental concepts in its managerial framework. The first is that entrepreneurs exist in all facets of business, including the public and private sectors, implying that homeland security professionals are entrepreneurs. Second, entrepreneurship is management, especially in ever-changing and unpredictable settings. Third, managers should employ the build-measure-learn model described in lean start-up and validate their learning with empirical data. Lastly, managers should achieve accountability by measuring real progress with benchmarking that avoids vanity metrics, those indicators that point only to positive achievements. All outcomes, both the positive and the negative, must be measured to understand how performance influences outcomes.

One example of entrepreneurship in the government is delivering dynamic and effective response services during critical incidents. Homeland security responders and emergency managers address emerging and often poorly understood problems in real time. They must be able to build a response, measure the effectiveness of their actions, and learn from the empirical data that their efforts produce. Mintzberg would likely agree with this

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[36] Eric Ries, *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses* (New York: Crown Publishing, 2011), 27.

[37] Ries, 29.

theory, writing that "sometimes strategies must be as broad visions, and not precisely articulated, to allow adaptations for a changing environment."[38]

C. COMPLEXITY AND DECISION-MAKING

During emergencies, responders and managers operate in multiple domains with varying degrees of difficulty or complexity. Every disaster is different, and every reaction is as well. Understanding those differences in applying solutions is critical for effective response and recovery. One tool for helping decision-makers understand the domain in which they are operating, and guiding them in deploying effective solutions, is the Cynefin framework.

Cynefin is a contextual framework based on complexity science, which explores the challenges that decision-makers confront by defining relationships between cause and effect.[39] It is five conceptual domains—obvious, complicated, complex, chaotic, and disorder—allow a decision-maker to understand more fully the domain within which one operates, and which type of solution might best lead to positive outcomes. By recognizing the correct domain, the decision-maker can choose an appropriate response strategy in real time. As complexity shifts, so too can response options (see Figure 2).

[38] Mintzberg, "The Fall and Rise of Strategic Planning," 112.

[39] David J. Snowden and Mary E. Boone, "A Leader's Framework for Decision Making," *Harvard Business Review*, November 2007.

Figure 2. The Cynefin Framework[40]

In the obvious domain, cause and effect are generally evident. An indication of operations in the obvious domain, defined by a "sense-categorize-respond" dynamic, is a stable and apparent relationship between what has occurred and how to solve the issue.[41] Responders apply "best practices" to the problem for an expected outcome.[42] For example, when firefighters respond to a common dumpster fire, using water is the best practice nationwide and the accepted course of action. This approach is sufficient and generally accepted by all who would respond in a similar situation.

One noted challenge of the obvious domain is the potential for complacency. When responders encounter obvious situations repeatedly, and accepted solutions are applied effectively over time, complacency may arise. The threat with complacency is that the situation might be misunderstood as simple when, in fact, it is not. This boundary, described as the complacency cliff, indicates the ease with which an issue can rapidly

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[40] Source: David Snowden, "Cynefin St David's Day 2019 (1 of 5)," *Cognitive Edge* (blog), March 5, 2019, https://www.cognitive-edge.com/cynefin-as-of-st-davids-day-2019/. Used with permission from the author, received September 20, 2020.

[41] Snowden and Boone, "A Leader's Framework for Decision Making," 1–2.

[42] Snowden and Boone, 2.

become chaotic if responders are not aware of the problem soon enough. In that case, a best practice is not appropriate, and complexity may amplify the potential for adverse outcomes. Decision-makers must also avoid what Snowden and Boone call "entrained" thinking. Commanders can become so accustomed to reacting habitually that they fail to consider new perspectives, approaches, or ideas.[43] Because leaders may fail to notice that, the situation is becoming more complicated, they should encourage dissent and differing views from others in the response.[44]

As cause and effect become less apparent, and when it takes either time for analysis or specific expertise to recognize the context of the incident, responders are operating in the complicated domain. As difficulty increases, the scenario must be analyzed carefully to determine an appropriate resolution. This "sense-analyze-respond" dynamic often leads to "good-practice" solutions.[45] Leaders must learn to listen to experts offering their input while also receiving ideas from others. Expertise in one field may transfer into unrelated specialties and provide unique approaches to problems.

Progression through the framework leads from complicated to complex. In the complex domain, novel situations are made manifest in emergence—unpredictable patterns that exceed the sum of their parts, whose possible solutions cannot be anticipated. Snowden and Boone detail complexity's "probe-sense-respond" dynamic: leaders first probe with safe-to-fail experiments, but then as they apply novel approaches, they must put in place amplifying and dampening controls to alter the trials based on observed results.[46] In complexity, leaders cannot impose solutions because the total implications are unknown.[47] Open communication and resource sharing are crucial to success when solving complex problems because experimentation is resource-intensive and immediate feedback provides maximum control.

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[43] Snowden and Boone, 2.

[44] Snowden and Boone, 3.

[45] Snowden and Boone, 3.

[46] Snowden and Boone, 3.

[47] Snowden and Boone, 4.

In the initial phase of an emergency response, leaders often encounter the chaotic domain. Chaos is that space in which looking for correct answers is ineffective.[48] For example, stopping a bleed—not discussing the pros and cons of safety measures or protective equipment—is the imminent action. Chaos dictates that an action comes first, then awareness, and then a measured response. Snowden and Boone describe this dynamic as "act-sense-respond."[49] Notably, there are no prescribed steps for intervention in a chaotic circumstance. As in the 9/11 terror attacks, responders typically apply maximum effort toward moving to another domain, where more controlled approaches become applicable.

The final, and dark, domain is disorder, where confusion reigns, and leaders do not recognize the ordered environment in which they are operating.[50] Without strong, intentional leadership, disorder may overcome response efforts. Snowden and Boone characterize this state as follows: "Multiple perspectives jostle for prominence, factional leaders argue with one another, and cacophony rules."[51] Snowden details the Cynefin framework and discusses the application of its principles in a 2010 video produced through his company, Cognitive Edge.[52] He emphasizes that this model is for sense-making, not categorizing, thus suggesting practitioners may move through the model from domain to domain as the situation or their understanding of it clarifies.

D. RESPONSE IMPLEMENTATION

Incident response is far more than theory and guidance. Public safety and emergency management leaders are responsible for implementing corrective actions associated with every possible hazard and threat, whether from an intelligent adversary or a natural disaster. The mechanism of implementation for an emergency response is

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[48] Snowden and Boone, 5.

[49] Snowden and Boone, 5.

[50] Snowden and Boone, 5.

[51] Snowden and Boone, 4.

[52] Cognitive Edge, "The Cynefin Framework," July 11, 2010, YouTube, video, 8:37, https://www.youtube.com/watch?v=N7oz366X0-8&t=436s.

organized people who carry out the strategies developed within the structure of the National Response Framework and NIMS. Whether they be a single resource—such as a patrolling police officer—or a small team—such as a public works crew, fire engine complement, or ambulance with driver and paramedic—people carry out the goals and strategies associated with disaster response.

In the United States, citizens typically think of first response and public safety organizations as police departments, fire departments, and EMS agencies. However, many governmental and non-governmental entities participate in disaster reactions. Public works and utilities, public health, regulatory services, volunteers, and private-sector companies all answer the call for assistance during times of disaster. Within the National Response Framework, responders can be identified by classification within their scope and purpose as incident management teams (IMTs), and nationally designated by their type.[53]

Type 5 teams are small, single-discipline teams with fundamental incident response obligations.[54] Though not ordinarily thought of this way, police, fire, and EMS departments are, in fact, specialized IMTs. Their scope, assignments, training, and licensing define their activities when they work singularly, even when they encounter each other on the same call for service. For example, in a motor vehicle accident scenario, each responder has a defined role. The police officer investigates criminality associated with the accident and may direct traffic for scene safety. Fire department personnel perform rescue functions, extracting victims from the damaged vehicle, and typically provide first aid. EMS staff examine victims in greater detail, provide advanced care interventions, administer medications, and transport the injured to a hospital. The coordination for this type of incident is pre-determined, and each element knows its roles before the accident occurs.

When scenarios advance and elevated cross-coordination is required, teams may form to address specific objectives. Type 4 teams are single- or multi-agency teams, formed

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[53] U.S. Fire Administration, *USFA Type 3 Incident Management Team, Instructor Guide*, version 1.0 (Washington, DC: U.S. Fire Administration and Federal Emergency Management Agency, 2013), 1.25.

[54] U.S. Fire Administration, 1.25.

for expanding incidents.[55] An example might be an active-shooter scene where leadership develops a coordinated plan with defined goals and strategies. Type 4 is a general categorization, not associated with a pre-selected or designated crew membership, developed ad hoc at the time of disaster. Beyond Type 4, IMTs are requested to respond by local decision-makers, such as city managers or county officials, and receive authority to spend funds and command local resources.

At the level of Type 3 IMTs, qualified, trained, and credentialed members form an on-call team available 24 hours per day, seven days a week, 365 days a year. The Incident Command System (ICS) defines the members of a Type 3 team, including command and general staff. Each member must have experience and training beyond one's profession and obtain certification as ICS-qualified to hold each position in the IMT (see Figure 3).[56] Accreditation of each member's qualifications, training, and experience is vetted at one's level of service, whether a state or local team.

[55] U.S. Fire Administration, 1.25.

[56] U.S. Fire Administration, 1.26.

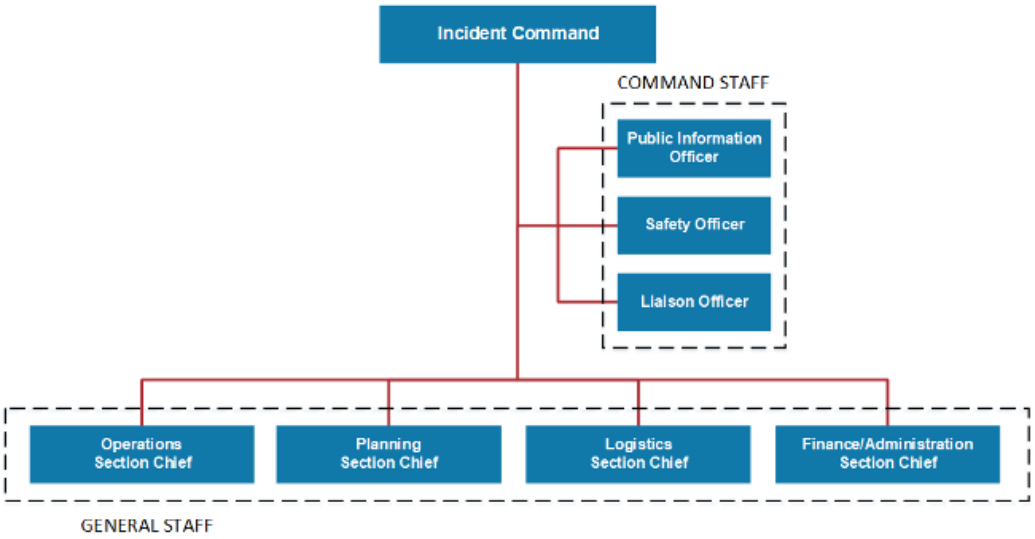

Figure 3. Incident Command Structure[57]

Beyond Type 3, at the regional and national level, teams are designated Type 2 or Type 1, respectively. Response efforts at all levels are carried out by the IMT. Incident planning and coordination take place within the foundational principles of ICS for each specific incident. While IMTs take command of a single incident, local authorities maintain responsibilities for all other local reactions, which may be necessary. When requested to respond, IMTs, regardless of type, are the instruments used to apply tactics, or the steps taken to mitigate a disaster, for all kinds of scenarios. Notably, the fundamental element of an IMT is that its most common use is as a deployable resource. People from outside entities form an IMT, before an incident, and then receive orders to provide aid to an affected jurisdiction at the time of a disaster. It is not routine to use an internal IMT only for an in-house response. What defines an IMT is the specific ICS training it receives for an express application during disaster response. When assembled as an IMT, members are no longer police officers, firefighters, medics, or other professions. They are incident commanders, section chiefs, unit leaders, and other ICS-specific responders who apply the principles of ICS as a coordinated team.

[57] Source: "ICS Review – ICS Structure," Federal Emergency Management Agency, accessed October 31, 2020, https://emilms.fema.gov/IS2200/groups/19.html.

This chapter described some of the most relevant literature regarding four components of emergency preparedness and response. Federal policies, laws, grants, and systems influence response agencies by suggesting, and in some cases requiring, the development of all-hazards pre-incident plans. In addition, it presented two planning perspectives: assumption-based pre-incident strategies attempt to predict future events and propose response options, while adaptive principles introduce flexibility and customization for emergency response. Furthermore, complexity theory relies on an understanding of a crisis in real time whereas process-based problem-solving allows the practitioner to apply a system within a given domain—so leaders must know the difference between categorizing, analyzing, and experimenting to find solutions. Finally, this chapter defined the need for having a mechanism to implement the tactics chosen during a response. IMTs ultimately provide the structure for transitioning ICS theories to practical applications. The next chapter presents case studies for analyzing each of these components as they occurred during actual incidents.

III. CASE STUDIES

In the aftermath of significant critical incidents, response agencies typically conduct after-action reviews (AARs) and develop corrective action plans (CAPs). The goal of these products is to archive the positive and negative aspects encountered in the response and provide a basis for improving capabilities. This chapter presents three separate incidents, of which one details responses for the same regional flood but from two distinct organizational perspectives. Each case study presents background information on the area affected, describes the incident as captured in the AAR/CAP, analyzes the response vis-à-vis the literature review components, and summarizes the case. Each case examines the impact pre-incident planning had on the response, discusses the planning process used by each entity during its response, determines how complexity affected decision-making, and discusses response implementation.

All case review materials were derived from publicly accessible information, either from the AAR/CAP for each incident or from a public information website for the jurisdiction. The first case presents the 2018 Colorado River flood, which affected central Texas, specifically the greater Austin area. This flood required two responses, one from the city/county EOC and one from the water utility, Austin Water.[58] The next case covers the impacts of Tropical Storm Irene on the town of Westport, Connecticut, in 2011. The final case involves the 2013 flood of the South Platte River, in Evans, Colorado. For consistency in evaluation, all three cases analyze naturally occurring disasters, but from different geographical areas of the country. Moreover, each experience required extended operations, which involved significant response planning and resource management.

A. COLORADO RIVER FLOOD: AUSTIN, TEXAS, 2018

Austin is the state capital of Texas, with a daytime population exceeding one million people. The bustling city, with a small-town feel, is the home of Texas barbeque, live music, and the University of Texas. It has a rich history of planned events, including

[58] This author served as the emergency management coordinator for Austin Water during the incident.

South by Southwest, Austin City Limits Live, and the Circuit of the Americas' Formula 1 motor race. The city and county work closely with private event groups to conduct these publicly attended festivals, utilizing the ICS and pre-event planning.

The relevance of this case study is that it provides two response perspectives for comparison from the same critical incident. Both the combined city/county EOC and Austin Water, as separate organizations, responded to and produced AARs for the 2018 flood. Following the completion of this incident, the city and county contracted with Hagerty Consulting to facilitate an AAR and produce an improvement plan and report.[59] Hagerty Consulting is an emergency management firm that aids its clients in preparation for and recovery from disasters.[60] According to its website, it provides preparedness and recovery consulting, which includes the development of AARs. Austin Water developed its AAR internally through a series of work sessions with its employees.[61]

Fall storms in Central Texas can be extremely challenging and have a devastating impact, with October being a particularly difficult month. Between October 2013 and October 2018, the greater Austin region experienced three 100-year flood events.[62] The Colorado River flood of 2018 brought significant challenges to Austin. Flooding crested the banks of the river in Lake Austin, in Lady Bird Lake, and downstream of the Longhorn Dam, located in downtown Austin.[63] Along with the flooding that prompted evacuations within Travis County, the river water became so inundated with dirt, silt, and debris that water treatment plants could not process raw water effectively. As a precautionary move

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[59] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, *Colorado River Flooding After Action Report* (Austin, TX: Hagerty Consulting, 2019), https://www.austintexas.gov/sites/default/files/files/HSEM/A_TC_Colorado_River_Flooding_AAR_05202019.pdf.

[60] "About Us," Hagerty Consulting, accessed August 31, 2020, https://hagertyconsulting.com/about-us/.

[61] The author of this thesis was the primary author of Austin Water's AAR.

[62] "Austin's October Weather So Far, by the Numbers," *Austin American-Statesman*, October 28, 2018 https://www.statesman.com/news/20181028/austins-october-weather-so-far-by-numbers.

[63] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, *Colorado River Flooding*, 9.

to avoid distributing unsafe drinking water, the utility ultimately issued a boil water notice (BWN), which directed all users of the public drinking-water system to boil water before consumption. At the time, the announced BWN was the largest in U.S. history, affecting more than one million residents over seven days. Overall, the incident resulted in activations of both the city/county EOC and Austin Water's Department Operations Center (DOC).

Beginning in mid-October of 2018, heavy rains fell in Llano, Texas, approximately 60 miles to the north-northwest of Austin, overwhelming waterways and creating flood conditions for the entire Austin region. Over just two days—October 15 and 16—the area received 10 inches of rain in 48 hours.[64] Reservoirs and lakes along the Lower Colorado River quickly began to experience flooding, from Llano to the Gulf of Mexico. This section of the river is referred to as the "Highland Lakes" area, snaking from Lake Buchanan through Austin and then downstream of the Longhorn dam. The city/county EOC directed evacuations within Travis County and led the process of distributing bottled water. Because of the BWN, city leaders decided to bring in bottled drinking water for use by those who were unable, or unwilling, to boil their water before consumption or use.

1. City and County Response

The City of Austin is the primary municipality within Travis County and, as such, operates the combined city/county EOC. The City of Austin's Department of Homeland Security and Emergency Management manages EOC operations, budget, and staffing. The Travis County Office of Emergency Management is a contributing stakeholder in the EOC, providing staff, funding, and coordination.

The EOC routinely coordinates local pre-planned events, such as Formula 1 Racing, the South by Southwest music festival, the Austin City Limits music festival, and others. Because these events are scheduled and pre-planned, ABP has historically worked well to coordinate the required resources. Notably, ABP works because planners have experienced

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[64] Tyson Broad, *Floods on the Llano River, Texas: Fall 2018* (Llano, TX: Llano River Watershed Alliance, 2019), https://75026e89-0e01-4222-a326-5a09962e5b19.filesusr.com/ugd/f8330c_4479def583f742dd8d1f4919d330c4f3.pdf.

these events in the past. Indeed, they can draw from their own experience and from the records of past events to develop current planning. Dates, time schedules, participation estimates, and resource needs are known before the event, simplifying the planning process. Conversely, the EOC has actively coordinated multiple past emergency incident responses, including floods, hurricanes, and wildfires, and have noted difficulties when attempting to rely on pre-existing plans.

a. Federal Guidance

As detailed in the literature review, the national incident management strategy asks—and in some cases requires—that response agencies operate under a coordinated, pre-incident, all-hazards emergency response plan (ERP). During the 2018 flood, the City of Austin's *Emergency Operations Plan* was approved and in place.[65] Travis County's *Basic Plan* was also authorized and active, encompassing the unincorporated areas of Travis County and 17 villages or cities located within the county.[66] The plans and related annexes provide the foundations for response based on the principles of NIMS and ICS to coordinate all city/county departments during critical incidents.[67]

Both plans declare flooding in central Texas as a significant and common natural hazard, with minor differentiations between flash flooding and river flooding. Austin cites late spring and fall as prime flooding seasons.[68] While both plans establish departmental and agency requirements for critical incident response for the many different city and county agencies, based on their routine or normal operational functions, neither contains

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[65] Austin Homeland Security and Emergency Management, *Emergency Operations Plan: Basic Plan* (Austin, TX: City of Austin, 2016), http://www.austintexas.gov/sites/default/files/files/hsem/Basic_ Plan_09-28-2016.pdf.

[66] Travis County Office of Emergency Management, *The Travis County Interjurisdictional Emergency Management Plan: Basic Plan* (Austin, TX: Travis County Office of Emergency Management, 2015), https://www.traviscountytx.gov/images/emergency_services/docs/emergency_mgmt_plan.pdf.

[67] Austin Homeland Security and Emergency Management, *Emergency Operations Plan*; Travis County Office of Emergency Management, *Basic Plan*, 14.

[68] Austin Homeland Security and Emergency Management, *Emergency Operations Plan*, 21.

specific flood incident response procedures. Moreover, these basic plans provide no shaping actions as prescribed by ABP.

Hagerty Consulting's review of this response notes many strengths, most of which related to the working relationships existing between the EOC and its many stakeholders. Having an extensive array of participants, across many functional boundaries, provided the basis for the successes realized during this incident.[69] However, despite the availability of both basic plans, Hagerty Consulting's AAR cites many deficiencies made manifest during the incident. For example, the city and county experienced confusion with activation and notifications, as well as with coordination between the two emergency documents.[70] Though the plans direct these processes, it appears that at the time of the disaster, staff relied more on routine actions and relationships than on activating the procedures from either plan.[71]

Though both plans provide coordinating guidance for different city and county departments, interagency coordination was a significant challenge as well. The AAR describes a lack of focus on inclusivity and organization with stakeholders.[72] Responders from agencies with specific experience fared much better than those who had received assignments at the time of the disaster. Learning specific ICS roles with just-in-time training presented powerful obstacles, prompting a recommendation within the AAR to explore the formation of a combined city/county IMT and consolidate emergency plans.[73] Arguably, this recommendation—to establish an IMT—supports the central theory behind this thesis.

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69 Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, *Colorado River Flooding*, 9–10.

70 Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 17.

71 Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 10.

72 Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 18.

73 Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 18.

Though both basic plans exist as integration documents, many other department- and agency-level plans are also in place. Thus, shortcomings in coordinating all existing procedures, among all responders, were a noted fault.[74] The size of the documents—at 160 pages for Austin and 48 for Travis County—is likely a deterrent for their use during emergencies. Moreover, these large documents present more generalities than directions for a response. The AAR repeatedly emphasizes the need for training and exercising staff who will respond during actual emergencies. In sum, basic plans are impractical when teams are not proficient with them, when teams are not skilled enough to implement them, and when the documents are so large that their use is unlikely during the stresses associated with disaster response.

b. Planning

The city's and county's emergency operations plans are both pre-incident, assumption-based documents that should provide fundamental frameworks for incident response. The plans assume that during a disaster, the city and county will have sufficient resources to implement a particular intervention.[75] However, these plans do not ensure that adequate resources are trained and in place. If the case arose that adequate resources were not available, both plans assume that regional, state, and federal partners would assist.[76] During this incident, the EOC activation and coordinated response lasted for 21 days.[77] The duration and limited resources proved to be some of the most significant challenges for response leaders. The toll on a relatively small cache of experienced and willing staff was heavy. Many served for the entire incident with little or no time off for rest and rehabilitation, while still responsible for their day-to-day duties. Together, the city and

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[74] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 25.

[75] Travis County Office of Emergency Management, *Basic Plan*, 19.

[76] Travis County Office of Emergency Management, 19.

[77] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, *Colorado River Flooding*, 9.

county had approximately 12,000 employees who could have helped had they been trained and activated. This incident saw only a fraction of that number in the EOC.

The assumption of coming aid is dangerous because it relies on the assistance of outside jurisdictions and fails to capitalize on the many city and county employees who could receive pre-incident training to staff activations internally. During a large incident, many jurisdictions might experience challenges that render them unable to spare resources. As with experiences noted during the COVID-19 pandemic, sometimes all jurisdictions are engaged and unable to send assistance. A widely held axiom of emergency management is that all disasters begin and end locally, yet the existing plans for Austin and Travis County do not ensure that local resources are sufficient.

This case study exposes another concern with pre-incident planning. What happens when leaders are unaware of an existing plan? In this incident, a stakeholder agency had a pre-planned process for establishing and operating points of distribution (PODs). However, response leaders were not aware of those plans and engaged in adaptive planning to set objectives and define tactics.[78] PODs allowed for distributing bottled water throughout the greater Austin area. Each site was set at a different location and presented specific issues, so leaders could adapt plans to each situation. Evaluating the effectiveness of the existing pre-incident POD plan in this case study is not an option, as it remained unused, on the shelf, during this response.

An adaptive planning process was used extensively during this incident in EOC operations and for evacuation and distribution planning. Existing emergency plans did not provide the shaping-action guidance necessary for leaders to assign tactics to meet incident needs. Instead, decision-makers relied on the experiences of only a relatively few departmental staff, brought with them from working together in their routine capacity or past incidents and events. At times, this response lost the feeling of being an ICS incident. Feedback from participants includes the recommendation to increase the utilization of ICS, specifically the incident action plan (IAP), and the need for much more EOC training for

[78] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 22.

all who do respond.[79] The ICS process receives more coverage in the response implementation section.

c. Complexity and Decision-Making

At the outset of this incident, leaders were likely operating in Snowden's obvious domain.[80] The AAR notes that the timing for activation to this incident was imprecise and that responding agencies were uncoordinated in their mobilization.[81] The incident occurred at the tail end of a pre-planned event, a Formula 1 race at the Circuit of the Americas' track in Austin.[82] There was, presumably, an assumption that this incident would follow patterns experienced in the past. However, as stressors mounted, the operational domain transitioned from complicated to complex. Existing response planning did not account for the complexity, and response efficiency suffered as leaders struggled to find adequate staffing and meet the cadence of the flood.[83]

Leaders failed to address this incident from a complexity perspective. The markers of operating in the obvious domain include the ability to use best practices for problem-solving and a clear connection between cause and effect. Moreover, while heavy rains had caused the flooding, no best practice available could ensure an adequate response. Furthermore, pre-incident plans had not provided the commensurate shaping actions necessary for the conditions experienced in this flood.

The two governing constraints for problem-solving in the complicated domain are time and expertise. Both limiting factors saw severe challenges during this incident. Continuous heavy rains did not afford responders the time to wait and see how conditions

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[79] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 62.

[80] Snowden and Boone, "A Leader's Framework for Decision Making," 1.

[81] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, *Colorado River Flooding,* 11.

[82] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 66.

[83] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 18.

might change, so evacuations were necessary to protect the lives of those impacted. As noted throughout the AAR, city and county responders lacked sufficient experience and expertise in addressing a flood of this magnitude. Because of the lack of time or knowledge to manage this flood, leaders should have defaulted to the complex domain.

In the complex domain, leaders would have developed many small experiments, with pre-determined abilities to magnify or attenuate their actions based on feedback, to address specific challenges presented by the flood. An example from feedback reported in the AAR is an experiment with POD operations. The EOC selected seven sites for bottled water distribution, yet site staff received operations and set-up instructions from the EOC. To experiment, the EOC could have provided operating parameters and included the power to amplify or dampen processes based on the traffic it received.[84] The ability to expand pick-up lanes, add security resources, or change processes at individual sites would reflect an adaptive, experimental probe-sense-respond method, as described by the Cynefin framework.

d. Response Implementation

As Hagerty Consulting's AAR states, "Operating the EOC while maintaining day-to-day operations of department/agencies and DOCs was challenging during this incident due to resource limitations."[85] Basic tenets of direction and control were problematic during this response. Indeed, the AAR points out that confusion evolved when leadership did not follow the basic principles of ICS.[86] At times, multiple individuals believed they had command of defined response elements because of an uncoordinated incident command structure.[87] Common ICS pillars, such as IAPs, standard response meetings and

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[84] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 75.

[85] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 13.

[86] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 21.

[87] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 19.

briefings, and ICS forms, were insufficient to coordinate effectively.[88] The AAR recommends adhering to the principles of ICS during emergency responses.[89] Following these principles allows responders to plan adaptively. Ultimately, ICS is an adaptive process that constantly drives leaders and planners—through the planning "P"—to analyze and modify plans when conditions either improve or worsen.

The many weaknesses discussed in the AAR include coordination of planning, operations, and communications. Recommendations repeatedly call for increased training and exercising of staff who have obligations to respond during critical incidents. Bringing a team together from multiple departments in an actual emergency without adequate training and experience creates issues that hamper the effectiveness of the response.[90] Numerous recommendations from the AAR stress the importance of training and exercises for any team that responds to disasters of this magnitude. Recommendation 1.18, under the response operations section, reads, "The City and County should explore the creation of a local IMT that is pre-trained for specific positions and can support meeting the needs of operational resource requirements."[91]

e. Summary

The City of Austin and Travis County did have emergency operations plans in effect during this incident. However, the plans did not provide the shaping actions necessary for directing the response. Recall from the literature review that shaping actions are those options designed to produce a specific outcome. Responders in this case were insufficiently trained and inexperienced in implementing either plan during a severe flood. The adopted planning strategy did not include instructions for an adaptive process that

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[88] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 21.

[89] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 20.

[90] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 39–43.

[91] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 12.

considered complications or complexity during emergencies. The NIMS strategy of developing pre-incident planning was ineffective for this response because responders lacked sufficient training on the plans, and leaders were unaware of incident-specific plans that were in place. A specifically designed operational POD plan for distributing bottled water remained on the shelf, rendering the document useless.

The AAR produced by Hagerty Consulting identifies many strengths that contributed to the eventual resolution of the incident but defines considerably more recommendations for improvement. Some of the highlighted recommendations include clarifying the process to identify and reassign personnel into emergency operations, pre-train and regularly exercise staff who respond during emergencies, use the ICS during disaster response, and align activation levels between city and county agencies. Primarily, though, Hagerty Consulting recommends establishing a pre-identified team trained and exercised to respond with enhanced response capabilities, and this thesis fully supports that proposition.[92]

2. Austin Water Response

Austin Water (AW) is the sole provider of treated potable water for the greater Austin region, serving approximately 1.5 million customers. The department has been in existence for more than 100 years, enduring many natural disasters and industrial accidents in its history, including flooding, extreme weather, industrial mechanical accidents, and hazardous chemical leaks. Following the devastating 2013 Halloween floods, the utility created the dedicated position of emergency management coordinator (EMC). Prior to introducing the EMC, each facility or functional program area within the utility was responsible for conducting site-specific emergency planning and response.

In March 2016, I established an internal Type 4 IMT to coordinate all emergency responses. I did so because the size and scope of the organization covered some 15 different locations and workgroups throughout the greater Austin area. Each had its own ICS

[92] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 1–2.

structure with the expectation of coordinating its own response during critical incidents. By pulling all locations under a modified area command and establishing the IMT, AW was better able to coordinate response operations and limited resources. The team began small, selecting approximately 35 AW staff with enough operational experience and positional authority from within the utility. All members obtained certification in ICS training, up to at least the intermediate level, and together attended training on the conduct and operations of an IMT. Since its inception, the team has expanded to approximately 125 members, routinely conducts training and tabletop exercises, and has responded to multiple incidents. The roster, in its current configuration, represents a little more than 10 percent of the total workforce for the utility, leaving significant resources to meet routine operational needs. Following the 2018 flooding incident, the AW's EMC produced an independent utility AAR, attached to the City of Austin's 2018 Colorado River flooding AAR.

From the AW perspective, this rain incident represented a concern for the Dam Operations Division. AW had taken over the operation of the dam from another city utility just a year prior and was relatively inexperienced in dealing with flooding. This particular dam has provided power generation in the past, but at the time of the incident, it maintained lake levels in a downtown recreational lake. The structure uses hydraulic gates and weighted bascules to maintain the desired level on Lady Bird Lake. During times of flooding, operators staff the dam 24 hours per day across two 12-hour shifts.[93] The utility monitors weather conditions continuously, so on October 16, it learned of the impending storm. Dam operations began their 12-hour rotations in preparation for responding to the floodwaters.

About two days into the incident, one of AW's three water treatment plants started noticing elevated turbidity in raw-water testing. Turbidity is a measure of relative clarity within a water sample and indicates the presence of particulate matter than can affect the

[93] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 107.

treatment process.[94] Turbidity levels exceeded anything historically known—at least at AW—and were so obstructive to the treatment process that plants began experiencing automated shutdowns. Essentially, the incoming raw-water was so thick with mud, silt, and debris from the flooding river that plant production could not meet potable water demands. Engineers and plant operators worked day and night for a week to develop new processes and system workarounds. Utility leaders decided to invoke use restrictions and a precautionary BWN to reduce demands on the system.[95]

a. Federal Guidance

AW did not have an overarching emergency operations plan in place at the time of this incident. Coincidentally, in the same month of the flood, the federal government passed the America's Water Infrastructure Act into law, requiring utility-wide ERPs. However, during the 2018 Colorado River flood, no such document existed. Facilities and work divisions within the utility did maintain some short issue-specific plans, such as localized chemical accident standard operating procedures (SOPs) and life-safety plans. Still, no plans existed to address excess turbidity in the raw river water.

An internal SOP establishing the AW's IMT was the precursor to having a response team in place. The SOP defines assignments and training requirements and details the inner workings of the group. All members must have ICS training, up to and including ICS 300, Intermediate ICS for Expanding Incidents. A few members have advanced and role-specific training as well. Recommendations from the AAR include the expansion of the IMT to fulfill response obligations better, with particular attention to situational awareness and a situation unit within the planning section.[96]

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94 "Turbidity and Water," U.S. Geological Survey, accessed September 8, 2020, https://www.usgs.gov/special-topic/water-science-school/science/turbidity-and-water?qt-science_center_objects=0#qt-science_center_objects.

95 Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, *Colorado River Flooding*, 109.

96 Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 121.

b. Planning

AW uses a combination of pre-incident continuity-of-operations planning and real-time IMT response planning through the ICS planning process.[97] During an incident response, the incident commander (IC) establishes incident objectives for each operational period. The general staff then utilize the ICS planning process to develop strategies and tactics related to each objective and document those tactics in the IAP.[98]

During this incident, I served as one of the DOC managers for the IMT. DOC manager is not a standard position within ICS but a specific local position within our IMT, providing direct assistance and advising the IC and members of the IMT. The information contained in this section is from the AAR and my recollections of the response. During the 2018 Colorado River flood, the AW's IMT generated IAPs for each of 17 consecutive 12-hour operational periods.[99] At the beginning of each operating period, the IC began the shift with a recap of the previous shift's accomplishments and review of objectives. The entire team followed the ICS planning P to work through selecting tactics and developing the IAP for the next evolution. The planning P is an iterative schedule for the adaptive planning process within ICS.[100]

AW did not have incident-specific plans for addressing extreme turbidity. To direct changes to the water treatment process, engineers and plant operators assigned within the Water Treatment Unit of the Operations Section adapted to the worsening conditions as they occurred. Without being tethered to a pre-incident plan, adaptation and flexibility were the keys to finding solutions. Each treatment plant operated with slightly different processes, so the team created separate process plans for each plant. The following section details the decision-making process.

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97 U.S. Fire Administration, *Type 3 Incident Management Team*, 3.6.

98 U.S. Fire Administration, 4.1.

99 Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, *Colorado River Flooding*, 111.

100 U.S. Fire Administration, *Type 3 Incident Management Team*, 3.7.

c. Complexity and Decision-Making

AW's initial approach to this incident was to monitor weather alerts from the National Weather Service and other regional stakeholders. Though the region anticipated heavy rains, the utility was not concerned about its ability to treat source water. The primary concerns involved dam operations, a responsibility that had been recently acquired by the department, in January 2018.[101]

No current staff at AW had ever experienced flooding and rains to the degree witnessed during this incident. This lack of familiarity presented barriers to understanding the troubles that lay ahead. Utility leaders and treatment operations managers could not have predicted that their systems would fail to treat the incoming river water—because of availability bias.[102] Their treatment systems had never failed from regional flooding, so they could not imagine it happening then.

Leaders began the incident by operating in the obvious domain. They relied on entrained thinking, attempting solutions that had worked in the past but were unproductive in this situation. No one in the utility was aware of the Cynefin framework during this incident, but without knowing it at the time, decision-makers transitioned into the complex operative domain. Managers had sufficient expertise to problem-solve in the complicated domain, but there was insufficient time to sense, analyze, and respond appropriately. Conditions within the plants deteriorated at such a pace that decision-makers had to experiment with optional response variances to find practical solutions.

Eventually, leaders realized they were attempting to hold onto a production standard that the plant equipment could not meet. Imagine a runner trying to maintain a pre-defined pace on a flat track, for instance, an eight-minute mile. That pace is likely easy for many runners. Such a speed is the equivalent of the treatment process producing water at its daily rate. Now imagine maintaining that same pace but up a hill instead of on flat ground. The runner is working harder on the incline to maintain her speed. The turbid

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[101] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, *Colorado River Flooding*, 109.

[102] Kahneman, *Thinking, Fast and Slow*, 131.

water, like the incline, caused the treatment process to gas out. Filters were working so hard that the plants could not keep up and went into automatic shutdowns. Once leaders realized that the production standard—a measure of the quality of water discharged from the plants—was the limiting factor, they could experiment with adjustments and overcome the issue.

Without understanding it at the time, the utility applied the principles of probing, sensing, and responding from Snowden's complexity domain.[103] AW isolated factors until it found the one that, with adjustments, would allow for sustained production. By recognizing the performance standard as the limiting factor, AW adapted to the turbidity and sustained production without jeopardizing public health.

d. Response Implementation

To address the risks associated with this substantial rainfall incident, AW activated its internal DOC and IMT.[104] The team assembled on Sunday morning, October 21, 2018, and worked in 12-hour segments of time, called operational periods. Members implemented the ICS planning P, a set of scheduled meetings and development deadlines, to produce IAPs for subsequent shifts. The IAPs guided team members who worked during a given operational period.[105]

Activating the DOC and IMT allowed AW to plan in real time for the circumstances it experienced during this incident. Members of the Resource Unit, within the Planning Section, monitored multiple relevant conditions, including weather, source water quality, treatment plant operations, discharge water quality, potable water supplies, pumping services, and flood impacts at utility facilities, as they occurred. Operations Section personnel then interpreted those conditions and developed response tactics to address

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[103] Snowden and Boone, "A Leader's Framework for Decision Making," 4.

[104] The DOC is a physical location within the department that houses personnel and equipment to coordinate an emergency response. The IMT is a group of Austin Water staff who have been selected to receive ICS training specifically for emergency incident response.

[105] U.S. Fire Administration, *Type 3 Incident Management Team*, 4.1–4.40.

shortfalls. Other general staff within the Logistics Section, Finance Section, and Planning Section then provided operational support to carry out the chosen tactics.

The command and general staff worked in the DOC, located in the administrative headquarters building of the utility, while Operations units worked at the three water treatment plants. Operations status meetings, planning meetings, and briefings occurred on internet-based video conferences. Those with a need to know or be involved with the planning could join remotely, which enhanced the ability to share information and build situational awareness over a large geographical area, in real time.

The IMT was critical, as the mechanism of implementation, for carrying out the plans developed to meet strategic objectives. It was the adaptability, of an ICS-trained team, that allowed AW to evaluate conditions that personnel had not experienced before and design practical experiments to address the novel conditions.

Following this incident, an internal AAR detailed the strengths and weaknesses of the team's response.[106] The IMT was a critical factor in the utility's ability to maintain potable water production for drinking and fire suppression throughout the entire incident. Though the department had not experienced an emergency of this magnitude before, the team provided real-time planning and support to maintain services to the community.[107]

e. Summary

AW did not have a pre-incident ERP, yet the utility fielded an IMT to address the situation. The pre-selected, pre-trained, and experienced team provided the basis for a response that permitted adaptive reactions to conditions in real time. Even without a guiding document, the team implemented its training in the ICS and developed effective response protocols. The IMT allowed AW to be flexible in its response and adapt to the situation as it was happening. That flexibility empowered team members to shift between Cynefin domains, regardless of whether the team knew what it was doing. Effectively,

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[106] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, *Colorado River Flooding,* 106–27.

[107] Austin Homeland Security and Emergency Management and Travis County Office of Emergency Management, 112.

planning in real time induces shifts between the different approaches to problem-solving that Cynefin details. The fact that the team was not adhering to a doctrinal policy was likely the reason it could experiment with different solutions. Experimentation, patience, and team interaction led to transitions from the obvious through the complicated and complex domains.[108]

B. TROPICAL STORM IRENE: WESTPORT, CONNECTICUT, 2011

In late August 2011, Westport, Connecticut, readied for an incoming storm. Westport is a small coastal town, just north of New York City, on Long Island Sound, and August is peak hurricane season. Westport officials had been tracking an incoming storm for a week, preparing for landfall in their backyard.[109] They anticipated that this storm would be one of the most destructive in decades.[110] The City of Westport has a long history of dealing with incidents from bouts with inclement weather.[111] Within the previous 24 months, local authorities had responded to multiple weather issues, including a severe flooding incident, a tornado in nearby Bridgeport, an extreme wind issue, and a January snow emergency.[112]

Following the passing of Tropical Storm Irene, the director of emergency management for the City of Westport produced an AAR. This report highlights details of the lead-up, response to, and recovery from this weather incident.[113] The report and information found on the City of Westport's website were the resources used to construct this case study.

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108 Snowden and Boone, "A Leader's Framework for Decision Making," 7.

109 Andrew Kingsbury, *Tropical Storm Irene: Preparation, Response and Recovery* (Westport, CT: Westport Fire Department and Westport Emergency Management, 2012), https://www.westportct.gov/home/showdocument?id=2727.

110 Kingsbury, 2.

111 Kingsbury, 3.

112 Kingsbury, 3.

113 Kingsbury, 1–22.

1. Federal Guidance

Neither the AAR for this case study nor the Westport city website mentions having an all-hazards city-wide ERP in place. The city website does list an emergency preparedness guide, which provides basic information for residents, and presents terms, suggested equipment, and general instructions.[114] It does not meet the standard of an ERP, as it is not scenario-based, does not include risk assessment language or information, and does not direct response actions for specific threats or emergency conditions.

2. Planning

The AAR for this incident describes planning conducted in expectation of the storm. Planning was not assumption-based, as would be the case with an all-hazards ERP, but was instead consistent with the adaptive approach, conducted in anticipation of an actual and specific threat. Local authorities monitored the storm as it advanced and began taking precautionary actions before the storm reached them. Modern weather tracking radar and modeling from the National Weather Service provided up-to-the-minute information on the path and severity of the storm.[115]

Public safety and emergency response planners did not reference an on-the-shelf plan but relied on their combined experiences to develop preparatory actions as Irene became imminent.[116] Authorities made decisions based on their past experiences with storms such as the one that was approaching. They anticipated flooding that would restrict their ability to respond but did not know precisely where flooding would occur. They pre-staged shelter locations for displaced residents, activated Community Emergency Response Team members and volunteers to staff their facilities, and made many other preparations.

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[114] Westport Fire Department, *Emergency Preparedness Guide* (Westport, CT: Westport Fire Department, 2012), https://www.westportct.gov/home/showdocument?id=665.

[115] Kingsbury, *Tropical Storm Irene*, 5.

[116] Kingsbury, 5.

However, one significant lesson learned was that they had to remain flexible during the actual response. "Our best plans had to be modified at the last moment due to storm acceleration," wrote the director.[117] As on-scene conditions changed, leaders and responders adapted to address new challenges. Attempting to stick to pre-incident planning, as circumstances vary, would most likely have degraded the effectiveness of their response.

3. Complexity and Decision-Making

Days before this storm reached Westport, authorities were evaluating the potential dangers and pre-staging resources for a response. Decision-makers attempted to understand the rising threat and applied their experience and expertise to this circumstance. The AAR does not reflect an attitude of complacency or of underestimating the challenges that they faced. Instead, decision-makers appear to have been operating within the complicated domain, as defined by Cynefin.[118] Authorities contemplated many factors as they developed their response approach, such as tidal implications, soil saturation from previous rain, the sheer size of the storm that was approaching, and the population density of their region.[119] All of these factors together led leaders to the response choices they made. While there is no mention of Cynefin as a guiding framework in this AAR, those crafting this response were seemingly acting within that decisional domain.

4. Response Implementation

This report does not directly identify an IMT for this episode; however, the responders acted as one. The AAR details regularly scheduled situational update meetings between command staff and liaisons from local utilities and regional critical infrastructure organizations.[120] Response groups—from financial tracking to public information—and damage assessment teams are detailed in the report. Financial monitoring was aided by assigning unique account numbers for expenditures associated with the response. Another

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[117] Kingsbury, 17.

[118] Snowden and Boone, "A Leader's Framework for Decision Making," 7.

[119] Kingsbury, *Tropical Storm Irene*, 5.

[120] Kingsbury, 15.

noted efficiency was in establishing a secondary command division to improve the span of control and account for the possibility of isolation from flooding.[121] All of these operational constructs are indicative of Westport's use of the IMT concept.

Suggested improvements from the AAR include using ICS documents and developing an IAP for every operational period.[122] An IAP is a specific documentary tool utilized by IMTs—and detailed in the instructions provided during IMT training—in the ICS planning process.[123] Another observation notes that adding a resource unit, a specialized component of the IMT Planning Section, would improve accountability for all resources during a response.[124] Again, these notes indicate the use of an IMT-like structured intervention.

5. Summary

Westport did not have an assumptive plan directing its response actions for Irene in 2011. It did have a group of experienced professional and volunteer responders who made just-in-time decisions as a significant storm approached. Though not referenced as an IMT in its AAR, the command structures and adaptive planning framework utilized for this storm are consistent with the principles of an IMT and the techniques associated with adaptive planning.

Decision-makers monitored the storm as it advanced and staged resources to meet the challenges they anticipated. However, they did not fall back on assumptions or become complacent as they analyzed the threat. The command structure did not fall into making habitual decisions; instead, it maintained flexibility by relying on analysis and evaluation of the efficacy of its choices. This build-measure-learn approach is consistent with the adaptive processes explained by lean theory.[125]

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[121] Kingsbury, 16.

[122] Kingsbury, 16.

[123] U.S. Fire Administration, *Type 3 Incident Management Team*, 4.1–4.40.

[124] Kingsbury, *Tropical Storm Irene*, 16.

[125] Ries, *The Lean Startup*, 22.

C. EVANS FLOOD: EVANS, COLORADO, 2013

In mid-September of 2013, the small city of Evans, Colorado, experienced a devastating storm and flood incident, which caused an estimated $17 million in damages.[126] Damage to infrastructure and housing included more than 200 mobile homes, 56 single-family homes, numerous commercial buildings, the city wastewater treatment facility, and nearly 1.5 miles of roadway.[127] More than 1,000 residents evacuated with their families for over 48 hours, and approximately 70 percent of the city was without sewer services for more than a week.[128]

The response to this incident involved some 64 separate entities from government, non-government, and private-sector stakeholders, including mutual aid from neighboring cities, Weld County, and the State of Colorado. Two days into their response, leaders deemed city resources insufficient to manage this crisis, and the South West Colorado IMT responded to provide aid.[129] Following the flood, the city commissioned an AAR, published in February 2015, which details the disaster and the associated response.

1. Federal Guidance

The AAR does not mention Evans' having an all-hazards ERP, nor does the city's website have an ERP posted for public review. The report states that the city did not have a "disaster recovery plan" at the time of the flood and recommends creating one. Several existing plans—including a continuity-of-operations plan last updated in 2009, flood mitigation, a utility emergency action plan, and a city master plan—needed to be revamped.[130] The city's Office of Emergency Management website does provide

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[126] David Burns, *Evans Flood After Action Report* (Evans, CO: City of Evans and Evans Fire Protection District, 2015), https://www.evanscolorado.gov/sites/default/files/fileattachments/flood/page/1041/evans_flood_2014_aar_final.pdf.

[127] Burns, 6.

[128] Burns, 6.

[129] Burns, 12.

[130] Burns, 2–44.

emergency preparedness information and links to several resources for citizen awareness.[131]

2. Planning

Response leaders did not rely on an existing ERP to address this flood. Heavy rains in the days leading up to this emergency raised concern; however, officials could not have predicted the berm failure that resulted in citywide flooding on September 13, 2013. Drawing from past experiences with floods and making plans as rains continued, on the evening of September 12, leaders issued voluntary evacuation notices to many residents.[132] The river berm failed the next day, and by September 14, floodwaters on the South Platte River crested to a historic 18.7 feet, almost 9 feet above flood-stage elevation for the city of Evans.[133]

Evans is a small city with minimal resources, so a state-sponsored IMT provided response command-and-control assistance on September 15, following a mutual aid request.[134] The AAR does not detail the planning process of the IMT; however, the team that responded was state-certified as a Type 3 all-hazards team.[135] Type 3 team members must have documented training and experience in applying the ICS, following the guidance presented in the *Interstate Incident Management Team Qualifications System Guide*.[136]

Type 3 all-hazards team members meet qualification and training guidance to deploy during significant incidents that extend into multiple operational periods and use an

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131 "Office of Emergency Management," City of Evans, Colorado, accessed August 10, 2020, https://www.evanscolorado.gov/oem.

132 Burns, *Evans Flood*, 8.

133 Burns, 8.

134 Burns, 12.

135 "Incident Management Teams," Colorado Division of Homeland Security and Emergency Management, accessed August 10, 2020, https://www.colorado.gov/pacific/dhsem/incident-management-teams.

136 Colorado Division of Homeland Security and Emergency Management, *Interstate Incident Management Team Qualifications System Guide* (Golden, CO: All-Hazards Incident Management Teams Association, 2016), https://www.colorado.gov/pacific/dhsem/atom/60956.

IAP to manage a response.[137] IAPs are neither pre-incident nor assumption-based documents. Team members, primarily in the Planning Section, create IAPs to document incident objectives for the operational period following their current shift. Developing an IAP follows the adaptive model, as planners monitor circumstances in real time and establish tactics to meet defined strategies and objectives.[138]

3. Complexity and Decision-Making

According to the AAR, "Due to the complexity of the incident, crews expressed that some staff members were placed into positions they were unqualified for."[139] The local authorities struggled with the management of an incident of this size and scope. The AAR reports that Evans had very few staff with enough experience to match the storm and flooding they encountered. In fact, decision-making was the most challenging trial of the incident.[140]

The report indicates that initial response actions were likely taking place in the obvious domain. While some best practices such as voluntary evacuations, resource staging, and others were occurring, the largely unseasoned leaders struggled to address challenges in real time. The AAR notes that the most recent flood before 2013 had occurred 16 years earlier, so as complications set in, responders could not draw upon proficiency.

The complicated domain connects an apparent relationship between problem and solution. To get to an appropriate answer, leaders sense, analyze, and respond.[141] The two constraining factors for decision-making in complication are competence and time. Evans did not have the luxury of time to evaluate solutions, so it called in more aptitude by requesting the state IMT. As the incident progressed through complication to complexity,

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137 Colorado Division of Homeland Security and Emergency Management, 9.

138 U.S. Fire Administration, *Type 3 Incident Management* Team, 3.1–3.32.

139 Burns, *Evans Flood*, 34.

140 Burns, 32.

141 Snowden and Boone, "A Leader's Framework for Decision Making," 2.

Evans brought in a resource with enough training and skill to manage in the complicated domain.

4. Response Implementation

Local authorities organized themselves, with limited resources, to address the heavy rains and potential for flooding. However, because of their inexperience, they had difficulty in identifying threats and determining response needs.[142] Within 24 hours of the berm's failure that flooded much of their city, leaders realized they needed assistance with managing the response. On Sunday, September 15, 2013, the South West Colorado Type 3 IMT assumed command, as authorized by the City of Evans, the Evans Fire Protection District, and the State of Colorado.[143] For eight days, the IMT coordinated response activities, including repairing the compromised berm, allowing residents to return, and beginning the recovery process.

Among the many benefits of having an experienced IMT in command, one particular advantage was that local responders could shadow and work with the team to gain hands-on experience. Training and exercises do aid responders, but the opportunity to work with and observe a trained IMT is invaluable. The local responders then understood the rhythm of an operational period, participated in planning meetings and briefings in real time, and developed actual IAPs.

A primary recommendation from the AAR is that the City of Evans create a local incident response team, emphasizing ICS training and structure. The AAR reports that local leaders were confused at the outset of this incident and that the lack of ICS structure was a significant contributing factor.[144] It further suggests that city leaders identify key participants to assume roles within the IMT structure and obtain the appropriate training

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[142] Burns, *Evans Flood*, 21.

[143] Burns, 12.

[144] Burns, 21.

for each position.[145] Many outlets offer such FEMA training—from introductory online courses to instructor-led intermediate, advanced, and position-specific classes.

5. Summary

The City of Evans did not have an ERP in place during the September 2013 flood that befell it. The continuity plan was outdated, and other smaller plans were not current. Adding to the issues faced during this flood, local responders and leaders were relatively inexperienced in managing natural disasters and critical incidents of this magnitude. However, they did monitor the incoming threat and did the best they could to get residents out of harm's way.

Nevertheless, local leaders did recognize the need to petition outside resources to assist them with their response. Requesting an IMT and authorizing it to take command provided the means with which the city met the challenges it faced. An IMT, with trained and experienced incident command staff, applied the principles of ICS to set objectives, determine strategies, and select tactics to respond to the residents' needs successfully. Though the AAR recommends updating existing plans, the primary focus should be to develop a local team of pre-selected and trained responders.

[145] Burns, 21.

IV. ANALYSIS: ENHANCING ASSUMPTIVE PLANNING FOR EMERGENCY MANAGEMENT

In their 2009 book *Managing Crises*, authors Arnold Howitt and Herman Leonard present a binary theory of reaction for entities with emergency response obligations, routine emergencies, or crisis emergencies.[146] The concept states that public safety and emergency management agencies build capabilities for response to condition and apply management principles as incidents arise.[147] Howitt and Leonard also discuss a bottom-up process for disaster management; known commonly in the emergency management field with the axiom "All emergencies begin and end locally."[148] That concept is widely regarded, as true in emergency management, and taught in instructor-led ICS classes.

Bottom-up means that local authorities have the responsibility of addressing issues that occur locally. It is the local police, fire, and EMS agencies, referred to typically as first responders, tasked with assisting the people who live in or visit their locales. Other agencies and departments also share in the process, such as public health departments, animal control, critical infrastructure, and private stakeholders.

By routine, Howitt and Leonard describe the process whereby training coupled with repeated experience prepares responders to formulate solutions to problems as they arise. With sufficient experience, commonly repeated situations become normalized, and solving them becomes a habit. There is danger in this practice, though, as experienced responders may overlook indicators that show a given circumstance is not as it appears. When responders act routinely, they are operating in Snowden's obvious domain.[149] Some may believe, even convince themselves, that the situation they are dealing with is routine and, in doing so, miss essential signals alerting them to the criticality of the incident. Even when

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146 Arnold M. Howitt and Herman B. Leonard, *Managing Crises: Responses to Large-Scale Emergencies* (Washington, DC: CQ Press, 2009), 4–5.

147 Howitt and Leonard, 275.

148 Howitt and Leonard, 3–4.

149 Snowden and Boone, "A Leader's Framework for Decision Making," 1.

events are repetitious, such as motor vehicle accidents, house fires, or complaints of chest pain, responders should avoid treating them as routine.

Crisis emergencies, according to Howitt and Leonard, are those instances where conditions present novelty.[150] Responders do not experience these types of incidents with regularity, or a common occurrence may become novel due to its size, scope, or other external factors. In these types of incidents, novelty can call into question preconceived templates for a response and may discredit pre-existing assumption-based plans. How, then, do response entities address crisis emergencies?

Snowden's Cynefin framework coupled with a qualified IMT provides the basis for improving emergency response outcomes. The IMT becomes the mechanism for implementing solutions, and the Cynefin framework guides operational perspectives and the problem-solving philosophy. Cynefin recommends that professional responders avoid the obvious domain unless they regularly review conditions and their solutions are apparent.

A. APPLICATION OF THE CYNEFIN FRAMEWORK

This chapter details the domains associated with Cynefin and discusses its application in disaster response. Snowden has provided direction for applying the Cynefin framework in his many articles and speeches. In a 2003 *IBM Systems Journal* article, he and co-author C. F. Kurtz describe in great detail Cynefin and its applications within knowledge management, strategy, management training, policy-making, and leadership.[151] One tool I use frequently and share with others is an eight-minute video on YouTube in which Snowden describes the process of using Cynefin for dynamic problem solving.[152] The video provides a ready resource that practitioners can review as they learn and apply the concepts of Cynefin.

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150 Howitt and Leonard, *Managing Crises*, 278.

151 C. F. Kurtz and D. J. Snowden, "The New Dynamics of Strategy: Sense-Making in a Complex and Complicated World," *IBM Systems Journal* 42, no. 3 (2003), http://alumni.media.mit.edu/~brooks/storybiz/kurtz.pdf.

152 Cognitive Edge, "The Cynefin Framework."

When dealing with complications and complexity, responders must be aware of the conceptual space in which they operate. They must understand that the situations presented are generally not routine at all. Snowden suggests that responders limit work within the obvious domain to avoid misidentifying complicated or complex issues as routine. The obvious domain dictates fixed constraints with predictable, repeatable patterns and a clear nexus of cause and effect, which suggest a best-practice approach.[153] The process here is to sense, categorize, and respond.[154] Upon recognizing a situation, the responder observes relevant conditions and categorizes them relative to one's past experiences. Imagine a mother walking into a room and seeing that her child has spilled milk on the table. This situation does not appear to be a new emergency, the toddler has spilled milk before, and mom knows the solution. She grabs paper towels and quickly cleans up the spill. However, does that best practice work best when the disaster is not milk? What if the problem is a caustic or poisonous substance? What if mom should not touch it all? Best practices could endanger responders and antagonize the situation if they are applied when inappropriate for the job.

Another factor for consideration when operating in the obvious domain is the complacency cliff. When responders believe they have seen all of the variables in repeated situations or become too comfortable with innately dangerous circumstances, they become complacent and oblivious to worsening conditions. Complacency can rapidly shift events from obvious to chaotic in the blink of an eye. When responders lose sight of changing dynamics, rapid shifts into chaos alter their ability to react. The problem-solving process becomes act-sense-respond.[155] An immediate response must take place to bring circumstances back under control. Chaotic responses do not offer guaranteed outcomes and are very hard on resources. How, though, should responders act as complications arise?

Increasing the gap between cause and effect moves the situation into the complicated domain. Characterization within this environment is a known solution—but

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[153] Cognitive Edge.

[154] Cognitive Edge.

[155] Cognitive Edge.

unknown to the practitioner—and suggests that analysis instead of categorization is the better approach to problem-solving. In the complicated domain, Snowden describes the process as sensing, analyzing, and responding, and defines time and expertise as two governing constraints that guide the response.[156] The restrictions are one of two dynamics involved in solving the new issue effectively. Responders must bring either specific expertise or time in which to analyze the situation more deeply.[157] These two factors are the defining characteristics of the complicated domain because a relationship exists between cause and effect; however, it is not immediately self-evident.[158] Responders operating in this domain utilize good practices to solve problems, as applying best practices here could have adverse effects.[159] Good practices allow for variables to solutions, giving responders more choice in specific tactics. Following a template or script is contraindicated and can be disruptive to the response.[160]

Complexity has a causal relationship, but only hindsight can provide its understanding. Outcomes are unpredictable, and solutions are novel and emergent.[161] The process for solving complex issues is to probe, sense, and respond.[162] Here, responders experiment with safe-to-fail options, having the ability to dampen or amplify inputs based on observed results.[163] Moreover, Snowden points out that responders should not enact experiments until they have clearly defined dampening and amplifying procedures.[164] Ultimately, there is an increased likelihood of a synergistic effect, in which experiments can push critical conditions into more considerably distress.

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156 Cognitive Edge.

157 Cognitive Edge.

158 Cognitive Edge.

159 Cognitive Edge.

160 Howitt and Leonard, *Managing Crises*, 279.

161 Cognitive Edge, "The Cynefin Framework."

162 Cognitive Edge.

163 Cognitive Edge.

164 Cognitive Edge.

Together, Cynefin's complicated and complex domains represent the space in which emergency responders should most frequently consider solutions. In theory, these two domains provide the best opportunity for positive outcomes with the least risk of falling into chaos. Resources move between the complicated and complex realms reasonably quickly, and responders remain alert for changing conditions and can either apply expertise or experiment for positive results. Resources in the obvious domain, however, tend to be at rest and can require significant effort to engage.

B. MECHANISM OF IMPLEMENTATION

If Cynefin offers the framework for making sense of dynamic situations, how do responders implement solutions in real time? In my professional opinion, the preferred mechanism of implementation during critical incident response is the IMT. Over the past 50 years, ICS has become the guiding principle behind emergency responses.[165] As discussed previously, federal laws and policies dictate the use of ICS for agencies with response obligations and as a requirement for federal disaster fund reimbursements.

ICS provides a standardized adaptive process for responding, ensures a universal understanding of terms and procedures, utilizes specific forms for documentation, assists with coordinating resources, and applies in every response and every state in the country. However, ICS is just a system, not a functional body. Effectively using ICS requires having a mechanism of implementation. The training required for an IMT is specific ICS training, and not the expertise that any single member brings from one's regular profession. The experience necessary for a robust adaptive response is the understanding of the application of ICS principles in response to any category of disaster. I believe that local IMTs are not used prevalently because the application of ICS is a perishable skill and requires repeated training and exercises to maintain proficiency. Dedicating staff time for training and practices is a costly, time-consuming proposition and requires a great deal of participation from contributing organizations.

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[165] Howitt and Leonard, *Managing Crises*, 131.

Nationally, the United States uses IMTs to affect the processes and procedures of ICS. There are five categories of IMTs, from small local Type 5 teams to large nationally accredited Type 1 structures.[166] Credentialed and qualified members fill team command and general staff positions. The IC, liaison officer, public information officer, and safety officer all make up the command staff.[167] The general staff positions are typically the four section chiefs, from Operations, Logistics, Planning, and Finance/Administration.[168] Teams can expand or contract based on the needs present at any given incident, giving them a great deal of flexibility when responding to a wide range of scenarios.

C. INTEGRATING CYNEFIN AND INCIDENT MANAGEMENT

When activated, two key IMT staff—typically the IC and the Operations Section chief—would use Cynefin to effect an optimal response. ICs lead the process of integration by identifying the conceptual domain in which the team operates and understanding which decision model to employ. ICs must be able to detach from the direct action and interpret conditions to know whether the incident is of the obvious, complicated, complex, or chaotic variety. By recognizing the appropriate domain, the IC then directs IMT staff to operate within it.

The IC develops practical incident objectives, which communicate desired outcomes with the rest of the IMT. Using the acronym SMART—specific, measurable, action-oriented, realistic, and timely—to establish objectives, ICs guide response activities, directing actions associated with each domain. This style of planning ensures an adaptive approach, as objectives, strategies, and tactics are continuously evaluated and updated with changing conditions. The ICS planning P is the iterative structure that ensures the adaptive technique is in use. For example, should the IC define the incident as complex, he or she can request safe-to-fail experimentation strategies from the Operations and Planning teams. The distinction between the two planning styles—assumption-based and adaptive—is

166 U.S. Fire Administration, *Type 3 Incident Management Team*, 1.23.

167 Federal Emergency Management Agency, *National Incident Management System*, 27.

168 Federal Emergency Management Agency, 28.

made manifest here as ABP provides pre-identified options based on past experiences while the adaptive planning P ensures flexibility in an iterative planning cycle.

The operations section chief (OSC) develops strategies and tactics from established objectives. Strategies are the various paths a team can take to meet objectives, and generally, OSCs look for multiple approaches that could work in a given situation. Tactics are the actual steps taken after choosing a particular strategy, and they translate into operational instructions for field-level crews addressing the emergency conditions.

In a complicated scenario, both the IC and OSC should understand the decision model sequence of sense-analyze-respond, as provided in Cynefin. With that perspective, they either bring specific expertise to address the issue or provide time for their team to analyze the situation for a resolution. The Cynefin framework provides the basis for adaptive planning during emergency response instead of reliance on pre-incident assumption-based plans. Cynefin, or a similar approach to integrate complexity theory into problem-solving, would enhance a leader's ability to respond to emergencies effectively.

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V. CONCLUSION

This thesis sought to examine whether a potential change in the national incident management strategy could improve emergency preparedness and test the hypothesis that a standard mechanism for implementation could improve critical incident response. A literature review of federal guidance and research in emergency management theory provided background and direction for the current policy of suggesting pre-incident, assumption-based, all-hazards planning as the standard national approach.

The case studies reviewed indicate that assumption-based plans had little effect on the outcomes of each situation though, in each case, a team of responders was required to manage impacts and find solutions. In the City of Austin's case, the *Emergency Operations Plan* provided no response direction, and the one pre-existing plan, for POD operations, remained unused. For AW and the City of Evans, an IMT provided direct response coordination and managed overall response operations. For the City of Westport, responders acted as an ad hoc IMT.

At AW, the IMT was the critical element that allowed the utility to work through a problem it had never experienced. Members of the team brought personal and professional knowledge and capabilities to the problem. Still, it was their collective ability to apply the ICS process that allowed for the experimentation that led to a successful resolution.

The cases reviewed do not, however, refute all value attributed to pre-incident planning. Jurisdictions should conduct ABP to understand the potential risks associated with their locations and services. All-hazards pre-incident plans aid in developing response capabilities and should be used for training and exercising coordinated response teams. Teams can use scenario-based procedures as learning tools to exercise responses within a simulated disaster.

A change in the national strategy, from a focus on ABP to the development of local IMTs, would provide a mechanism for agencies and jurisdictions to respond. Local response teams that train and exercise together would provide the foundation for improved response efforts. The goal is not to eliminate assumption-based plans but to synthesize

them with established local response teams—preferably, teams that have an understanding of complex problem-solving, as presented in the Cynefin framework.

In hindsight, the 2018 Colorado River flood is an example of a scenario that began as complicated but transitioned to complex as impacts of the flood progressed. Never having seen this particular problem, AW engineers developed experimental processes to address the turbidity issue that overwhelmed their treatment plants. The conversion took place as the engineers decided to attempt multiple solutions for the problem, using the probe-sense-respond framework.[169] Though AW did not know it was working within the Cynefin model, it indeed followed the protocols developed by Snowden. It was the IMT that provided the mechanism for the utility to address the emergency conditions it faced. Adopting Cynefin as an analytical tool could aid decision-makers during critical incident responses.

Because IMTs are pre-selected, trained, and exercised before emergency incidents, they represent possibly the most effective way for jurisdictions to prepare. I want to emphasize here that the following recommendations are not the easiest way to prepare for disasters. In my opinion, they are the best way to strengthen state and local responders. Assumption-based plans cannot possibly account for every variable within any given disaster. They offer more value as training tools for response teams. Organizations with the obligation to respond during disasters should continue to develop pre-incident plans and use them as tools to train and exercise responders before events unfold as emergencies.

IMTs that learn and apply the Cynefin framework as a decision-making model transition from being reactionary to adaptive. Together, the team and the adaptive practice should significantly enhance any jurisdiction's capacity to respond to emergencies. The cases reviewed in this thesis show that a shift in the national approach, by emphasizing teams utilizing an adaptive process, would assist local authorities in their response obligations. As shown in Table 2, ICs must recognize the appropriate domain in which to problem-solve. Understanding transitional indications, appropriate strategies, warning signs, and Cynefin concepts can help leaders manage effectively.

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[169] Snowden and Boone, "A Leader's Framework for Decision Making," 2.

Table 2. Application of Cynefin for Crisis Response

Obvious	• Clear relationship between cause and effect • Repeatable • Evidence-based operations	• Rapid transition to chaos • Unknown answers • Unexpected reactions	• Sense-categorize-respond • Use SOPs or standard operating guidelines • Delegate to subordinates • Routine monitoring practices suffice	• Complacency • Routine thinking • Ignoring the unexpected outcome
Complicated	• Answers exist but must be researched or analyzed • More than one right answer • Discoverable but not obvious cause/effect relationship	• Expert solutions produce unexpected outcomes • Situation improves (shift to obvious) or worsens (shift to complex/chaotic)	• Sense-analyze-respond • Consult with experts • Embrace conflicting theories/options	• Reliance on past solutions • Shutting out differing opinions • Reliance on best practices
Complex	• Volatility and uncertainty • Lack of patterns or replication • Competing ideas • Unknown cause/effect relationship	• Emerging patterns (improving conditions) • Conflict and instability (worsening conditions)	• Probe-sense-respond • Experimental solutions • Known methods for amplifying or attenuating	• Over-constraining leadership • Impatience with outcomes • Blaming/conflict within team
Chaotic	• Conflict and high stress • Unknown answers • No time for analysis • Significant loss of property/life	• Discovering links to cause/effect • Reduction in losses and stress • Emerging answers	• Act-sense-respond • Apply all available resources • Seek assistance • Communicate and act	• Belief in a single leader more than process • Failure to empower responders • Progressive losses

Some influences may assist or detract from a jurisdiction's move to initiate local IMTs. It would be beneficial to secure political backing from local elected officials and senior leadership within organizations before attempting to build these teams, as training and practice demand resources, funding, and time away from assigned duties to complete. Moreover, proficiency in the application of ICS is a perishable skill that can fade over time, and it is not unusual for individuals to take instructive courses in ICS and then not use those skills for months or even years. The ICS process requires dedication from leaders for participants to maintain their skills.

ICS is very formulaic in its practice and is rife with forms. Personnel must understand how and when to use them, as failure to use documents, structures, and hierarchies properly can lead to confusion and deficiencies, as noted in Hagerty Consulting's AAR. However, when practitioners adhere to the process and the standardized structures are used effectively, the process allows for adaptive planning in real time.

This study recommends several actions to improve local, state, and federal preparedness for crisis response. Each proposal stems from a review of current literature as analyzed within the context of the four selected case studies. The following recommendations correspond with each variable analyzed.

A. FEDERAL GUIDANCE

Through NIMS, DHS and FEMA should, in accordance with homeland security presidential directives, presidential policy directives, emergency management performance grants, and ICS, 1) continue to encourage local, state, and federal response agencies in the development of all-hazards ERPs and 2) require the establishment of IMTs by all jurisdictions or agencies seeking grant funding or disaster reimbursement. IMTs provide the mechanism by which response agencies coordinate collaborative response efforts, and through selection, training, and planning.

B. PLANNING

ABP provides value for local, state, and federal response agencies in identifying risks to operational continuity and as a tool for the training and exercise of crisis responders—and should continue for those purposes. This thesis recommends shifting to an adaptive process during actual response efforts. Active adaptive planning, executed in concert with the ICS planning P, and an understanding of complexity decision-making fundamentals provide strategic and tactical flexibility as operational conditions change.

C. COMPLEXITY DECISION-MAKING

This thesis recommends that critical response leaders obtain training in the application of the Cynefin framework to understand the theory of operations within each conditional constraint and develop problem-solving skills within each domain. Critical

skills include the ability to transition from chaotic conditions to an ordered status and avoid an uncontrolled decline from complacency into chaos.

D. RESPONSE IMPLEMENTATION

An IMT comprising pre-trained, experienced responders provides the mechanism with which jurisdictions and organizations can respond to critical incidents. Teams, through the use of task books, can track and measure each member's training and experience to gauge a given entity's capacity to respond during disasters and plan improvements as needed. Teams can utilize the four primary domains, as defined by the Cynefin framework, to design response processes.

(1) **Obvious Domain**: Develop and use SOPs, standard operating guidelines, all-hazards ERPs, and incident-specific plans.

(2) **Complicated Domain**: Develop and identify subject-matter experts within, or available, to provide conditional analysis during critical incident response.

(3) **Complex Domain**: Provide key team leaders, such as ICs and section chiefs, with training in the application of the Cynefin framework, with an emphasis on applying the fixed, governing, or enabling constraints associated with each operational domain, as previously described.

(4) **Chaotic Domain**: Engage all available resources to transition from chaos into the complex or complicated domain for management of the response.

Type 4 teams, representing single agencies, should be built to handle expanding departmental incidents. Type 3 teams would be appropriate at the county or municipal level, capable of responding during developing events for extended operational periods. All required training materials are readily available to begin creating these teams. FEMA and the U.S. Fire Administration currently offer all-hazards IMT training in their O-305 course.

Practitioners or leaders who want to establish local IMTs can follow the process created at AW. It developed an IMT by identifying the minimally viable product needed to coordinate utility-wide responses and selected existing staff required to form the core team. AW wanted to have the capability of responding over multiple operational periods, so it

decided to develop three separate groups, each consisting of an IC, his command, and general staff.

ICS requires that all incidents must have an IC. Whether a single-officer police unit or a multiple-alarm fire response, all crises must have an established commander with the responsibility and authority to commit resources, command actions, and make expenditures.[170] In ICS, the elected official or department head is not the suitable person to fill the IC position. AW recruited three assistant directors, each with enough expertise in utility operations and sufficient authority to move resources within an incident as first ICs.

Command staff are aides to the IC and perform functionally specific tasks. They are the public information officer, liaison officer, and safety officer. The utility has a Safety Division, so it selected personnel from within that group to become the first safety officers. The utility also has a marketing and information program, so personnel from that group became the first public information officers. In the ordinary course of work, AW interfaces with regulatory agencies and the state legislative body, so it selected staff with those experiences to serve as liaison officers.

It is typical for public safety organizations, such as police, fire, and EMS agencies, to use ICS. Utilities and other non-typical response entities can lack familiarity and expertise in applying the system. AW's lack of experience led me to create a position not routinely included in the command staff structure. We developed a DOC manager position to serve as an assistant for the new ICs and provide ICS-specific input and guidance during activations. We sought out military veterans who worked for the utility to fill the DOC manager role because veterans are comfortable with hierarchy and a chain of command and take to the position quickly. I worked closely with these new members to teach them ICS and how to apply it.

The next steps included developing the IMT's general staff. They are section chiefs responsible for the functional aspects of ICS—Finance, Logistics, Operations, and

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[170] Federal Emergency Management Agency, *An Introduction to the Incident Command System, ICS 100*: *Student Manual*, IS-0100.c (Washington, DC: Department of Homeland Security, 2018), 62–65.

Planning, or "FLOP," Sections.[171] Three of these sections align well with most organizations. Operations involves the work a department does. For AW, this translates to treatment, distribution, collections, and support staff. The utility uses operations managers in the daily execution of work, so those managers were a natural fit for the OSC roles. We recruited six OSCs so that each team could have a primary and back up, called the deputy OSC. Deputies must have the same qualifications as their primaries and can replace chiefs should the need arise.[172] The Finance and Logistics Sections equate with financial services and purchasing divisions in almost any department. Existing AW financial services personnel were engaged in filling these roles in our IMT.

The ICS Planning Section is not readily associated with normal organizational operations and was a particular challenge for AW to fill. The planning section is directly involved with solution planning during a disaster response, responsible for tracking information related to all aspects of the activation. I leveraged an occupational role within our department—the business process consultant, position—whose expertise involved facilitating meetings, managing projects, and explaining business processes to department staff. The skills associated with this job title were precisely what we were looking for in our Planning Section chiefs.

With the basic positions filled for our IMT, we initiated the training requirements necessary for membership on the team. Each member was required to obtain certification through Intermediate ICS. Four basic online courses were prerequisites for the intermediate class, which was instructor-led. Once each member completed the individual training, the team was brought together as a group for a two-day course in IMT operations. As three separate teams, they received instruction and completed tabletop exercises as simulated activations. They worked their way through increasingly challenging and complex scenarios, applying the principles of ICS.

With the teams established and trained, we set up a notification and reporting system that allowed members to activate in case of an emergency. The emergency

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171 Federal Emergency Management Agency.

172 Federal Emergency Management Agency.

management program began a schedule of exercises, intending to provide at least one opportunity per year for all members to practice what they had learned. Assumption-based plans have been the most effective tool for exercising the IMTs. Scenarios have been designed to reflect assumed threats to the utility, and teams work through response options.

We capture AARs for each exercise and distribute the lessons learned to all members. As the IMT has expanded, we continue to provide training and practice exercises. The utility has activated the IMT about a half-dozen times over the past four years. With each activation and exercise, we improve our ability to respond effectively. Entities or jurisdictions can emulate this process to develop their own IMTs.

Capitalize on talent pools that exist within your department, city, county, or state. Emergency management often overlooks potential contributors, as they are not traditional first responders. Librarians, auditors, project managers, and many others bring skills and behaviors to assist with the Planning Section and other demands. Be creative and inclusive, welcome assistance from individuals who want to serve but are not looking to respond in the field.

Two issues this study did not fully address include team size and unit development. As the emergency manager for AW, I started small and added to the team as the need arose. I recommend team size and unit development as a research subject for future study. At AW, the team roster consists of about 10 percent of our total number of employees. A future project could research multiple jurisdictions and departments to determine ICS unit development recommendations and make suggestions on appropriate staffing depth for IMTs. Perhaps staffing levels ought to be a ratio of full-time employees within a given jurisdiction or local department and team size might be a fraction of a given population served.

In final summary, agencies, jurisdictions, regions, and all others with crisis mitigation and reaction obligations can employ the IMT concept, in addition to pre-incident ABP, to better prepare themselves and their constituents. It is my greatest desire that the research and analysis provided in the thesis is used to improve upon the national preparedness strategy. I hope that the information presented in this work enhances the

process of preparing local, state, and other responders nationwide for the inevitable disasters that will affect our people and our great nation.

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