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FIGHTING THE FIRE IN OUR OWN HOUSE: HOW POOR DECISIONS ARE SMOLDERING WITHIN THE U.S. FIRE SERVICE

by

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March 2018

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This thesis examines how large organizations that routinely engage in high-risk activities—particularly the U.S. fire service—discover, interact with, and counteract deviant behaviors that latently influence safety-centric attitudes within organizational frameworks. To a larger extent, the thesis analyzes how sociological interactions in the workplace shape decision-making processes in dangerous situations. The research question specifically asks whether the U.S. fire service has normalized deviant behaviors that negatively influence firefighter safety. A policy analysis with recommendations was the methodology incorporated to validate the absence or presence of normalized deviance. This method required analyzing at a granular level the policies and procedures of a large metropolitan fire department, with the Dallas Fire Rescue Department (DFRD) chosen as a representative organization. While the thesis did not reveal widespread institutionalized deviance within DFRD's emergency operation procedures, analysis of internal documents about specific emergency incidents signal a trend toward abnormalities in decision-making abilities in low-probability, high-risk incidents. Recommendations include capturing routine information for best-practices reinforcement in addition to comprehensive analysis of emerging deviance patterns. Additionally, a second recommendation suggests incorporating an anonymous near-miss reporting system to identify workplace incidents that fall short of an accident, but nonetheless contain pertinent educational information.

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FIGHTING THE FIRE IN OUR OWN HOUSE: HOW POOR DECISIONS ARE SMOLDERING WITHIN THE U.S. FIRE SERVICE

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ABSTRACT

This thesis examines how large organizations that routinely engage in high-risk activities—particularly the U.S. fire service—discover, interact with, and counteract deviant behaviors that latently influence safety-centric attitudes within organizational frameworks. To a larger extent, the thesis analyzes how sociological interactions in the workplace shape decision-making processes in dangerous situations. The research question specifically asks whether the U.S. fire service has normalized deviant behaviors that negatively influence firefighter safety. A policy analysis with recommendations was the methodology incorporated to validate the absence or presence of normalized deviance. This method required analyzing at a granular level the policies and procedures of a large metropolitan fire department, with the Dallas Fire Rescue Department (DFRD) chosen as a representative organization. While the thesis did not reveal widespread institutionalized deviance within DFRD's emergency operation procedures, analysis of internal documents about specific emergency incidents signal a trend toward abnormalities in decision-making abilities in low-probability, high-risk incidents. Recommendations include capturing routine information for best-practices reinforcement in addition to comprehensive analysis of emerging deviance patterns. Additionally, a second recommendation suggests incorporating an anonymous near-miss reporting system to identify workplace incidents that fall short of an accident, but nonetheless contain pertinent educational information.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAR	after action report
ARFF	aircraft rescue and fire fighting
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
DFRD	Dallas Fire Rescue Department
DOT	Department of Transportation
EMS	emergency medical services
ERB	Emergency Response Bureau
ERG	emergency response guidebook
FDNY	Fire Department of New York
FEMA	Federal Emergency Management Agency
FGC	fire ground commander
HazMat	hazardous materials
HE	human error
HRO	high reliability organization
IAFF	International Association of Fire Fighters
IC	incident commander
ICS	incident command system
IDLH	immediately dangerous to life and health
IDS	internal document system
INSAG	International Nuclear Safety Advisory Group
IRB	Institutional Review Board
ISO	incident safety officer
KSC	Kennedy Space Center
LODD	line of duty death
MDC	mobile data computer
MOP	manual of procedure
MTI	Morton Thiokol, Inc.
NASA	National Aeronautics and Space Administration
NFFF	National Fallen Firefighters Foundation

NFIRS	National Fire Incident Reporting System
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NMRF	near miss reporting form
OSHA	Occupational Safety and Health Administration
PASS	Personal Alert Safety System
PIA	post-incident analysis
PPE	personal protective equipment
RE	resilience engineering
RIC	Rapid Intervention Crews
RPDM	recognition-primed decision model
SA	situational awareness
SAR	search and rescue
SCBA	self-contained breathing apparatus
SCM	Swiss cheese model
SOP	standard operating procedure
SPOPS	SOP Special Operations
SRB	solid rocket booster
SRM	solid rocket motor
STS	Space Transportation System
TCFP	Texas Commission of Fire Protection
TIC	thermal-imaging camera
TTF-2	Texas Task Force-2
USAR	urban search and rescue
USFA	U.S. Fire Administration

EXECUTIVE SUMMARY

Oftentimes, organizations declare employees to be their greatest asset. Workers engaging with others in their insular workplace achieve organizational goals through collaboration and establishing and developing a localized work ethos. However, when work processes are strained by supervisory production demands, performance of the local workgroup can adjust to accept risk that makes safety negotiable.[1] Incremental and leisurely erosion of safety-centric workplace processes can influence and drive an entire institution to analyze and perform actions under aberrant decision-making frameworks. This thesis seeks to understand how high-risk occupations, especially the U.S. fire service, potentially adopt and eventually contend with the normalization of deviance.

The concept of normalizing deviance within high-risk vocations was first examined in depth after the 1986 space shuttle Challenger disaster by sociologist Diane Vaughan. Vaughan's analysis of the tragedy disclosed several sociological failures within the National Aeronautics and Space Administration (NASA) that contributed to poor decision-making.[2]

At the organizational level, normalization of deviance elucidates the social construct of workplace catastrophes.[3] Decisions that would otherwise appear illogical outside NASA were seemingly rational inside the agency, as the boundaries of normality had been widened to accommodate incremental failures and near misses now fell within the boundaries of acceptable performance.[4] Delineating between unsafe acts, near misses, incidents, and accidents is crucial to understanding the escalation of occurrences, and

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[1] David L. McLain and Kimberly A. Jarrell, "The Perceived Compatibility of Safety and Production Expectations in Hazardous Occupations," *Journal of Safety Research* 38, no. 3 (January 2007): 299, doi: 10.1016/j.jsr.2006.10.011.

[2] Diane Vaughan, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA* (London and Chicago: The University of Chicago Press, 2016), loc. 483 of 13511, Kindle.

[3] Ibid., loc. 500.

[4] Ibid., loc. 1687–1696.

their cumulative effect upon an organization.[5] Additionally, understanding how organizations are structured and operate, from either a linear or complex construct, provides a level of clarity as to potential problems encountered. Furthermore, the belief that organizations can conceivably exist in a pre-accident period, called an incubation period, is examined for legitimacy.[6]

Another major theme explored is the abstraction known as a drift into failure. This framework suggests that organizations methodically and slowly make incremental changes that direct the organization toward the boundaries of safety, which challenges those borders with increasing frequency.[7] A reviewed accident causation model is the Swiss Cheese Model, which seeks to define the conception of defense in depth, and how active and latent failure pathways can defeat such protective layering.[8] Finally, consideration is given to the idea of the overall effects of either loose or tight coupling on organizations; specifically, how these organizational characteristics can either help or hinder business continuity and operations.[9]

Chapter IV of this thesis delves into whether normalization of deviance exists within high-risk organizations. The principle of production over safety as a stark reality encountered by high-risk organizations, and its contributive effect on workplace justification of shortcuts are examined. Shortcuts sometimes give rise to satisficing, implying that people choose an easier way as opposed to the best way to solve a problem.[10] Structural secrecy as an insulating mechanism against outside influence is

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[5] Sidney Dekker et al., *Resilience Engineering: New Directions for Measuring and Maintaining Safety in Complex Systems* (Ljungbyhed, Sweden: Lund University School of Aviation, 2008), 12–13, https://pdfs.semanticscholar.org/a0d3/9cc66adc64e297048a32b71aeee209a451af.pdf.

[6] Barry A. Turner, *Man-Made Disasters*, 1st ed. (London: Wykeham Publications, 1978), 86.

[7] Sidney Dekker, *Drift into Failure: From Hunting Broken Components to Understanding Complex Systems* (Farnham, United Kingdom; Burlington, VT: Ashgate Publishing, 2011), preface, xii.

[8] James Reason, "A Systems Approach to Organizational Error," *Ergonomics* 38, no. 8 (August 1995): 1711, doi: 10.1080/00140139508925221.

[9] Charles Perrow, *Normal Accidents: Living with High-Risk Technologies* (Princeton, NJ: Princeton University Press, 1999), 8, Kindle.

[10] Barry Schwartz et al., "Maximizing versus Satisficing: Happiness Is a Matter of Choice," *Journal of Personality and Social Psychology* 83, no. 5 (2002): 1178, doi: 10.1037//0022-3514.83.5.1178.

considered as influential to promoting normalized deviance.[11] To evaluate the U.S. fire service effectively and fairly, and particularly the Dallas Fire Rescue Department (DFRD), evaluative criteria are established to determine whether normalization of deviance exists in the fire service.

The fifth chapter opens up with a discussion of annual firefighter Line of Duty Death (LODD) statistics that reveal consistent mortality rates despite innovations within the fire service industry, such as the Incident Command System.[12] Decision-making paradigms on the fireground are examined that might explain perpetual LODD, including violations of existing rules and regulations that place firefighters at elevated risk of injury or death. Loss of situational awareness is reviewed as a possible factor in fireground injury or death.[13] The concepts of both goal seduction and situation aversion are analyzed to verify if either advance unsafe fireground actions.[14] Next, the idea of a safety culture within the fire service is inspected and how a firefighter's identity is based on both internal and external influences.[15]

The sixth chapter specifically examines the DFRD for instances of institutionalized deviance in its internal documents and training resources used in both initial and operating platforms. After action reports (AARs), in addition to manuals of procedures and standard operating procedures are reviewed. Also, a study of almost 2,000 injury claims over a 17-year period is reviewed. Finally, specific instances of safety breaches are analyzed for conformity to firefighting best practices. The chapter concludes

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[11] William H. Starbuck and Moshe Farjoun, eds., *Organization at the Limit: Lessons from the Columbia Disaster* (Malden, MA: Blackwell Publishing, 2005), 54.

[12] U.S. Fire Administration, *Firefighter Fatalities in the United States in 2015* (Emmitsburg, MD: U.S. Fire Administration, 2016), 5, https://usfa.fema.gov/downloads/pdf/publications/ff_fatalities_2015.pdf. See Figure 1. On-Duty Firefighter Fatalities (1977–2015).

[13] Dubé Robert, "Situational Awareness Ensures a Safe Operation," Fire Rescue, January 31, 2008, http://www.firerescuemagazine.com/articles/print/volume-3/issue-2/firefighter-safety-and-health/situational-awareness-ensures-a-safe-operation.html.

[14] Christopher Bearman and Peter A. Bremner, "A Day in the Life of a Volunteer Incident Commander: Errors, Pressures and Mitigating Strategies," *Applied Ergonomics* 44, no. 3 (May 2013): 489, doi: 10.1016/j.apergo.2012.10.011.

[15] William Pessemier, "Developing a Safety Culture in the Fire Service," *International Fire Service Journal of Leadership and Management* 2, no. 1 (2008): 11, http://www.ifsjlm.org/sites/default/files/past-edition-pdfs/IFSJLM_Vol2_Num1.pdf#page=9.

with a review of documents external to the DFRD and their potential relevance to the overall discussion of permitting deviant mindsets on the fireground.

The final chapter seeks to draw conclusions and offer specific recommendations to assist the DFRD in restraining normalized deviance. Four conclusions and three recommendations are presented that provide pragmatic solutions to outstanding issues. Conclusions range from initiating in-depth studies of near miss incidents and increasing overall situational awareness, to an acceptance that organizational drift towards failure is manifest within the fire service in general and the DRFD in particular. Recommendations include accepting a resilience engineering approach to understanding accidents by embracing a modified risk matrix model that aligns more with the reality actually observed. Next, a proposal to initiate an anonymous near-miss reporting system is examined, including a draft form that captures incidents that occur more frequently than accidents. Quantifying and documenting such events can scope the size of the issues leading to the near miss. Lastly, the recommendation to summarize and document more everyday incidents in an abbreviated AAR is suggested, including a shortened AAR form that can be collected and analyzed.

In closing, the thesis seeks to understand how deviant behaviors progress to such a degree that they actually influence how unsafe work is performed in high-risk occupations. Focusing on the fire service, normalization of deviance is the tragic end state of a long-term turning of a blind eye to workplace productivity over safety, coupled with an almost unabated allowance of local workgroups to construct dangerous subcultures that are permitted to thrive. While the fire service has the public perception of being quintessential risk takers in limited situations, normalizing and allowing risk to infiltrate the mundane decision-making paradigm of the firefighting profession is a dreadful thought. The recommendations of the thesis advance practical solutions that ideally expose organizational drift into failure before a more systemic normalization of deviance settles into the fire service organization.

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I. INTRODUCTION

A. PROBLEM STATEMENT

Large organizations that operate in high-risk environments ideally have the safety of their employees embedded within their operational guidelines and procedures. The U.S. fire service, as one of these organizations, knowingly places its employees in imminently life-threatening situations with regularity. Firefighters are trained to conduct risk assessments prior to committing actions, and they continuously reassess to maintain situational awareness for themselves and those being rescued. Boundaries of acceptable courses of action at an emergency incident are sometimes boiled down to the mantra of "risk a lot to save a lot, risk a little to save a little, and risk nothing to save nothing." Has the fire service, in some ways at the organizational level, normalized risky behavior, which allows employees to operate outside of established norms?

Sociologist Diane Vaughan examined similar actions within National Aeronautics and Space Administration (NASA) after the Challenger space shuttle tragedy in 1986, and explored NASA's acceptance of non-normative decision-making processes, and an ultimate acceptance of unsafe actions that led to a critical failure. Yet Vaughan probes deeper into the organizational mentality and seeks to "explicate the sociology of mistake. It shows how mistake, mishap, and disaster are socially organized and systematically produced by social structures."[1] Vaughan ultimately described the actions, particularly the decision-making process leading up to action, as a "normalization of deviance."[2] Dekker provided better context about the interval of time associated with this decision-making process when he describes it as a slow descent into catastrophe, a "drift into failure."[3]

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[1] Diane Vaughan, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA* (Chicago and London: University of Chicago Press, 1996), xiv.

[2] Ibid., 75.

[3] Sidney Dekker, *Drift into Failure: From Hunting Broken Components to Understanding Complex Systems* (Farnham, United Kingdom; Burlington, VT: Ashgate Publishing, 2011), xii.

Additionally, the fire service can be considered a highly complex system, non-linear in thought and actions during emergencies, which gives rise to an increased ability to experience critical failures, as Roberts, Bea, and Bartles assert highly complex organizations are prone to do.[4] Moreover, organizations should not take previous successes as assurance of future protection, which can mask hazards that go underestimated.[5] Starbuck and Milliken echo these sentiments, adding that employees can confine their performance in predictable patterns.[6] According to Dekker and Woods, it is the high reliability organizations (HROs), which includes the fire service, that have developed an ability to perceive emerging problems and are able to adjust, prior to that critical failure.[7]

B. RESEARCH QUESTION

Does the U.S. fire service practice a safety normalization of deviance? Specifically, does the Dallas Fire Rescue Department (DFRD) practice a safety normalization of deviance?

C. KEY TERM DEFINITION

Ascribing meaning to the term *normalization of deviance* for the duration of this thesis originates from Dr. Diane Vaughan, a noted sociologist at Columbia University. In a 2008 interview, she defines the term as, "Social normalization of deviance means that people within the organization become so much accustomed to a deviant behaviour that they dont [sic] consider it as deviant, despite the fact that they far exceed their own rules for the elementary safety."[8]

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[4] Karlene H. Roberts, Robert Bea, and Dean L. Bartles, "Must Accidents Happen? Lessons from High-Reliability Organizations [and Executive Commentary]," *The Academy of Management Executive (1993–2005)* 15, no. 3 (2001): 71.

[5] Sidney W. A. Dekker and David D. Woods, "The High Reliability Organization Perspective," *Human Factors in Aviation* 2 (2010): 123–44.

[6] William H. Starbuck and Frances J. Milliken, "Challenger: Fine-Tuning the Odds until Something Breaks," *Journal of Management Studies* 25, no. 4 (1988): 319.

[7] Dekker and Woods, "The High Reliability Organization Perspective," 123.

[8] "Interview Diane Vaughan," Consulting News Line, accessed October 22, 2017, http://www.consultingnewsline.com/Info/Vie%20du%20Conseil/Le%20Consultant%20du%20mois/Diane%20Vaughan%20(English).html.

D. RESEARCH DESIGN

The object of the thesis is the fire ground safety policies of the DFRD.

1. Selection

Simply put, too many firefighters are sustaining on the job injuries at emergency incidents, with some even succumbing to death as a result of catastrophic injuries. It is possible that some of these injuries and line of duty deaths (LODDs) are a result of an organizational deviation from established safety procedures at local workgroup levels, and thus, potentially preventable.

2. Limits

The thesis focuses on the fire service in general, from an organizational point of view, and is not directed towards the individual firefighter.

3. Data Sources

Sources include applicable federal regulations, recognized fire service standards, DFRD manual of procedures (MOPs) and standard operating procedures (SOPs), fire service periodicals, fire service textbooks, and journal articles. Aggregated statistical employee injury data from the DFRD was requested and obtained through the DFRD safety officer. Such a request requires a one-time human interaction, with an Institutional Review Board (IRB) determination form submitted with a final determination that no IRB process was needed, received on May 15, 2017. No formal interview, surveys, or correspondence beyond the sole request for information is performed.

4. Type and Mode of Analysis

The steps of analysis are the following.

- What is the conceptual background of a normalization of deviance?

The initial step explores how the term “normalization of deviance” came into existence, by exploring Diane Vaughan’s investigation of NASA in her book, *Challenger Launch Decision*. Next, an investigation into how various sociological constructs within

organizations can influence organizational-wide safety deviance in high-hazard occupations. The primary goal of this step is to define the problem space for this concept to ascertain that a normalization of deviance exists as a phenomenon.

- Does a normalization of deviance exist in other high-risk occupations?

With the concept of a normalization of deviance now realized, an examination of various high-risk industries, not including the fire service, is assembled and conducted. Verification of deviance comes through scrutinizing evidence located in journal articles, books, and open sources that highlight previous critical failures within these high-risk occupations. Within this review, the conflict between safety and productivity is studied as a primary and latent contributing factor leading to normalizing deviance.

- Define what a normalization of deviance in the fire service might resemble.

As a high-risk organization, the fire service in the United States may also be subject to a normalization of deviance; therefore, this section investigates in what specific ways a normalization of deviance may be manifest during fire emergency incidents. Again, the notion that safety and productivity are in opposition is researched by utilizing open-source statistics of injury statistics of firefighters, as well as “near-miss” injury reporting to discover trends within the fire service that indicate potential organizational deviance.

- Does evidence exist of a normalization of deviance in the DFRD?

A review of department specific MOPs and SOPs, both present and previous versions, are studied to determine if organizational normalization of deviance is embedded within such documents, as related to incident safety procedures. A base case is reviewed as an example of deviance. Furthermore, a review of past employee injury statistics is examined for patterns that may indicate deviance as well. Lastly, department-generated safety notices and other documents are studied for prospective organizational deviance.

- If evidence exists, what are some recommendations to counteract such challenges?

Three policy recommendations are generated potentially to offset any normalization of deviance discovered during the analysis and research phases. Options seek to quantify measurable reduction in injuries related to departmental normalization of deviance. Options also acknowledge and seek to balance departmental, regulatory, political, and monetary constraints.

E. METHODOLOGY

The framework incorporated to confirm or deny the presence of normalized deviance within the DFRD is a policy analysis with recommendations. A review of DFRD's operational documents, namely its MOPs and SOPs, may expose any embedded deviance that may benefit from prior research into other HROs. While policy analysis is typically thought of as an intra-organizational function for continued relevance and revision, the policy analysis conducted for this thesis is comprehensive and strategic in scope, designed to disclose specific examples of deviance throughout the DFRD. Once the analysis phase is complete, suggestions are recommended. Recommendations are intended to influence future decision-making strategies by DFRD leadership in light of evidentiary findings. The ability to implement one or more of the recommendations is dependent upon a number of factors that fall outside the purview of this thesis.

F. CHAPTER DISCUSSION

The thesis is divided into seven chapters. Chapter I is an introductory chapter that discusses the framework of the thesis. Chapter II, the literature review, presents a comprehensive exploration of previous research on the normalization of deviance. Chapter III delves into various assorted principles bolstering normalized deviance as an aberrant organizational construct. Chapter IV contemplates the veracity of the claim that high-risk occupations are particularly at risk of normalizing deviance. Chapter V concentrates on the fire service as a specific high-risk occupation and whether deviations exist. Chapter VI is scoped down even further and centers on a policy analysis for

deviance within the DFRD's MOPs and SOPs and other internal documents. Chapter VII concludes with offering four conclusions and three recommendations for the DFRD to execute in hopes of identifying occult deviance. Recommendations offer realistic instruments designed to engage DFRD firefighters as a source of information-sharing platforms in both an anonymous route (through the near miss reporting form (NMRF)) and from a candid leadership perspective (through the AAR). Limitations and impediments to implementation of applications are briefly characterized.

II. LITERATURE REVIEW

The following literature review constitutes an assessment of various sources that are essential to the idea that risk, as well as dangerous actions, can be systematically and perhaps knowingly normalized and accepted in hazardous and high-risk occupations, particularly within the U.S. fire service—a "normalization of deviance," in Vaughan's term.[9] By deviance, Vaughan "refers to behavior that violates the norms of some group."[10] It is the ever changing (and accepting) of a "new normal," which constitutes a departure from the true and accepted tenets of an occupation. Vaughan furthermore asserts that accepting and normalizing risk and alternate behaviors can conceivably lead to systemic and catastrophic outcomes.[11]

This section first explains the origins of the normalization of deviance. Next, an investigation of diversified, high-risk occupations prone to experience a normalization of deviance is briefly examined. Afterwards, a study of the fire service in general seeks to answer how deviance can manifest itself in this type of organization. In addition, all high-risk institutions cope with the issue of a safety culture, and a concept of "defense in depth." This literature review is drawn solely from open source journal articles, studies, fire service periodicals, reports, websites, and books.

A. THE ORIGINS OF THE NORMALIZATION OF DEVIANCE

The idea of a "normalization of deviance" has its origins in the NASA Space Shuttle program, stemming from the Challenger space shuttle tragedy that occurred on January 28, 1986. Diane Vaughan's fundamental assessment of the Challenger disaster is described in her book, *Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*, which serves as the basis for her normalization of deviance argument. Vaughan explains how an organization like NASA socially embraced errors, oversights, and flaws, considering such items normal over time; and how such complex social

[9] Vaughan, *The Challenger Launch Decision*, 75.

[10] Ibid., 58.

[11] Ibid., 75.

systems can influence and alter groups, and summarizes the normalization of deviance within NASA during the shuttle program.[12] Related to the Challenger catastrophe, Vaughan explored how the recognition of industrial deviation was discovered and interpreted in a way that was "normalized" at NASA, and "then finally officially labeled an acceptable risk."[13] Turner similarly suggests that disasters can be viewed as a "socio-technical" problem, one in which complex connections exist between various processes.[14] Vaughan seemingly concurs with Turner when she writes, "The explanation in this book explicates the sociology of mistake. It shows how mistake, mishap, and disaster are socially organized and systematically produced by social structures."[15]

NASA astronauts were cognizant of safety-related issues, at times speaking out. Astronaut Sally Ride would state, "After the Challenger accident, NASA put in a lot of time to improve the safety of the space shuttle to fix the things that had gone wrong."[16] The safety enhancements alluded to by Astronaut Ride primarily came out of a Presidential Commission report on the Challenger accident, more commonly referred to as the Rogers Commission report, after its Chairman, William P. Rogers. This exhaustive and rigorous report would expose the depths of NASA as an organization, from both structural and social perspectives. Perhaps one of the report's most damning conclusions was the apparent sacrifice of flight safety through the dismissal of launch restrictions and exemptions through the absence of any mandatory executive level consideration.[17] The Rogers Commission report was central to exposing the path that deviance takes through an organization, which exploits a weakness of rigid production schedules that seek to diminish high safety standards.

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[12] Vaughan, *The Challenger Launch Decision*, xiii.

[13] Ibid., 65.

[14] Barry A. Turner, *Man-Made Disasters*, 1st ed. (London: Wykeham Publications, 1978), 3.

[15] Vaughan, *The Challenger Launch Decision*.

[16] "Safety Quotes," BrainyQuote, accessed April 1, 2017, https://www.brainyquote.com/quotes/keywords/safety.html.

[17] William P. Rogers et al., *Report of the Presidential Commission on the Space Shuttle Challenger Accident, Volume 1* (Washington, DC: NASA, 1986), 110, https://ntrs.nasa.gov/search.jsp?R=19860015255. See Findings, number 2.

The notion of attaining high employee output to the detriment of safety is not a novel idea among some outcomes-based professions, including some high-risk occupations as well. The synergistic effect of poor safety and a striving for productivity through performance at emergency scenes can be a catalyst for an organization to accept non-normative, deviant behavior patterns that can lead to a normalization of deviance. Going a step further, McLain and Jarrell claim that the nexus between safety and performance, which they call production, occurs in an arduous and rapidly changing work setting, one in which fulfilling either safety or production adequately, will likely sacrifice one over the other.[18] Pettersen and Schulman argue along similar lines of thought, claiming that when employees face a dilemma that traditional procedures fail to address, the worker will readily alter work processes to mitigate the problem.[19] A divergence from approved methods can prove disastrous. Dekker adds that both intra and extra-organizational stressors can actually cause stalwart safety parameters to be tested during critical periods where achieving goals seems to outweigh rigid safety principles.[20] Referring to disasters, Pidgeon and O'Leary state, "disaster is defined in the man-made disasters model not by its physical impacts at all, but in sociological terms, as a significant disruption or collapse of the existing cultural beliefs and norms about hazards."[21] Dekker and Pruchnicki argue that disasters are a result of a long, leisurely, and unacknowledged acceptance of risk that an organization accepts.[22] Turner alluded to this pre-disaster timeframe as an "incubation period."[23] In a 2011 book, Dekker aptly defines this same phase, and its features, as a "drift into failure," adding that

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[18] David L. McLain and Kimberly A. Jarrell, "The Perceived Compatibility of Safety and Production Expectations in Hazardous Occupations," *Journal of Safety Research* 38, no. 3 (January 2007): 300, doi: 10.1016/j.jsr.2006.10.011.

[19] Kenneth A. Pettersen and Paul R. Schulman, "Drift, Adaptation, Resilience and Reliability: Toward an Empirical Clarification," *Safety Science*, March 2016, 4, doi: 10.1016/j.ssci.2016.03.004.

[20] Dekker, *Drift into Failure*, preface, xii–xiii.

[21] Nick Pidgeon and Margaret O'Leary, "Man-made Disasters: Why Technology and Organizations (Sometimes) Fail," *Safety Science* 34, no. 1–3 (2000): 16, doi: 10.1016/s0925-7535(00)00004-7.

[22] Sidney Dekker and Shawn Pruchnicki, "Drifting into Failure: Theorising the Dynamics of Disaster Incubation," *Theoretical Issues in Ergonomics Science* 15, no. 6 (November 2, 2014): 534, doi: 10.1080/1463922X.2013.856495.

[23] Turner, *Man-Made Disasters*, 81.

technological and social considerations play decisive roles during this time.[24] In closing, the literature seems to suggest that normalization of deviance has sociological origins.

B. STUDY OF THE FIRE SERVICE

The previously mentioned "drift into failure" concept is best understood by assigning a suitable nomenclature that suggests a successive escalation in severity of action and potential consequences. Dekker et al. explains four progressive steps, culminating with the most severe act referred to as an accident.[25] One of these four terms fundamental to the normalization of deviance is a "near miss," which Dillon and Tinsley describe as an occasion when something dreadful almost happened, but did not.[26] Such events position the employee at the boundaries of safety, stopping just short of an accident for a variety of reasons. Dee, Cox, and Ogle take a different approach to near misses and maintain that these examples can prove advantageous for organizations by unmasking arcane frailties within a system.[27] An accurate percentage of near misses reported by those experiencing such circumstances remain relatively unknown, perhaps due to the fact that no threshold of true injury was reached, with antecedent events now irrecoverable.

The readings revealed that several high-risk occupations are prone to a normalization of deviance, and share several common characteristics. Charles Perrow's book, *Normal Accidents: Living with High-Risk Technologies*, seeks to identify and explain such industries, even going so far as to classify such groups as being complex and tightly coupled.[28] Industries include nuclear plants, aircraft, chemical plants, nuclear

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[24] Dekker, *Drift into Failure*, xii.

[25] Sidney Dekker et al., *Resilience Engineering: New Directions for Measuring and Maintaining Safety in Complex Systems* (Ljungbyhed, Sweden: Lund University School of Aviation, 2008), 12–13, https://pdfs.semanticscholar.org/a0d3/9cc66adc64e297048a32b71aeee209a451af.pdf.

[26] Robin L. Dillon and Catherine H. Tinsley, "How Near-Misses Influence Decision Making under Risk: A Missed Opportunity for Learning," *Management Science* 54, no. 8 (August 2008): 1426, doi: 10.1287/mnsc.1080.0869.

[27] Sean J. Dee, Brenton L. Cox, and Russell A. Ogle, "Using near Misses to Improve Risk Management Decisions," *Process Safety Progress* 32, no. 4 (December 2013): 322, doi: 10.1002/prs.11632.

[28] Charles Perrow, *Normal Accidents: Living with High-Risk Technologies* (Princeton, NJ: Princeton University Press, 1999), 98, Kindle. See Figure 3.1, Interaction/Coupling Chart.

weapons accidents, space missions, and military early warning.[29] Roberts, Bea, and Bartles expanded on this idea of tight-coupling by stating that in organized systems, of which those industries previously listed would qualify, "accidents can be viewed as normal because the interdependencies in a system are so great that one small glitch in one place can lead to a large failure somewhere else."[30] Weick therefore concludes that in the event of a failure, loose coupling is preferred, as the portion of the system experiencing failure can be quickly isolated from the unaffected portions, and thereby, preserve the remaining system.[31] Starbuck and Milliken contend that organizations often rely on previous achievements as a barometer of proficiency in performance and thus become complacent in demeanor.[32]

Whether such mindsets are pervasive within a fire service organization, ones that lead to a true normalization of deviance, requires further examination. Pessemier declares that correlations exist between high safety standards and high performance, and vice versa for poor safety and poor standards in other high-risk professions, including the fire service.[33] Pessemier and England argue that the U.S. fire service is plagued with diminishing degrees of safety due to its communal structure.[34] Yet, firefighters are taught to assess situations regarding their own safety, as well as those who need to be rescued. Wilson rightly points out the safety mantra that has existed for decades in the fire service by stating, "What happened to the axiom taught in incident safety officer training that says, 'Risk a lot to save a lot (human life); risk a little to save a little; risk nothing to save

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[29] Perrow, *Normal Accidents*, 98.

[30] Roberts, Bea, and Bartles, "Must Accidents Happen?" 79.

[31] Karl E. Weick, "Educational Organizations as Loosely Coupled Systems," *Administrative Science Quarterly* 21, no. 1 (March 1976): 7.

[32] Starbuck and Milliken, "Challenger," 319.

[33] William Pessemier, *Improving Safety Performance by Understanding Perceptions of Risk and Improving Safety Management Systems* (Fairfax, VA: Public Entity Risk Institute, 2008), 4, http://www.academia.edu/download/33187447/S908-D2-Pessemier.pdf.

[34] William L. Pessemier and Robert E. England, "Safety Culture in the U.S. Fire Service: An Empirical Definition," *International Journal of Emergency Services* 1, no. 1 (2012): 11, doi: http://dx.doi.org/10.1108/20470891211239290.

nothing?'"[35] Therefore, a tenuous relationship can exist between personal safety and productivity in the fire service.

Starbuck and Milliken seem to argue from a different perspective by claiming in their article that "successes foster complacency, confidence, inattention, routinization, and habituation: and so human errors grow increasingly likely as successes accumulate."[36] John Dixon, in a 2015 Firehouse article, sums up safety issues when he writes, "looked at another way, we as humans take shortcuts while we are under time and pressure constraints. These shortcuts are usually referred to as 'safety shortcuts.'"[37] Such shortcuts are perhaps reflective of the oftentimes-quoted mantra of "this is the way we've always done things." Possibly, such stagnant thoughts still dictate the actions of some firefighters throughout the United States.

Kunadharaju, Smith, and DeJoy reaffirm such sacrifices in either safety or production capabilities in their article when they conclude from a root cause analysis that "four higher order causes emerge: under resourcing, inadequate preparation for/anticipation of adverse events, incomplete adoption of incident command procedures, and sub-optimal personnel readiness."[38] It is in such areas within the fire service that a normalization of deviance thrives and can expand within an organization. These same authors allege that the four higher order causes are indicators of the fire service culture itself; that tasks must get done with any resource, as expediently as possible, and one that fails to embrace safety adequately, which leads to a normalization of deviance.[39] According to Kunadharaju, Smith, and DeJoy, such attitudes are fortified both inside and outside the fire service. Inside influences include tradition and interagency social

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[35] Jim Wilson, "Change Your Mind, Change Your Culture," *Fire Chief*, January 2009, 32.

[36] Starbuck and Milliken, "Challenger," 322.

[37] John Dixon, "Firefighter Safety: The Normalization of Deviance," *Firehouse*, October 1, 2015, http://www.firehouse.com/article/12109412/firefighter-safety-the-normalization-of-deviance.

[38] Kumar Kunadharaju, Todd D. Smith, and David M. DeJoy, "Line-of-Duty Deaths among U.S. Firefighters: An Analysis of Fatality Investigations," *Accident Analysis & Prevention* 43, no. 3 (May 2011): 1179, doi: 10.1016/j.aap.2010.12.030.

[39] Ibid.

networks, possibly at the station or company level, whereas outside influences are from stereotypes that firefighters have in the public as positive role models.[40]

In terms of inside influences that can lead to a normalization of deviance, the literature speaks oftentimes of individuals of an organization who embrace deviant attitudes in a variety of ways (not wearing issued personal protective equipment (PPE), or performing hazardous tasks). Smith and Dyal discuss the overwhelming amount of work assigned to firefighters at an emergency scene and argue that under increased workloads, firefighters feel stressed, which can influence the ability to make rational decisions.[41]

Even fire-service periodicals have weighed in on deviant practices within the fire service as a whole, primarily centered on safety and leadership issues. Daniels writes in his article for *Fire Chief* magazine, "It will take a personal commitment from the person who sets the tone in the organization-the fire chief-to begin a cultural shift in an organization."[42] Adding to the discussion is Jim Wilson, who quotes one of the sixteen firefighter life-safety initiatives, which states "Define and advocate the need for cultural change within the fire service relating to safety; incorporating leadership, management, supervision, accountability and personal responsibility."[43] These articles speak of a common theme of compromised safety, a top priority in high-risk occupations.

Kunadharaju, Smith, and DeJoy maintain that three sections must be considered to improve safety: strict execution of SOPs for various firefighting tactics and methods, adherence to incident command procedures and personnel management, and improved communication and firefighter tracking at incidents.[44] Referring to SOPs, Hodous et al. emphasize the value of SOPs at fire ground incidents as a foundational contributor to

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[40] Kunadharaju, Smith, and DeJoy, "Line-of-Duty Deaths among U.S. Firefighters: An Analysis of Fatality Investigations," 1179.

[41] Todd D. Smith and Mari-Amanda Dyal, "A Conceptual Safety-oriented Job Demands and Resources Model for the Fire Service," *International Journal of Workplace Health Management* 9, no. 4 (September 5, 2016): 448, doi: 10.1108/IJWHM-12-2015-0073.

[42] David Daniels, "Unacceptable Behavior," *Fire Chief* 49, no. 1 (January 2005): 52–53.

[43] Wilson, "Change Your Mind, Change Your Culture," 30.

[44] Kunadharaju, Smith, and DeJoy, "Line-of-Duty Deaths among U.S. Firefighters," 1172.

achieving incident safety when the SOPs are followed.[45] To strengthen safety at incidents, Porter, Bliss, and Sleet proclaim that situational awareness can greatly contribute to a safety-based behavioral mindset.[46] Situational awareness is of paramount importance in the dynamic fire ground safety plan. Concerning incident command systems (ICSs), Bigley and Roberts state that the ICS found in firefighting sets a proper framework for what is found in highly reliable organizations.[47] Finally, in response to fire ground communications, Hodous et al. argue that constant fire ground communication via handheld radio, with constant communication between incident command and firefighters working inside, can immediately report either improving or deteriorating conditions.[48] An organization-wide normalization of deviance is possible in these three safety-based sections.

Several authors write about the need for a resilient safety framework in high-risk occupations like firefighting, and how such strategies seek to diminish the organizational level of normalization of deviance. For example, Reason writes about organizations having "defensive layers," whether they are designed, human-based, or managerial.[49] Additionally, Kunadharaju, Smith, and DeJoy also speak to this multi-layered safeguard, what they refer to as "defenses in depth."[50] These same authors argue that a multi-layered organizational defense seeks to defend the entire organization, despite singular elements that falter, a tautological argument.[51] Reason makes a compelling argument for the layered defense against normalizing deviance in his "Swiss cheese model (SCM)," where each slice of cheese represents a defensive layer, where each slice has a single hole

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[45] T. K. Hodous et al., "Fire Fighter Fatalities 1998–2001: Overview with an Emphasis on Structure Related Traumatic Fatalities," *Injury Prevention* 10, no. 4 (August 2004): 224, doi: http://dx.doi.org/10.1136/ip.2004.005348.

[46] B. E. Porter, J. Bliss, and D. A. Sleet, "Human Factors in Injury Control," *American Journal of Lifestyle Medicine* 4, no. 1 (January 1, 2010): 95, doi: 10.1177/1559827609348679.

[47] Gregory A. Bigley and Karlene H. Roberts, "The Incident Command System: High-Reliability Organizing for Complex and Volatile Task Environments," *The Academy of Management Journal* 44, no. 6 (2001): 1293, doi: 10.2307/3069401.

[48] Hodous et al., "Fire Fighter Fatalities 1998–2001," 224.

[49] James Reason, "Human Error: Models and Management," *BMJ* 320 (March 18, 2000): 769, doi: 10.1136/bmj.320.7237.768.

[50] Kunadharaju, Smith, and DeJoy, "Line-of-Duty Deaths among U.S. Firefighters," 1171.

[51] Ibid.

capable of getting smaller or larger.[52] Reason argues that holes in one slice are not a concern until several slices have holes that "momentarily line up to permit a trajectory of accident opportunity-bringing hazards into dangerous contact with victims."[53]

What does a "defenses in depth" look like at a fire-related incident? A 2014 article suggests that several aspects of safety have been improved, from applied science in tools, methods of operation, and personnel improvement.[54] Such improvements can lead to several layers of redundant safety. Another safety implementation is actually the enforcement of National Fire Protection Association (NFPA) 1407, Standard for Training Fire Service Rapid Intervention Crews (RIC).[55] NFPA 1407 is a safety precaution comparable to the Occupational Safety and Health Administration (OSHA) standard found in the U.S. Code of Federal Regulations (CFR), CFR 1910.134(g)(4), which discusses the "2 In/2 Out" rule that requires two firefighters staging outside a dangerous environment to rescue the two firefighters working in the dangerous environment.[56] Layers of safety should be built as an incident grows in complexity and size. An additional redundant safety feature in the fire service is the establishment of the independent incident safety officer (ISO) at larger emergency responses with the sole focus on all aspects of firefighter safety, according to NFPA 1521, the Standard for Fire Department Safety Officer Professional Qualifications.[57]

In conclusion, the study of normalizing deviance seeks to roadmap *how* an organization, beginning with high-risk occupations and filtering down specifically to the

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[52] Reason, "Human Error: Models and Management," 769.

[53] Ibid.

[54] Thomas N. Warren, "Fireground Safety Tips," *Fire Engineering*, April 16, 2014, http://www.fireengineering.com/articles/2014/04/fireground-safety-tips.html.

[55] "NFPA 1407: Standard for Training Fire Service Rapid Intervention Crews," National Fire Protection Association, accessed April 20, 2017, http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and standards?mode=code&code=1407&tab=editions. 2015 edition.

[56] "Regulations (Standards-29 CFR 1910.134)(g)(4)," United States Department of Labor, accessed April 20, 2017, https://www.osha.gov/pls/oshaweb/owadisp.showdocument?ptable=STANDARDS&p_id=12716#1910.134(g)(4).

[57] "NFPA 1521: Standard for Fire Department Safety Officer Professional Qualifications," National Fire Protection Association, 16, accessed October 26, 2017, http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1521. 2015 Edition. See Section 5.2.1 General Requirements.

fire service, adopts a culture and methodology of practice that may normally be rejected. Dekker's "drift into failure" succinctly characterizes how an organization becomes in a sense entropic in thought, which invariably leads to dangerous actions and potential failures at critical times, at the scene of emergencies. Vaughan's normalization of deviance argument applied first to high-risk professions then down to the fire service provides various levels of understanding about how safety and performance (or productivity) competes for a preeminence of thought in the first responder's mindset. Turner's incubation period underscores the timeframe in which normalization of deviance settles within an organization. As a result, the "holes" in Reason's SCM align in an organization, with a cascading failure lurking. Non-linear thought processes, such as those in high-reliability organizations (HROs) like the fire service, seek a solution to a normalization of deviance. The following chapter seeks to explore how normalized deviance emerges and is conveyed throughout an organization.

III. THE CONCEPTUAL BACKGROUND OF NORMALIZATION OF DEVIANCE

The term "normalization of deviance" originated from sociologist Diane Vaughan's in-depth analysis of the 1986 NASA Challenger Space Shuttle disaster, and is discussed in her book, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA.* In the preface of the 2016 edition, Dr. Vaughan encapsulates her findings when she states, "The explanation presented in this book explicates the sociology of mistake. It shows how mistake, mishap, and disaster are socially organized and systematically produced by social structures."[58] Simply stated, Vaughan unequivocally attempts to connect systemic failures to social frameworks within organizations, as both a means of providing the context in which failures occur, as well as providing a roadmap to explain how NASA's decision-making paradigms had become deviant and normalized. Thus, a normalization of deviance can be viewed as a progressive lowering of organizational guidelines to achieve departmental goals, where "normal" is socially redefined and inadvertently degraded, concealing a latency period prior to an accident. This chapter endeavors to describe both a historical examination of NASA in the wake of Challenger disaster, as well as acknowledging the various concepts that support a framework in which a normalization of deviance develops and succeeds, coupled with its pernicious effect on organizational safety.

In the aftermath of the Challenger disaster, NASA, when regarded as a social organization, was shaken from the doldrums of their routineness. Soon after, NASA initiated its own internal investigation into the catastrophe. Concurrently, a formal fact-finding panel known as the Presidential Commission was formed by President Reagan under Executive Order 12546, and their authoritative report, known as the Rogers Commission Report, revealed information that put NASA's leaders and their multi-tiered launch decision process in the crosshairs.[59] Succinctly, investigations would reveal the

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[58] Diane Vaughan, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA* (London and Chicago: University of Chicago Press, 2016), loc. 500–508 of 13511, Kindle.

[59] Rogers et al., *Report of the Presidential Commission on the Space Shuttle Challenger Accident, Volume 1*, 212–13; Vaughan, *The Challenger Launch Decision*, loc. 630.

origin of the mechanical failure of the two O-rings on Challenger's right solid rocket booster (SRB), with the O-ring failure ascribed to extraordinarily frigid temperatures the night before launch.[60] Vaughan writes that Morton Thiokol, Inc. (MTI) engineers feared that extremely cold temperatures would have an effect on the elastic capabilities of the O-rings (primary and secondary) to expand into the joint at SRB ignition; essentially that the O-rings would harden and be less flexible, and thus, potentially be less reliable.[61] For the record, the temperature at Challenger's launch was 36 degrees Fahrenheit, representing the coldest weather launch to date, 15 degrees colder than the absolute lowest temperature (53 degrees) that MTI guaranteed the O-rings to operate normally.[62]

The potential of O-ring failure had been addressed years earlier, as far back as 1980, with resolution taking the form of a redundant or secondary O-ring. Starbuck and Milliken express that even prior to the redundant measure in 1980, MTI had increased the O-ring's width to 0.028 inches, as well as enlarged exterior shims that aided in pressing the O-rings into the joint in an attempt to appease NASA's calls to revamp the joint design completely.[63] This dual approach to appease NASA's concerns obviously worked, as evidenced by a final Committee report that stated, "NASA specialists have reviewed the field joint design, updated with larger O-rings and thicker shims and found the safety factors to be adequate for the current design."[64] In the same vein, in 1980, the secondary SRB joint appeared on a critical items list as a Criticality 1R. According to NASA, Criticality 1R items are described as any system that includes redundant components that if ineffective, may precipitate a destruction of the shuttle and the lives of astronauts.[65] It is unmistakable that both MTI and NASA had significant concerns and held lingering

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[60] Vaughan, *The Challenger Launch Decision*, loc. 670.

[61] Ibid., loc. 572.

[62] Rogers et al., *Report of the Presidential Commission on the Space Shuttle Challenger Accident, Volume 1*, 19.

[63] Starbuck and Milliken, "Challenger," 324.

[64] Rogers et al., *Report of the Presidential Commission on the Space Shuttle Challenger Accident, Volume 1*, 126. Quoted from a report entitled *SRM Program Response*. NASA, *SRM Program Response* (Washington, DC: NASA, 1980), PC 102359.

[65] Ibid. Originally found in a NASA Handbook. NASA, *NASA Handbook*, 52300.4(ID-2) (Washington, DC: NASA, n.d.), Appendix A, a-1.

reservations about the SRB joints, principally at the O-ring-joint interface, in addition to optimal performance issues in inclement weather. It is under never-encountered and adverse conditions, frigid temperatures and an ice-coated launch platform, that Challenger enters history, not as a historic mission as touted, but a horrific failure for NASA as an organization. Nevertheless, beyond any technical failures that fell within the purview of NASA's control, or cold temperatures that were out of NASA's control, the Presidential Commission would determine "that the NASA organization contributed to the technical failure."[66] In closing, several organized investigative bodies drew logical conclusions that would look beyond the technical failures to more ingrained social failures of the entire organization that uncovered the insidious culture of normalized deviance.

In retrospect, Challenger was to be an extraordinary mission, an underscore of NASA's confidence and ability to send an ordinary citizen into space and was part of NASA's space shuttle program, "Officially known as "Space Transportation System (STS) 51-L, it became publicly identified as the "Teacher in Space" mission."[67] Challenger was the 25th launch within the STS, and the first mission of 1986.[68] What captivated much of America, and specific to the Challenger mission, was one of its crewmembers was an ordinary citizen, Payload Specialist Christa McAuliffe, a New Hampshire high school teacher. NASA's goal was to send a teacher into orbit on the space shuttle to educate students from space.[69] Challenger would launch from the Kennedy Space Center (KSC) on January 28, 1986, after a two-hour delay. The shuttle underwent catastrophic failure just 73 seconds into launch, when both the launch vehicle and its crew were lost. That same evening, President Ronald Reagan would address the nation, where he states in part, "We've grown used to wonders in this century. It's hard to dazzle us. But for 25 years the United States space program has been doing just that.

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66 Vaughan, *The Challenger Launch Decision*, loc. 688.

67 Ibid., loc. 532.

68 "Shuttle Missions–1986," NASA, accessed July 26, 2017, https://www.nasa.gov/mission_pages/shuttle/shuttlemissions/list_1986.html.

69 "The Crew of the Challenger Shuttle Mission in 1986," NASA, accessed July 26, 2017, https://www.nasa.gov/mission_pages/shuttle/shuttlemissions/list_1986.html.

We've grown used to the idea of space, and perhaps we forget that we've only just begun. We're still pioneers. They, the members of the Challenger crew, were pioneers."[70] While the nation mourned Challenger's seven-member crew, questions quickly arose from every direction as to how such an accident could occur.

The Presidential Commission made sweeping conclusions about the cause of the disaster, both technical, as well as cultural in nature. Page 73 of the Rogers Commission Report declares:

> In view of the findings, the Commission concluded that the cause of the Challenger accident was the failure of the pressure seal in the aft field joint of the right Solid Rocket Booster Motor. The failure was due to a faulty design unacceptably sensitive to a number of factors. These factors were the effects of temperature, physical dimensions, the character of materials, the effects of reusability, processing, and the reaction of the joint due to dynamic loading.[71]

To the official Presidential Commission, the causative mechanical failure of Challenger had been isolated and identified, but the same report would also reveal NASA's culture and operational frame of mind, ones that were surprising to Commission members. The report would charge NASA with sociological deficiencies as well. Such shortcomings were formally addressed when the Commission wrote, "That testimony reveals failures in communication that resulted in a decision to launch 51-L based on incomplete and sometimes misleading information, a conflict between engineering data and management judgments, and a NASA management structure that permitted internal flight safety problems to bypass key Shuttle managers."[72] Overall, the Presidential Commission's report seemed to lay bare an overwhelmingly weakened communication culture within NASA. However, Vaughan's analysis of the Presidential Commission's final report, analyzed chiefly through sociological and cultural lenses, would declare the contrary; that NASA and contractors within the STS, including MTI, developed and had

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[70] "Reagan's Address to the Nation," NASA, accessed July 26, 2017, https://history.nasa.gov/Reagan 12886.html.

[71] Rogers et al., *Report of the Presidential Commission on the Space Shuttle Challenger Accident, Volume 1*, 73.

[72] Ibid., 83.

open dialogue concerning problems and concerns. She (Vaughan) evidenced this issue when she disclosed from a personal interview with Larry Wear, a solid rocket motor (SRM) manager with Marshall, "I believe there was truth in flight readiness reporting. It was open, the whole environment was entirely open. What keeps everybody honest is, Lord knows, a room of 150 people. You just couldn't keep problems secret."[73] In conclusion, the Presidential Commission established both a technical and cultural basis for the Challenger disaster, even though Vaughan in certain respects drew disparate conclusions from her assessment of the report.

Prior to even discussing accidents, distinctions should be made between the following terms: unsafe acts, near misses, incidents, and accidents. Oftentimes, within the workplace, the terms incident and accident are used interchangeably, yet the terms are indubitably discernible within a safety culture framework. This paper considers incident and accident as distinct terms, with qualifying definitions being explained soon. However, it should be noted that the terms accident and disaster are essentially synonymous for purposes of this paper, although Turner seeks to separate the two terms based on several subjective criteria, such as an event's magnitude, financial toll, publicly witnessed event, and unforeseen problems, whether in isolation or a fusion of many factors.[74] Ideally, the terms are best represented in a pyramidal graphic, collectively referred to as an iceberg model, with unsafe acts at the base, thereafter moving up to near misses, then incidents, with accidents at the peak.[75] The upward movement, from unsafe acts through accident within the iceberg model, is conveyed and best understood in a progressive fashion, one in which danger and the potential for harm to people increase with each successive step.

Within the workplace, unsafe acts are likely too numerous and underreported to be accurately calculated, given the ability of the perpetrators to react and recover quickly, thus averting any level of personal injury or equipment damage as a result of their aberrant activity. What defines however an act as unsafe? What makes a system or action

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[73] Vaughan, *The Challenger Launch Decision*, loc. 5449.

[74] Turner, *Man-Made Disasters*, 26.

[75] Dekker et al., *Resilience Engineering*, 12–13.

unsafe is truly subjective. A myriad of issues could account for classifying an act as unsafe, from the conditions leading up to the event, as well as the people involved, comprising an individual's mindset, as well as physical and mental capabilities to regain a normal state competently prior to committing the unsafe act. Unsafe acts are deceptive, however, and can lead to a near miss. Dillon and Tinsley in their article quote Dejoy by defining a near miss as "when an event *could have* happened (for example, because of hazardous conditions) but did not."[76] Therefore, some might view such events that did not occur as non-events, seemingly from a qualitative stance. Nevertheless, the literature seems to argue from a quantitative frame of reference; not did an event occur, but how bad is the event? Near misses themselves can be regarded as enlightening, as well as beneficial from two dissimilar perspectives. First, near misses can reveal vulnerabilities associated with the barely avoided incident, as both Dee, Cox, and Ogle and Dillon and Tinsley maintain.[77] Antithetical to highlighting vulnerabilities, these same authors promote the idea that near misses can also emphasize the concept of a system's resiliency and protect the person from experiencing actual harm.[78] The near miss is viewed as a successive step towards an incident, but one in which no harm comes to the one experiencing the near miss, as the name implies, and therefore, is outcome driven. The near miss does not necessarily signify a breach of established policy, but it does suggest a greater degree of acceleration towards an incident.

Incidents indicate a progression beyond near misses, and include more serious events that lead up to the edge of failure, stopping just short of producing injury or death. In the iceberg model alluded to previously, incidents precede accidents. Dekker et al. make several observations regarding incidents and accidents by starting with the declaration that in essence, both are the same, except for the final disposition.[79] Second, the writers declare that more incidents simply occur than accidents, which allows for greater opportunities to examine such phenomena, and at a reduced expense, as no real

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[76] Dillon and Tinsley, "How Near-Misses Influence Decision Making under Risk," 1426.

[77] Dee, Cox, and Ogle, "Using near Misses to Improve Risk Management Decisions," 322; Dillon and Tinsley, "How Near-Misses Influence Decision Making under Risk," 1427.

[78] Ibid.

[79] Dekker et al., *Resilience Engineering*, 12.

damage was done.[80] While incidents may not cause injury, the potential exists to inhibit production processes; a quantitative measure exists by which such incidents can affect the overall efficiency, perhaps measured by a percentage drop in output. Connecting incidents back to the aforementioned iceberg model, Dekker et al. profess that near misses can be successfully leveraged to forecast potential incidents.[81] Documented instances of near misses can serve to uncover trends in the workplace, whether such events are either grouped into broad categories, or narrowly identified. Finally, an accident denotes a fulfillment of a chain of events that crosses the boundary of an incident into a territory filled with the most severe conclusions, grave injury or death of one or more persons. Yet, disasters are an opportunity to increase the collective knowledge by studying these events, so as to not repeat them, as Starbuck and Milliken claim.[82] Ideally, the same authors are convinced that dissecting accidents can lead to a greater understanding of how to curtail the true and supreme cost that accidents demand, lives and resources.[83] Therefore, an accident, in the context of an organizational normalization of deviance, reflects an explicit and comprehensive failure of an entire system, as the established and interconnected socio-technical system's defenses were unable to prevent the accident from occurring.

Before any further discussion of the normalization of deviance can be considered, several longstanding concepts regarding how and why accidents happen are being challenged; the very frame by which several modern organizations have endeavored to ascribe a level of understanding to accident causation. These challenges seek to go beyond the traditionally held beliefs that accidents are merely the results of cause and effect sequence of events, best described by a linear trajectory. As author Barry Turner concisely states, "The time has come to set aside the assumption which has been tacitly made for so long, that all disasters are unique, and that they are caused by singular chains of events which are beyond the reach of rational consideration because they are not

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[80] Dekker et al., *Resilience Engineering*, 12.

[81] Ibid.

[82] Starbuck and Milliken, "Challenger," 38.

[83] Ibid.

amenable to generalization."[84] With this statement, Turner concludes that disasters contain essential components that are potentially predictable and therefore, not extraordinary in origin. Such contemporary views unquestionably challenge conventional cause and effect paradigms.

In similar fashion, a modern day author is seeking to revolutionize the theoretical lens through which accident causation is even examined to boldly challenge the continued relevance of iconic scientific revolution theories. Dekker, in his book *Drift into Failure*, confronts mainstream causation models based on what he terms the "Newtonian-Cartesian vision."[85] Applying such nomenclature is an obvious reference to both Sir Isaac Newton and René Descarte, who have both enjoyed a perpetual influence into the 21st century in regards to cause and effect analysis and assigned a linear understanding of how accidents happen. Dekker postulates that with the theory of accidents presenting as a complex and nonlinear arrangement, that exercising a linear problem analysis yields inaccurate and oftentimes unsuitable results, even going to the extent of declaring that such investigative methodologies can actually facilitate failures.[86] For the record, Descarte was a staunch proponent of reductionism, a methodology in which he proposes that any system could be meticulously deconstructed to its most basic functional parts, primarily to comprehend how a system of components worked.[87]

In the context of organizational accidents, a proclivity exists for drilling down to discover a root problem, whether it is revealed in a person or a process that failed. Newton would reinforce Descarte's reductionist philosophy and canonize it formally in his Second Law of Motion, which essentially describes cause and effect relationships.[88] In regards to accident causation within organizations, Dekker seems to promote an even larger view than both Cartesian and Newtonian theories offer, by advocating for an

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[84] Turner, *Man-Made Disasters*, 2.

[85] Dekker, *Drift into Failure*, 2.

[86] Ibid., preface, xiii.

[87] *Hmolpedia*, s.v. "Cartesian reductionism," An Encyclopedia of Human Thermodynamics, accessed August 9, 2017, http://www.eoht.info/page/Cartesian+reductionism.

[88] "Cause and Effect Laws of Motion," Millennium Relativity, accessed August 9, 2017, http://www.mrelativity.net/CauseEffectLawsofMotion/Cause%20and%20Effect%20Laws%20of%20Motion.htm.

expanded view beyond the individual level that reaches to organizational levels of review.[89] Finally, investigative frameworks, like those proposed by Dekker, should match the complexity of modern accidents and seek to progress in understanding accidents and abandon the perpetual use of Newtonian-Cartesian doctrines to address issues. In essence, accidents in today's modern world should be perceived as containing attributes that are both complex and non-linear, what Turner referred to "as a 'socio-technical' problem, with social, organizational, and technical processes interacting to produce the phenomena to be studied."[90] As a result, the socio-technical basis for today's accidents is truly complicated, with multiple nodes of potential failure interwoven into the fabric of an organization.

For this reason, establishing causality becomes an arduous task. Potentially, accidents can best be described as the result of multiple associations between the same social, organizational, and technical interactions within an organizational structure. Although a failure might ostensibly appear to be isolated to a single event based on the outcome, research has shown that disasters are generally the culmination of convoluted, sociological-centric interactions on many levels. Pidgeon and O'Leary, in their analysis of Turner's work, advance the narrative of redefining how accidents should be viewed and conclude that disasters should be described with sociological expressions and not by a disaster's tangible effects.[91] Such declarations seek to persuade a paradigmatic shift in interpreting disasters. Charles Perrow, in his classical work *Normal Accidents*, makes clear distinctions between what constitutes linear and non-linear (complex) systems, as depicted in Figure 1.

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[89] Dekker, *Drift into Failure*, 58.

[90] Turner, *Man-Made Disasters*, 3.

[91] Pidgeon and O'Leary, "Man-Made Disasters: Why Technology and Organizations (Sometimes) Fail," 16.

Complex Systems	*Linear Systems*
Tight spacing of equipment	Equipment spread out
Proximate production steps	Segregated production steps
Many common-mode connections of components not in production sequence	Common-mode connections limited to power supply and environment
Limited isolation of failed components	Easy isolation of failed components
Personnel specialization limits awareness of interdependencies	Less personnel specialization
Limited substitution of supplies and materials	Extensive substitution of supplies and materials
Unfamiliar or unintended feedback loops	Few unfamiliar or unintended feedback loops
Many control parameters with potential interactions	Control parameters few, direct, and segregated
Indirect or inferential information sources	Direct, on-line information sources
Limited understanding of some processes (associated with transformation processes)	Extensive understanding of all processes (typically fabrication or assembly processes)

Summary Terms

Complex Systems	*Linear Systems*
Proximity	Spacial segregation
Common-mode connections	Dedicated connections
Interconnected subsystems	Segregated subsystems
Limited substitutions	Easy substitutions
Feedback loops	Few feedback loops
Multiple and interacting controls	Single purpose, segregated controls
Indirect information	Direct information
Limited understanding	Extensive understanding

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Figure 1. Complex and Linear Systems[92]

As an organization experiences unsafe acts, near misses, and incidents in an upward trend that may ultimately lead to accidents, it does so within a span of time that merits discussion, one in which Turner succinctly labels an "incubation period."[93] The application of the term is suggestive of a negative connotation, as *Merriam-Webster* defines the term as "the period between the infection of an individual by a pathogen and the manifestation of the illness or disease it causes."[94] The dictionary term seems to coincide with normalization of deviance type behaviors that endure within organizations: that near misses and incidents contaminate organizations and germinate over a period of time, remaining obscured or unaddressed until the revelation of such incidents culminates in an organizational accident. Pinto, in a 2013 article referring to the normalization of deviance in organizations, says, "in effect, it [normalization of deviance] provides a

[92] Source: Perrow, *Normal Accidents*, 87.

[93] Turner, *Man-Made Disasters*, 86.

[94] *Merriam-Webster*, s.v. "incubation period," accessed August 3, 2017, https://www.merriam-webster.com/dictionary/incubation+period.

perfect petri dish environment for corporate (or project) misbehavior."[95] The term is therefore truly befitting of the esoteric nature of the aforementioned events, with Turner acknowledging that such incidents seem to aggregate in a furtive manner, either inconspicuously present, or perhaps simply that events were somehow misinterpreted, as persons or safety features were incapable of detecting such impending events.[96]

Dekker and Pruchnicki expound on the notion of how such knowledge could be misinterpreted, calling it "subversion," and argue that data might have failed to be grouped properly to see the impending event, or information that clashes with how the organization perceives risk in the first place.[97] Carrillo and Samuels conceptually leverage an iceberg model by considering impactful organizational safety controls delineated between restraints that are visible (above the waterline) or invisible (below the waterline).[98] Visible regulatory mechanisms include items that are mostly objective and measurable, such as earnings and regulatory compliance. Invisible processes, which are understandably more subjective, include employee associations and views about safety.[99] Finally, Tinsley, Dillon, and Madsen allege that "people are hardwired to misinterpret or ignore the warnings embedded in these failures, and so they often go unexamined or, perversely, are seen as signs that systems are resilient and things are going well."[100]

Turner is also quick to observe a correlation between the number of errors (near misses and incidents) and the magnitude of the accident, when it finally occurs.[101] He concludes that accidents that happen as a result of only a handful of events have a shorter incubation period and thus a small-scale accident ensues, whereas accidents that occur

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95 Jeffrey K. Pinto, "Project Management, Governance, and the Normalization of Deviance," *International Journal of Project Management* 32, no. 3 (April 2014): 377, doi: 10.1016/j.ijproman.2013.06.004.

96 Turner, *Man-Made Disasters*, 86.

97 Dekker and Pruchnicki, "Drifting into Failure," 534.

98 Rosa Antonia Carrillo and Neil Samuels, "Safety Conversations: Catching Drift & Weak Signals," *Professional Safety* 60, no. 01 (2015): 24.

99 Ibid.

100 Catherine H. Tinsley, Robin L. Dillon, and Peter M. Madsen, "How to Avoid Catastrophe," *Harvard Business Review* 89, no. 4 (2011): 41, http://edelweiss-assets.abovethetreeline.com/BXBC/supplemental/must-reads-smart-decisions.pdf.

101 Turner, *Man-Made Disasters*, 87.

after a long series of events, perhaps measured in years, tends to terminate in epic-scale accidents. As it relates to the incubation period, Turner discusses precisely when this period begins. Turner claims that the moment an unnoticed event happens, and is terminated by what he names a "precipitating event" that generates an unanticipated, modified, and abnormal response, the period is initiated.[102] In summation, the concept of an incubation period as proposed by Turner helps define the boundaries in which the normalization of deviance develops.

Within the incubation period, an almost imperceptible transformation occurs in organizational behaviors at the operator end, known as a "drift into failure." Once again, Dekker makes a bold statement and alleges that every organization drifts into failure.[103] He is confident in making such a claim and defends his stance by explaining that failures are routed through several avenues within an organization that were initially destined to make a company extraordinary.[104] Dekker maintains that organizations drift into failure due actually to pursuing their overall goals, whether it is in fabricating or selling a product or providing a service, common business obstacles develop tensions that compete for preeminence, inevitably assuming higher levels of risk while simultaneously diminishing safety margins.[105] In effect, the organization seems predisposed to operate closer to the edge of failure without the intrinsic knowledge that it is doing so. Reason buttresses this argument by claiming organizations that fail to analyze negative events properly operate with incognizance to impending failure, with failure only perceptible when an organization performing at the edge of safety crosses the line, what he calls a "recurrent error."[106] Reduced safety boundaries allow organizations to reach those limits in a compressed timeframe, which increases the likelihood of an incident, and feasibly, an accident.

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[102] Turner, *Man-Made Disasters*, 89.

[103] Dekker, *Drift into Failure*, preface, xii.

[104] Ibid.

[105] Ibid., preface, xii–xiii.

[106] Reason, "Human Error: Models and Management," 769.

Operating within specific perimeters is reminiscent of the ancient story of Icarus' flight. In Greek mythology, Icarus' father Daedalus designed a pair of wings from bird feathers and wax. Attaching the wings to Icarus, Daedalus warned his son that ascending too high would cause the sun's heat to melt the wax, and thus destroy the wings. When Icarus took flight, he simply could not resist soaring high. Flying outside of the boundaries, the wax began to melt, and Icarus plunged to his death in the sea.[107] While the story is mythological, a kernel of truth can be gleaned that it is organizationally dangerous to flirt with the boundaries of safety, as oftentimes those who do so, pay dearly. Furthermore, it is easy to drift "over the edge" of safety and not realize the magnitude of the problem until it is simply too late.

Another characteristic of drifting into failure, with an ultimate goal manifested as an organizational normalization of deviance, is the speed in which drift occurs. When examining NASA workgroups, Vaughan makes several observations that demonstrates, and in many respects validates, Dekker's premise of drifting into failure. Vaughan addresses drifting at the workgroup level and implies that the group slowly but steadily embraces the slightest modifications to normal standards, all within the framework of everyday work.[108] She adds that by influencing a group with a multitude of new events occurring simultaneously they would certainly be noticed, but not when presented little by little and distributed among the normally accepted ideas in the workplace. Clarifying the issue, Perrow concludes that drift can have disastrous consequences if several workgroups are individually drifting towards failure. He allegorizes multiple workgroups drifting simultaneously to a group of ships sailing towards a common port. As the boats make course corrections to avoid collisions, independent of the other vessels, the "big picture" of all boats reveals boats that are sailing towards disaster, where collisions will occur.[109] Vaughan writes about these workplace modifications, "Small changes-new behaviors that were slight deviations from the normal course of events- gradually become

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[107] "The Myth of Daedalus and Icarus," Greek Myths & Greek Mythology, accessed August 10, 2017, https://www.greekmyths-greekmythology.com/myth-of-daedalus-and-icarus/.

[108] Vaughan, *The Challenger Launch Decision*, loc. 8979–8988.

[109] Perrow, *Normal Accidents*, 377.

the norm, providing a basis for accepting additional deviance."[110] Yet, as Rashid, Sambasivan, and Rahman note, change is a normal component of any business model, whether in direction, tempo, or pace of workload, as well as employee and managerial performance levels.[111] Change is a rather robust word that indicates a resignation of a former methodology or practice in lieu of a new way of doing something, and can be viewed either positively or negatively. Once more, Rashid, Sambasivan, and Rahman allege that people by and large oppose change, which in their estimation amplifies the chance of failure.[112] Burke envisions organizational change developing in one of two ways, either evolutionary, which he claims is more accepted as a necessity of business, and revolutionary, which is exhibited in changes in management or radical departures from previous agendas.[113]

The detrimental organizational change that Dekker theorizes about, which comes to fruition through a drift into failure, should not be confused with normal business adjustments designed to evolve as markets change and the flexibility to improve processes that are normally viewed as anticipated and somewhat expected. The speed of true organizational drift in complex systems is remarkably slow and undetected until an accident occurs. Moreover, it is within this drifting period that deviance is truly hazardous to organizations. The longer the drift, the more embedded and hidden alternative processes become, and easily acceptable as normal practice. Pettersen and Schulman, who contemplated Snook's views on drifting into failure, claim that employees modify actions to accomplish workplace goals when the established guidelines fail to address the current dilemma.[114] Simply put, under production pressures, personnel develop what they think is a reasonably alternative solution, albeit one that is unsanctioned and more hazardous to fulfill performance measures.

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[110] Vaughan, *The Challenger Launch Decision*, loc. 8988.

[111] Zabid Abdul Rashid, Murali Sambasivan, and Azmawani Abdul Rahman, "The Influence of Organizational Culture on Attitudes toward Organizational Change," *Leadership & Organization Development Journal* 25, no. 2 (2004): 162.

[112] Ibid.

[113] Ritu Gupta, "Organization Change Theory and Practice," *DIAS Technology Review* 7, no. 2 (October 2010–March 2011): 72.

[114] Pettersen and Schulman, "Drift, Adaptation, Resilience and Reliability," 4.

Those organizations undergoing a drift into failure deviate from normal work processes appear to do so out of necessity and consider those decisions both rational and vital to success that are accepted within social work groups. The resulting aberrant activities, taken within the context of countless other actions in the workplace, get "lost in the shuffle" of properly performed operations and then become deeply rooted into workplace processes. Due to stressed environments, improper actions are accepted and ingrained within the organization, ready to be incorporated throughout an organization at multiple levels that are then deemed to be acceptable. At the end of a work cycle, success is qualitatively measured by the absence of any problems or setbacks and with the deviant action obscured by countless good decisions, the organization drifts further into failure. Starbuck and Milliken put forward the idea that organizations oftentimes look back at former victories as a benchmark of success and point to an absence of failure as tantamount to proficiency both procedurally and administratively.[115]

Nevertheless, leaning on prior success as an indicator of future success is dangerous, especially in high-risk occupations that interact and operate in dynamic environments. A famous colloquialism warns to "not rest on one's laurels." While organizations, much like individuals, want to bask in the accolades that accompany success, people are inclined to bank on past victories to propel those same companies through future obstacles. Bruggeman notes that organizations, such as NASA, profoundly leverage the success of previous launches to affect future plans.[116] Starbuck and Milliken promote this same belief when they write, "Successes foster complacency, confidence, inattention, routinization, and habituation; and so errors grow increasingly likely as successes accumulate."[117] The hypothesis that errors grow as successes accumulate seem to stand in sharp contrast to popularly held axioms that promote a popular and opposing point of view.

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[115] Starbuck and Milliken, "Challenger," 319.

[116] David Bruggeman, "NASA: A Path Dependent Organization," *Technology in Society* 24 (2002): 416.

[117] Starbuck and Milliken, "Challenger," 322.

Interactions are inevitable, despite any preventative actions taken. Innumerable interactions, whether one way or reciprocal, exist between the environment, humanity, objects, and even within people's own selves. In the workplace, people interface with computer or mechanical equipment, tools, people, and other business entities, all with the intent to conduct a fraction of the overall work that contributes to an organization's success. Several of these interactions can occur at various intra or extra-organizational strata within a normal work cycle. Inside organizations, however, interplay occurs between overarching organizational goals, revealed as SOPs, as well as constraints that affect those goals and have an influence down to the work group or individual level. Riley seems to support this view by explaining that inter-organizational rules and regulations aid in the fabrication of social systems and provide structural support to the organization while also affirming the idea of "what has come before," by which she infers that formerly used information is blended into the organization.[118] The concept that prior experience is valued in an organization helps to define organizational culture, or as Riley notes, "It is the combination of individuals and institutions that creates culture."[119]

Vaughan adds context to Riley's argument, at least within her assessment of NASA, when she claims that any organizational constraints upon subordinate workgroups to produce should be viewed as reasonable and almost a nudge in a certain direction by those the constraints affect, while concurrently respecting the workgroup's prior knowledge and discretion in how to proceed.[120] Therefore, the "macro" or organizational level policies and procedures establish the guidelines and parameters in which "micro" level workgroups or individuals interact and conduct operations through approved processes. These processes and accompanying SOPs help frame the work environment. The articulation of organizational goals and desires flows through its codification of SOPs and is designed to influence decision-making down through social constructs, as well as its technical processes, even if that means the application of

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[118] Patricia Riley, "A Structurationist Account of Political Culture," *Administrative Science Quarterly* 28, no. 3 (September 1983): 415, doi: 10.2307/2392250.

[119] Ibid., 435.

[120] Vaughan, *The Challenger Launch Decision*, loc. 4507.

pressure to subordinate groups to produce in a certain manner. Dekker proclaims that Vaughan would perfectly capture the essence of such tensions in the macro-micro connection at NASA in unmasking how upper management internalized production pressures to launch, and its terminal effect on how individual workgroups estimated risk and appraised hazards.[121] Verification of organizational goals are oftentimes seen from the macro-level, as either success or failure, in qualitative terms, even though a comprehensive internal examination might reveal more conflicted, micro-level disturbances.

Organizations typically try to achieve numerous goals concomitantly, with a handful that eventually finds themselves in conflict with one another. How do such entities reconcile differences in achieving goals from a macro-level, managerial viewpoint to the micro-level, decision-maker's perspective? Dekker and Pruchnicki think that most disputes are worked out at the local level, as a series of compromises executed by local workgroups.[122] Caution must be noted in micro-level assessments that can have macro-level repercussions, as both levels are uniquely linked together, as Bergström and Dekker maintain was the case in the Challenger catastrophe.[123] Dekker points out that when organizational level (macro) problems increase, whether from extrinsic or intrinsic causes, a strain in the relationship between productivity and safety emerges.[124] It is in the fertile ground of dissonance between productivity and safety that the weeds of failure sprout.

In discussing the failure of complex organizational systems, employing an accident causation model, such as Reason's SCM, serves as a primer to understand further how accidents happen. A goal in dissecting models, such as the SCM, is relatively straightforward; to increase someone's comprehension of the layered defenses that comprise complex systems, in addition to realizing how various levels of an organization

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[121] Dekker, *Drift into Failure*, 103.

[122] Dekker and Pruchnicki, "Drifting into Failure," 537.

[123] Johan Bergström and Sidney W. A. Dekker, "Bridging the Macro and the Micro by Considering the Meso: Reflections on the Fractal Nature of Resilience," *Ecology and Society* 19, no. 4, art. 22 (2014): 5, doi: 10.5751/ES-06956-190422.

[124] Dekker, *Drift into Failure*, 101.

can contribute to failures. Reason introduces the SCM by explaining that at least three defensive tiers make up complex systems: designed, human, and managerial.[125] Designed barriers can be a physical obstruction, while a human restraint could consist of a person whose role is to perform in a safety function. Finally, a managerial deterrent can be a myriad of SOPs or laws that seek to inhibit irrational behaviors.

The SCM, as shown in Figure 2, depicts the trajectory of accident causation in complex systems, read from right to left. The individual "cheese slices" represent organizational defenses positioned against failure. While such defenses may ideally provide a formidable defense, free of error or defect, the reality is that all defenses have weaknesses, whether inherent or unforeseen. Sheridan identifies these weaknesses as "opportunities," whether the fragility of the defense was in either a human or machine component.[126] Reason allegorically compared the defensive tiers to Swiss cheese, of which a small portion of the surface is perforated with holes that represent failures within the specific layer.[127] Certainly, some events can penetrate through a single or perhaps multiple defensive layers, where an event is stopped prior to penetrating through all layers, and thus, prevent an accident. Roberts, Bea, and Bartles note that some organizational vulnerability always exists, while some open and close, and are contingent upon current conditions.[128] Sheridan acknowledges that when holes in defensive layers happen to be aligned, a simple error can advance through these layers and create an accident.[129]

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[125] Reason, "Human Error: Models and Management," 769.

[126] Thomas B. Sheridan, "Risk, Human Error, and System Resilience: Fundamental Ideas," *Human Factors* 50, no. 3 (June 2008): 421, doi: 10.1518/001872008X250773.

[127] Reason, "Human Error: Models and Management," 769.

[128] Roberts, Bea, and Bartles, "Must Accidents Happen?" 71.

[129] Sheridan, "Risk, Human Error, and System Resilience," 421.

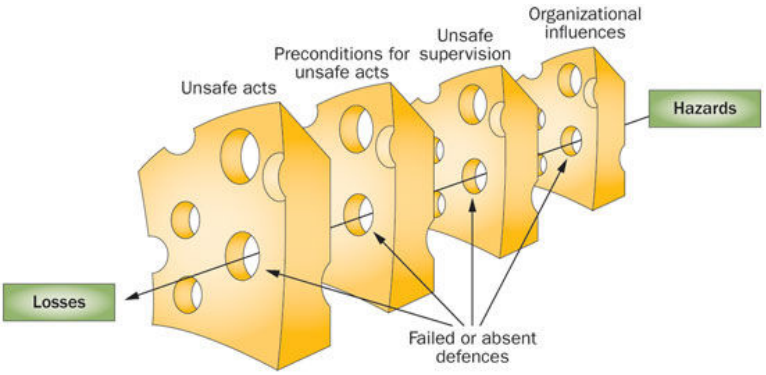

Figure 2. Reason's Swiss Cheese Model[130]

The openings in defensive layers discussed in the SCM necessitate further explanation and insight to understand better proximal root causes of system frailties. Reason holds that two causes of the holes are experienced in organizational defense postures, active and passive failures.[131]

Figure 3 reveals both active and passive failure paths. Active pathways run completely through the organization into the workplace and filter down to the workgroup or individual worker, through all defenses (as described in the SCM), which culminates in an accident, with active pathways ending in what is known as the "sharp end" of organizations.[132] As a result, sharp end personnel include those employees at the distal end of organizations; workgroups and employees that interface with organizational processes and equipment at a technical level that apply themselves to a finished product or service. Reason uses the active failure pathway to disprove the long-held belief that the individual worker is the prime mover of accidents, which supports a belief that accidents actually start above the worker level.[133] A host of factors may influence incipient behaviors that can lead to initiating events within complex systems. On the other hand, the latent pathway bypasses the workplace and the employee workgroup altogether,

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130 Source: "Swiss Cheese Model of Error," Google, accessed August 13, 2017, https://www.google.com/search?q=swiss+cheese+model+of+error&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwiEv6j73NLVAhXqzlQKHVz9C2QQsAQIcA&biw=1270&bih=583#imgrc=sKZVP4_T84OYyM.

131 Reason, "Human Error: Models and Management," 769.

132 Reason, "A Systems Approach to Organizational Error," 1710.

133 Ibid.

which originates from upper management realms far removed from daily operations at the individual level and terminates at the defense level, again as Figure 3 shows.[134] Sheridan refers to administrators, in addition to those not at the sharp end of an organization, as the "blunt end."[135]

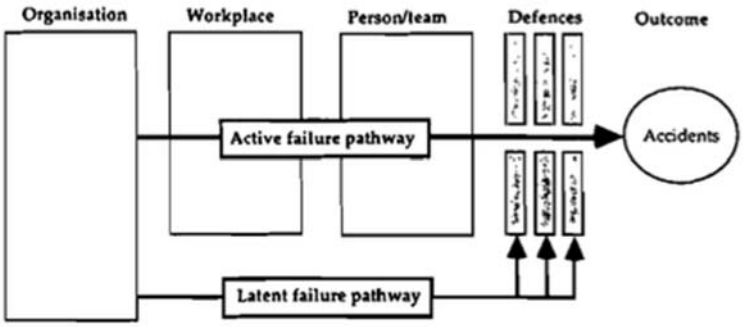

Figure 3. Active and Latent Failure Pathways[136]

Figure 4 attempts to provide additional context to accident causation by adding details and job tasks within various organizational levels.

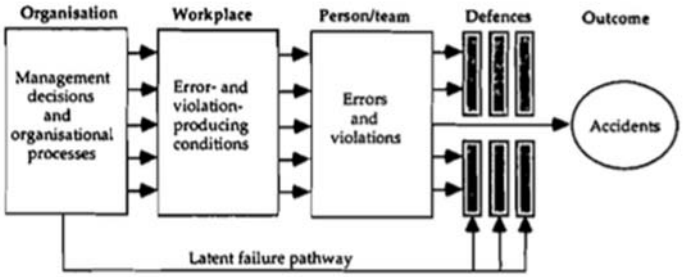

Figure 4. A Model of Organizational Accident Causation[137]

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134 Reason, "A Systems Approach to Organizational Error," 1710.

135 Sheridan, "Risk, Human Error, and System Resilience," 420.

136 Source: James Reason, "A Systems Approach to Organizational Error," *Ergonomics* 38, no. 8 (August 1995): 1711, doi: 10.1080/00140139508925221. The figure was originally entitled "Emphasizing the distinctions between the active and latent failure pathways."

137 Source: Ibid., 1710.

Finally, Reason does point out that latent conditions can exist within an organization for an extended timeframe, either hidden or in plain sight, and can merge with active failures to produce accidents in a synergistic fashion.[138] Such binary failures may be extraordinarily dangerous due to the involvement of both active pathways and surfacing latent conditions. In conclusion, the SCM offers a roadmap and prospective blueprint of accident causation in complex systems by revealing a bifurcated pathway that delineates between active pathways that pass through weakened sections of defensive layers and latent paths that circumvent much of the normal processes within an organization.

One of the final considerations that can affect the normalization of deviance is the idea and influence of loose and tight coupling on organizations. The notion exists that organizations can have countless interactions between systems, such as human to human, human to machine, and even machine to machine, just to name a few. Such relationships between persons or entire systems are vital to any successful operation, and are both necessary and proper. Some transactions are uncomplicated and effortless, while some exchanges are elaborate and drawn out. To appreciate the effect of coupling on systems, a brief discussion of linear and complex systems must take place, as well as a reference back to Figure 1.

Linear systems, as the most elementary of organizational systems, are the most prevalent type of networks, according to Perrow.[139] The classic example of a linear system is the basic assembly line. Linear system failures are fairly easy to recognize, as only one path is possible, and locating where the system failed is as simple as investigating either uphill (at the beginning of the process) or downhill (towards the terminal end). Repair the failed section, and normal production processes continue. Perrow however introduces the intricacy of complex systems, where he writes, "complex interactions, suggesting that there are branching paths, feedback loops, jumps from one linear sequence to another because of proximity and certain other features."[140] Simply

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138 Reason, "Human Error: Models and Management," 769.

139 Perrow, *Normal Accidents*, 75.

140 Ibid., 74–5.

put, a component within a complex system may perform a handful of actions, but in the event of a failure at this juncture, all interdependent paths are negatively affected. Downstream from the point of failure, other system elements can deteriorate, with a cascading effect occurring throughout the system. Consequently, what initially presents as a negligible local failure can lead to a generalized systemic failure.

It is vital that an elementary understanding of complexity be understood as it relates to the interactions of either loose or tight coupling or their potential to influence complex system failures. For the purposes of this project, it is noteworthy to remember that coupling generally refers to the ability of systems to rebound back to a pre-accident state after suffering a failure. Several industries, in referring to coupling, normally associate the term with resiliency inside a system. Resiliency should not be misconstrued with redundancy, which is often used interchangeably, which adds to a perversion of both terms. For clarification, resiliency as defined in an article by Peruggia is "an ability to recover from or adjust easily to misfortune or change," whereas redundancy is explained as "exceeding what is necessary or normal."[141] Distinctions and applications of proper nomenclature are essential to understand that redundancy in a system contributes to that system's resiliency. An influencing factor of resiliency is whether elements of a system in question are loosely or tightly coupled. Coupling, as applied in context of this discussion, is intended to show the degree in which components of a system (inside an organization) are associated or bound to each other.

The first type of coupling considered to exist within organizational systems is known as loose coupling. Perrow begins his assessment of loose coupling by insisting that the use of the term "loose" should not be confused with being in a state of disorder; rather, it characterizes the ability of system's components to retain a distinctiveness and individuality, despite its affiliation with the entire system.[142] Loosely coupled parts have a negligible correlation between other components. Consequently, in the event of a failure of a single component, the entire system suffers only slightly, as the points of

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[141] John Peruggia, "Resiliency vs. Redundancy: Are You Prepared?" JEMS, June 1, 2012, http://www.jems.com/ems-insider/articles/2012/06/resiliency-vs-redundancy-are-you-prepared.html.

[142] Perrow, *Normal Accidents*, 91.

connection are not interwoven to the overall system. While a system may experience a temporary setback, a total failure is averted due to the weak bonds that suggest minimal influence over the system.

Weick noted that loose coupling may actually encourage determination within a system, although it may lack the ability to discern what survives.[143] In the aftermath of a failure, the weakened component can be exchanged for another component, although it is understood that replacing the damaged segment is not as easy as it sounds. Legitimate questions could arise as to why the component was not more resilient, which leads to whether a similar component should be replaced by a more robust one, or to add a redundant layer of protection. Perrow claims that loosely coupled systems can absorb more failure, while maintaining adequate stability.[144] When a failure does occur in a single component, the nature of the attachments, whether in a shared process between adjacent parts or between any two things, is detached to preserve the overall system. Perrow adds that the loose coupling of systems, such as those exhibited through manufacturing processes, exhibit a degree of "equifinality," which allows that system to create an end product in an assortment of ways.[145] The capacity to produce a product or service through a number of pathways, essentially working around a localized failure, is the essence of resiliency that reveals multiple layers of redundancy. Additionally, loose coupling allows the organization to benefit by having more heterogeneous response options, as remedies can be more diverse than tightly coupled systems, as Perrow wrote in *Normal Accidents*.[146]

The second category of coupling is known as tight coupling, which is predominantly found in complex organizational systems. Perrow explains tight coupling as the absence of defense between two items, which results in a direct and negative

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[143] Weick, "Educational Organizations as Loosely Coupled Systems," 6.

[144] Perrow, *Normal Accidents*, 92.

[145] Ibid., 94.

[146] Ibid.

correlation between two tightknit elements.[147] With regard to complex systems, Perrow in *Normal Accidents* highlights common qualities of such systems:

- Proximity of parts or units that are [sic] not in a production sequence;
- Many common mode connections between components (parts, units, or subsystems) not in a production sequence;
- Unfamiliar or unintended feedback loops;
- Many control parameters with potential interactions;
- Indirect or inferential information sources; and
- Limited understanding of some processes.[148]

A perfunctory review of this list reveals an asymmetrical arrangement, one in which multiple links are established between various portions of the overall system, including repeatable networks that are inserted and exit the system at multiple locations, commonly known as feedback loops. It is due to the complexity of these numerous and multi-level exchanges that Rijpma claims as the cause of initial stimuli that create initial problems that abruptly expand into organizational failures.[149] Barton and Sutcliffe amplify the tight coupling problem by adding procedural constraints of rigid timeframes and the perpetual demands of the organization to produce the good or service.[150] Dekker et al. supports Barton and Sutcliffe's conclusions but adds a third confining factor, a slim margin of error, as some processes are simply unforgiving and require a "one time only" mode of operating.[151] Perrow's conclusions also addressed unequivocal intolerance of

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[147] Perrow, *Normal Accidents*, 89.

[148] Ibid., 85–6.

[149] Jos A. Rijpma, "Complexity, Tight–Coupling and Reliability: Connecting Normal Accidents Theory and High Reliability Theory," *Journal of Contingencies & Crisis Management* 5, no. 1 (March 1997): 15.

[150] Michelle A. Barton and Kathleen M. Sutcliffe, "Overcoming Dysfunctional Momentum: Organizational Safety as a Social Achievement," ed. Nick Turner and Garry C. Gray, *Human Relations* 62, no. 9 (September 2009): 1328, doi: 10.1177/0018726709334491.

[151] Dekker et al., *Resilience Engineering*, 27.

workplace deviations from embedded procedures in tightly coupled systems, as marginal noncompliance can lead to cataclysmic effects.[152]

Tightly coupled organizations are "intertwined," as Roberts, Bea, and Bartles claim, which encounter failures when the slightest perturbations create significant imbalances in the total system.[153] These reverberations have a rapid ripple effect throughout the tight couplings that lead to other system components that can cause mass disruption in a brief amount of time. Perrow warns that counteractive measures to failures in tightly coupled and complex systems, to be effective, must be considered and designed into processes beforehand, so that actions can be deployed without delay.[154] The sequence of events, from failure to detection to response, is rather intolerant of extended timeframes that gives rise to the necessity of managed and integrated control features. The narrowness of process pathways in tightly coupled systems is perhaps indicative of similar reactive and protective processes that are leveraged against failures. Perrow, in highlighting the unforgiving nature of narrowly wound, complex systems, summarizes that tightly coupled systems have "unifinality;" in essence, a single way of operating these systems, in opposition to loosely coupled systems that enjoy equifinality.[155] In summary, vast disparities occur between organizational systems that are either loosely or tightly coupled, which are dependent in part on the linear or complex nature of a system.

Reviewing the various organizational issues attributed to workplace failures and accidents can facilitate a deeper understanding of a normalization of deviance, which puts its contributory nature to accident causation into perspective. Overt as it was, Vaughan's exploration of NASA's technical failure led to a more covert and deep-rooted explanation of Challenger's demise with her applied normalization of deviance framework. The normalization of deviance in many ways is the tragic fulfillment of Turner's sociotechnical theory written about years earlier. That is to say, accidents rarely have a purely technical cause, at least when a human-technology interface is involved, but also

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[152] Perrow, *Normal Accidents*, 94.

[153] Roberts, Bea, and Bartles, "Must Accidents Happen?" 71.

[154] Perrow, *Normal Accidents*, 94.

[155] Ibid.

to blame are the sociological undercurrents that buttress and act as a catalyst within organizations to propel it towards failure. Even applying the term "failure" is subject to gradation, as unsafe acts, near misses, incidents, and accidents all describe levels of failure. While one business might be more tolerant of near misses, another business might consider a near miss untenable in any context or degree. Therefore, failure may be thought of in quantitative terms, such as a percentage of operations that are negatively impacted by a failure, as well as qualitatively, in whether an operation can simply continue or not; yes or no.

Yet, within organizations where a normalization of deviance has developed, social interactions can have a profound impact on the overall performance and operational status of a system. Social interactions as applied to the workplace include the individual workgroup's influence on other groups above or below their location on an operational chain, including groups internal or external to the organization. The workgroups operate and make a myriad of decisions within their sphere of influence about their assigned tasks. Culturally, normative values as to what is acceptable or unsatisfactory are established in the routineness of endless and daily decision-making, which is what Vaughan referred to as a "native view," and describes as the most basic cultural belief that the workgroup has established as a way of conducting business.[156] Vaughan dissects NASA's work cultures, from the organizational level down to the granular SRB work group level to show how a myriad of day-to-day decision-making shaped internal work culture. Particularly, how repetitive decision-making, conjoined with risk, took small and incremental steps to accept as normal that which had previously been considered abnormal.

Invariably, when considering the Challenger disaster, a question is raised that states, "how could NASA move forward with a launch when so many contradictory safety features had been violated?" Vaughan offered the normalization of deviance as an answer, by theorizing that within the NASA SRB workgroup, the decision to launch was nothing unusual, although external to the organization, clear indications of safety

[156] Vaughan, *The Challenger Launch Decision*, loc. 2063.

violations would cancel any launch. As overarching proof, Vaughan claims that employees had broken rules to complete their mission, with groups compelled to do so as production took precedence over safety.[157] With such an informal imbalance, tilted awkwardly towards production at the expense of following industry and organizational safety standards, the slightest cultural acceptance towards committing future infractions occurs, particularly if no negative repercussions result. Inside the workgroup, what was once aberrant and forbidden by rule or communal influence now becomes ordinary and customary, acceptable at a cultural level; where the workgroup redefines its own subculture of accepted norms and limitations. Dekker claims that psychology refers to such actions as "the local rationality principle: people are doing what makes sense given the situational indications, operational pressures, and organizational norms existing at the time."[158]

The interval in which a workgroup experiences a transformation from what is genuinely normal towards a normalization that is deviant is precisely what Turner designated as an incubation period. Recalling that during such a span of time, organizational culture is negatively shifting at a sluggish pace. Likewise, minute changes at foundational levels are taking place to meet organizational goals; however, the alterations are outside the normal boundaries of safety, and are reinforced by positive outcomes. Gradual changes continue with reinforcement from repeated successes, despite an unknown realization of Dekker's "drift into failure" concept. Pessemier concurs with Dekker in the notion that the absence of negative outcomes after dangerous actions were performed can foster the idea that such actions are a suitable way to operate.[159] Dekker notes that a drift into failure is pushed within an organization as a result of local decisions that were perceived to be correct and proper when they happened, and therefore, more likely to be accepted as satisfactory to the degree that local decisions went unchallenged and accepted as the dominant way of operating throughout the organization.[160]

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[157] Vaughan, *The Challenger Launch Decision*, loc. 1189.

[158] Dekker, *Drift into Failure*, 12.

[159] Pessemier, *Improving Safety Performance by Understanding Perceptions of Risk and Improving Safety Management Systems*, 3.

[160] Dekker, *Drift into Failure*, 14.

In closing, the normalization of deviance can penetrate organizational defenses that originated as a series of trade-offs between production and safety, which compete for preeminence in the workplace and frame a workgroup's cultural norms. Positive outcomes in the shadow of poor decisions affirm the bias against organizational norms that then turn to alternate avenues to achieve goals. While defenses, such as the SCM, seek to prevent accidents by implementing a layered defense posture, drifting into failure combines with operating unknowingly inside an incubation period. Additionally, a series of micro decisions within a work culture can negatively affect macro levels of operation and lead to organizational normalized deviance. An additional complicating factor of normalizing deviance is the idea that those inside the organization understand and view their actions and decisions as normal and rational, as their decisions have been met with past success, which reinforces cultural acceptance of deviant practices to the point of normality. The idea that mistakes are born out of social interactions cannot be overstated. Looking ahead to the following chapter, consideration is given to the idea that high-risk occupations are susceptible to functioning with various principles of normalized deviance.

IV. THE POTENTIAL OF NORMALIZED DEVIANCE TO OCCUR WITHIN HIGH-RISK OCCUPATIONS

With reference to high-risk occupations, a question of the propensity for "sharp end" personnel to slowly and methodically embrace practices and develop behaviors that can lead to a normalization of deviance within an organization should be examined. The rationale for conducting an analysis stems in part from the close proximity that select organizational sections have in relation to the edge of safety in an already hazardous setting, with an understanding that adopting particular attitudes and developing divergent social standards towards safety can negatively influence an organization. Remaining objective, an analysis should be rooted in evaluative criteria that are unbiased and pertinent to answering whether high-risk occupations either have drifted or are in the midst of drifting into failure that leads to a normalized deviance of an entire organization. Individual components of the review include discussions about balancing safety and production, as well as concepts of satisficing and escalation of commitment. Finally, the evaluative criteria utilized for analyzing high-risk occupations is discussed. An overarching goal is to conduct an impartial investigation based on the established criteria to determine whether a normalization of deviance has an increased probability of occurring in high-risk occupations.

Normalization of deviance, as an abnormal process, is both antagonistic and opportunistic in nature as its name implies and can potentially infiltrate an organization over a protracted period of time. Organizations, despite the end product produced, whether a good for sale or a service provided, works within production limitations and constraints. Ordinarily, the margins of normal output have been established and safety goals declared to achieve a level of recognized and acceptable output. Classical constraints, such as time and resources (whether in personnel or materials), can quickly challenge processes and safety practices designed to protect the optimal production method and safeguard the employee. Author Sidney Dekker asserts that when external pressures of supply and demand, coupled with the internal pressures of production goals and safety expectations are pushed to their limits, these same perimeters that earlier

defended an organization from disaster are now drawn upon by those in charge of production to meet organizational goals.[161]

In many respects, NASA can be considered the epitome of an organization inclined to drift into failure, albeit unknowingly, in conjunction with a latent ability to produce a normalized deviance. Unsurprisingly, other high-risk industries and certain occupations seem predisposed to follow in NASA's footsteps when it comes to workplace cultures that push the envelope of safety to its borders. What defines a high-risk occupation? The OSHA job hazard analysis list includes industry professions that encounter routine workplace dangers, including toxic chemicals, explosion hazards, radiation, and fire/heat.[162] In *Normal Accidents*, Perrow organized all sorts of industries, admittedly from his cognitive standpoint, into what he termed an "interaction/coupling chart." Perrow integrated two variables into his chart, with the x-axis showing "interactions" from linear to complex, as read from left to right. The y-axis denotes the level of coupling, loose to tight, as read from the bottom towards the top. Perrow's chart is presented as Figure 5 and is intended to show a wide swathe of industries, with emphasis on those in quadrant 2, which are traditionally considered higher-risk occupations than others on the same chart by hazards in the workplace.

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[161] Dekker, *Drift into Failure*, preface, xii–xiii.

[162] Occupational Safety and Health Administration, *Job Hazard Analysis*, OSHA 3071 2001 (Revised) (Washington, DC: United States Department of Labor, 2001), https://www.osha.gov/Publications/osha30 71.html#App2. See Appendix 2-Common Hazards and Descriptions.

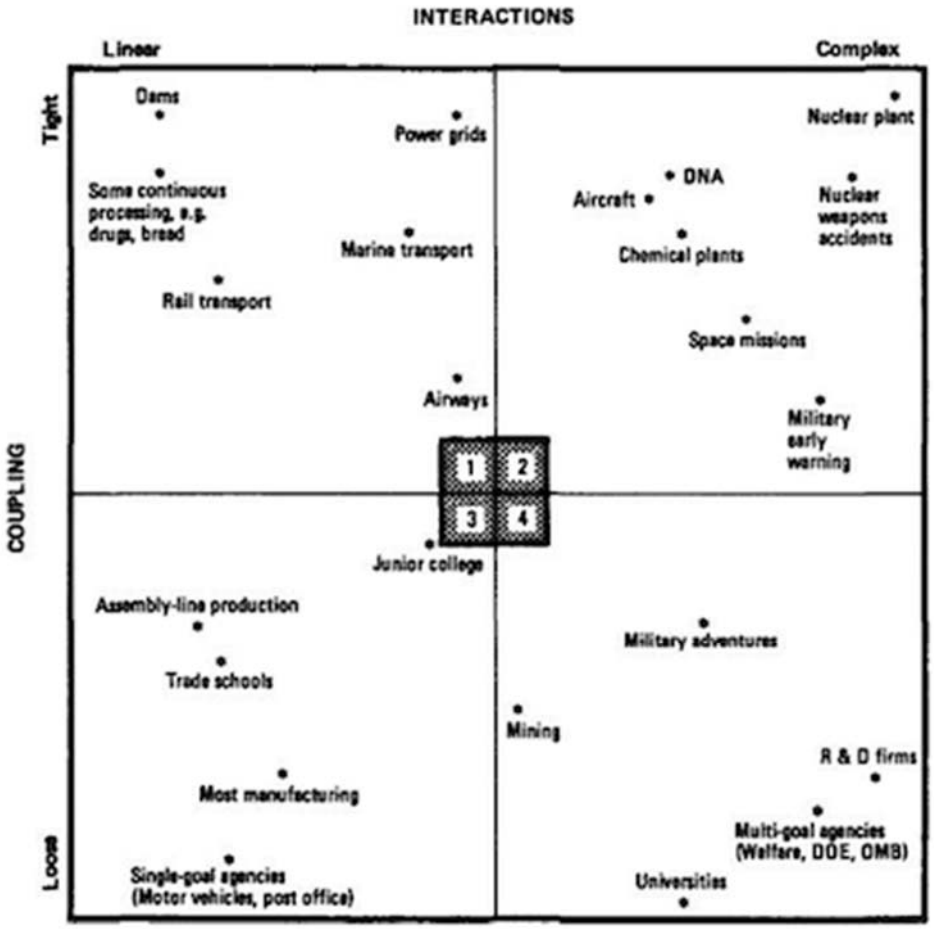

Figure 5. Interaction/Coupling Chart[163]

Unauthorized shortcuts are developed within social work groups that seemingly contribute positively to production processes. Nevertheless, such actions have an inversely proportional effect that alters safety protocols that have been little by little justified through the increased adoption of a "new normal," which performs opportunistically outside the boundaries of an organization's guidelines. As the shortcut is progressively engaged and leveraged against an organization's obstacles, and done so devoid of any negative repercussions, the deviance becomes sluggish and entrenched within operational paradigms, sometimes undistinguishable to supervisors as risky behavior. A resultant standard of suboptimal work processes is cultivated. Dekker

[163] Source: Perrow, *Normal Accidents*, 98. Interaction/Coupling Chart. See Figure 3.1.

concludes that risky actions become commonplace and writes, "Drifting into failure is a gradual, incremental decline into disaster driven by environmental pressure, unruly technology, and social pressures that normalize growing risk."[164]

In light of the NASA Challenger example, how could a massive, multi-tiered organization like NASA allow itself to drift into failure as a result of improperly handling several interagency stressors by normalizing deviant actions, as Dekker suggest organizations are prone to do?[165] Vaughan argues that opposing forces and limited funds elevated the pressure within NASA workgroups to keep the Space Shuttle program on a rigorous flight schedule; pressures that had a negative, yet synergistic effect on astronaut safety.[166] To compound the issue, Vaughan applied a tertiary rationale to NASA's substandard behavior patterns, namely that the organization had adopted a habit of concealing the O-ring complications from various internal NASA workgroups, as well as outside vendors.[167] Presumably, the masking of perpetual O-ring difficulties was attributable to production pressures to launch on schedule. Recall that the STS mission by design was to be a utilitarian orbiter to carry payloads into space at compressed and recurrent intervals, which was an order of magnitude more challenging for NASA and its vendors.

When considering various high-risk occupations that experience pressures related to safety and production simultaneously, a proclivity exists towards embracing various concepts that circumvent a problem in harmful ways. Regardless of industry, management leaders seek high levels of performance from their employees. Administrative expectations are based typically on an anticipated output from members and specific production levels require workers to operate with a certain level of tempo and an equally quick pace. Like most operations, increased demands equate to working faster and depending on the occupation, performing at a faster pace could increase the margin of error, as all actions are expedited to meet demands. However, McLain and

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164 Dekker, *Drift into Failure*, preface, xii.

165 Ibid.

166 Vaughan, *The Challenger Launch Decision*, loc. 1189–1198.

167 Ibid., loc. 1198.

Jarrell emphasize that to increase production, safety parameters are stretched beyond what is standard, what they call a "safety-production incompatibility."[168] Prielipp et al. in their article speak to this same struggle between safety and production, basically stating that stress-laden industries, such as medical anesthesia, as well as both NASA Challenger and Columbia tragedies, allowed increased risk to meet deadlines.[169]

High-risk occupations, as the name implies, denotes increased risk of injury or death to one or more workers based on either a dangerous environment in which workers operate, or perhaps the operation and interaction with dangerous and unforgiving machinery that can jeopardize employee safety. Smith and Dyal, in their article about the dangers and varying job safety in the fire service, state that firefighters perform tasks under austere conditions and are subjected to increased mental pressures that occur in dynamic settings.[170] In the Challenger disaster, Vaughan discovers that at various levels, even a heavily scrutinized, safety conscious organization like NASA felt compelled to be results-driven, at the expense of breaching safety protocols, including the concealment of critical information related to shuttle launches.[171] Within high-risk occupations, organizations endeavor to find equilibrium between safety and production, as though safety is on one scale and production is on the opposite scale. Yet, in the real world, high-risk organizations, like other entities, appear to resolve imbalances between safety and production by a series of concessions, either leaning towards one or the other as a series of trade-offs.

Dekker and Woods allege that organizational output is a short-term goal, whereas safety is a persistent, long-term goal.[172] Although the two goals seem to be in a steady

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[168] McLain and Jarrell, "The Perceived Compatibility of Safety and Production Expectations in Hazardous Occupations," 299.

[169] Richard C. Prielipp et al., "The Normalization of Deviance: Do We (Un) Knowingly Accept Doing the Wrong Thing?" *Anesthesia & Analgesia* 110, no. 5 (May 2010): 1499, doi: 10.1213/ANE.0b013e3181
d5adc5.

[170] Smith and Dyal, "A Conceptual Safety-Oriented Job Demands and Resources Model for the Fire Service," 443.

[171] Vaughan, *The Challenger Launch Decision*, loc. 474.

[172] Dekker and Woods, "The High Reliability Organization Perspective," 137.

state of hostility towards one another, they act on one another in various exchanges for control. Zohar implies a rivalry between safety and production, adding that how bosses react to this struggle, whether safety or production takes priority, sends a distinct message to subordinates as to which goal is primary, and which is secondary.[173] Workgroups, as social entities, form cultural norms for their specific group, based on what supervisors have stressed is of supreme importance. If the workgroup perceives managerial signals that production is of paramount importance, then socially, workplace decisions and successive actions can align with a belief that safety measures can be somewhat disobeyed; that aberrant safety actions are sanctioned to achieve production goals.

Employees functioning within any profession, but especially complex, high-risk occupations, may extract information from their operating environment, as well as from other sources (other employees, technical information, monitors, and gauges) both internal and external to their environment, with a goal of integrating such data into a decision-making matrix that is rational and decidedly in the best interest of organizational goals. In fact, Bruggeman employs a graphic to show collaborations within a NASA project, as seen in Figure 6.

[173] Zohar Dov, "Safety Climate and Beyond: A Multi-Level Multi-Climate Framework," *Safety Science* 46, no. 3 (March 2008): 377, doi: 10.1016/j.ssci.2007.03.006.

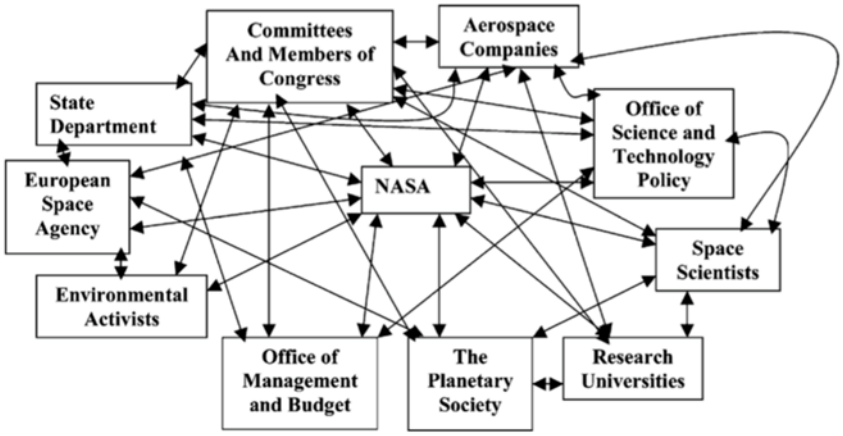

Figure 6. NASA Global Interactions[174]

Nonetheless, Turner poses that possessing absolute information about an issue is often inhibited by many factors that induce a finite information base that leads to finite decisions, adding that compressed information streams can culminate in uncalculated outcomes.[175] Constrained and incomplete information uniquely places high-risk organizational decision-makers at a disadvantage, as obscured or undisclosed knowledge could have devastating impacts on segments of an organization and arguably the entire organization. Simon refers to decision-making with such constraints as the principle of bounded rationality.[176] Turner, in an attempt at lucidity of Simon's thoughts, maintains that despite someone's best attempts, rationality is truly a deficient attribute as people themselves are restricted and incapable of perfect knowledge.[177] Be that as it may, Dekker makes a counterargument about rationality and submits that a person tasked with making rational choices is competent to do so when he writes, "Finally, the decision maker is fully rational and able to rank the alternatives according to their utility relative to the goals the decision maker finds important."[178] Organizational decision-makers who

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174 Source: Bruggeman, "NASA: A Path Dependent Organization," 418.

175 Turner, *Man-Made Disasters*, 131.

176 Herbert A. Simon, *Models of Man, Social and Rational: Mathematical Essays on Rational Human Behavior in a Social Setting* (New York: John Wiley & Sons, Inc., 1957), 199.

177 Turner, *Man-Made Disasters*, 134.

178 Sidney W. A. Dekker, "Rasmussen's Legacy and the Long Arm of Rational Choice," *Applied Ergonomics* 59 (March 2017): 554, doi: 10.1016/j.apergo.2016.02.007.

perceive production over safety struggles receive filtered informational cues from sources biased towards "cutting corners." Translating this model to high-risk occupational leaders whose decisions profoundly influence narrow and rigid safety margins, it is no surprise that final determinations can carry substantial consequences.

When presented with workplace pressure to produce, a possibility exists that individuals or workgroups will do a minimum amount of work to achieve a goal, as opposed to performing the ideal action, an observation known as satisficing. Schwartz et al. contends that in situations where options exist, that decision-makers have a "threshold of acceptability."[179] Those responsible for decision-making might choose between various courses of action, some of which will marginally meet a standard but one that is not optimal for a given situation. Combining a satisficing position on top of critical decision-making authority within high-risk occupations can prove perilous to the workgroup and organization alike, as satisficing may be integrated into safety measures or other processes integral to a successful operation. Turner, in his book *Man-Made Disasters*, expands the conversation of satisficing when he writes, "and as a result of being unaware of possible alternatives of action lying outside those considered, the decision-maker is forced to settle for 'acceptable' or 'win' outcomes (if, indeed he is able to achieve these) rather than pursuing notions of *maximum* acceptability, or *best possible* win."[180]

As explained by Weick, citing an earlier work by Barthol and Ku, when people are hard-pressed in situations, they retreat to a more familiarized position.[181] This conclusion is much like a statement by the Greek poet Archilochus, who is credited with writing, "We don't rise to the level of our expectations, we fall to the level of our training."[182] The implication, applied to high-risk occupations and decision-making in

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[179] Barry Schwartz et al., "Maximizing versus Satisficing: Happiness Is a Matter of Choice," *Journal of Personality and Social Psychology* 83, no. 5 (2002): 1178, doi: 10.1037//0022-3514.83.5.1178.

[180] Turner, *Man-Made Disasters*, 134.

[181] Karl E. Weick, "The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster," *Administrative Science Quarterly* 38, no. 4 (December 1993): 638–9.

[182] Cumulus Dublin et al., ed., *Cumulus Conference Dublin* (Helsinki: Aalto University School of Art, 2014), 17.

strenuous moments, is that people in distressing times will not rise to the moment; rather they will turn back to what they can comprehend as a workable solution; a former presumptive state that is in actuality a form of satisficing and decide on merely an option that is adequate (a previous state) versus one that transcends and transforms the current dilemma. While examining the communal culture formed at NASA, Vaughan deducted that it was bounded rationality that swayed workgroups that had the ability to investigate and understand problems at their respective levels, yet were repressed by scientific data that suggested aberrations could be effectively rationalized from an entropic to a uniform state, characterized as "the representation of chaos in an orderly fashion."[183] As a result of bounded rationality, satisficing becomes a viable option, as the optimal solution becomes an implausible reality.

However, should organizational decision-making leaders and particularly those in high-risk occupations be held accountable as amoral calculators with wanton regard for safety in the wake of disasters, or are decisions merely signs of an underlying disease of normalized deviance? A central question to disaster causality is whether those in a position to make decisions did so out of gross indifference to safety procedures, and are thus considered amoral calculators, or out of a flawed organizational decision matrix that filtered and constrained rational decision-making to a few criteria. Regarding the Challenger disaster as it relates to MTI, Vaughan was able to show that NASA was culpable in satisficing shuttle launches in the midst of a competent MTI design, coupled with the favorable economical impacts and unyielding launch timetables.[184] The dichotomy between satisficing and amoral calculations appears to be birthed in the freedom of rationality in the decision-making process. When considering amoral calculators, such persons deliberately (and irrationally) push processes and workers beyond safety boundaries for the sake of production and are cognizant of such actions. Whereas satisficing, when bounded rationally, limits the decision-maker's options, yet is still within the context of being rational. In addition, the person satisficing contemplates

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[183] Vaughan, *The Challenger Launch Decision*, loc. 8695 and 8705; Susan Leigh Star, "Simplification in Scientific Work: An Example from Neuroscience Research," *Social Studies of Science* 13, no. 2 (1983): 205.

[184] Vaughan, *The Challenger Launch Decision*, loc. 1547.

rational choice options from *within* the organization and according to Dekker, may shed light on why poor results are realized. [Emphasis added][185] The intentionality of amoral calculators in high-risk occupations seeking to economize safety for the sake of increased production anesthetizes an organization from within.

Another contributing component to the normalization of deviance in high-risk occupations is the idea of structural secrecy. Enormous organizations that contain multiple divisions or levels of production are essentially smaller internal organizations under a massive corporate name. Organizations can certainly expand beyond national borders and hold an international profile that gives rise to additional levels of structural secrecy. Simply put, structural secrecy occurs when monolithic organizations have complex and diverse operations that are disconnected from company-wide or "global" knowledge, including top executives. Within this organizational isolationist domain, cultural norms can flourish unrestricted, while at the same time, conceal problems from internal and external customers. Additionally, employees in such divisions essentially become inter-organizational authorities, with few (including administrators) understanding technical jargon or rationale for decision-making networks, as Vaughan points out.[186] Starbuck and Farjoun, in their assessment of the Columbia shuttle disaster, view structural secrecy as a "blind spot" amongst other characteristics within large organizations.[187] When applied to high-risk organizations, structural secrecy contributes to a normalization of deviance by masking internal workgroup problems that lie dormant within the group, as well as translating erroneous or technically enigmatic information throughout the organization.

A final persuading element that can advance a normalization of deviance in high-risk occupations is an idea known as "escalation of commitment." According to Staw, this theory suggests that persons with management decision authority become extremely resolute in assigning supplemental assets to an increasingly failing program or

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[185] Dekker, "Rasmussen's Legacy and the Long Arm of Rational Choice," 555.

[186] Vaughan, *The Challenger Launch Decision*, loc. 5629.

[187] William H. Starbuck and Moshe Farjoun, ed. *Organization at the Limit: Lessons from the Columbia Disaster* (Malden, MA: Blackwell Publishing, 2005), 54.

operation.[188] Simply stated, it happens when executive leaders refuse to admit that a strategy is losing and rather than commit more resources, such as time, personnel, or finances, the persons in charge actually assign *more* assets to attempt to overcome negative outcomes in hope of a favorable or profitable solution. Such actions can effectually draw an organization deeper into a quagmire and expose the organization to increasingly harmful conclusions that decrease resiliency due to overburdened assets. Ross and Staw question how organizations progress on a certain trajectory and once on a certain course, how can an organization be deterred from continuing on that path?[189]

An illustration of escalation of commitment contributing to organizational normalized deviance is expressed in NASA's social culture within the SRB workgroup through a variety of ways. In the opinion of Ramanujam and Goodman, escalation of commitment frameworks actually assist in deemphasizing cues that alert organizations of a potential need to pivot into another direction.[190] One such signal within NASA's SRB division came to light through the Presidential Commission Report, where a 1978 correspondence letter showed that MTI rejected initial SRB tests that revealed a design weakness.[191] This same report would state that NASA repudiated its own engineers' conclusions and curtailed concerns through official documents.[192] NASA appeared to advance its escalation of commitment to a defective design, irrational as it was, when the Commission Report wrote, "At no time did management either recommend a redesign of the joint or call for the Shuttle's grounding until the problem was solved."[193] The "joint" referred to the aft field joint of Challenger's right SRB.

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188 Barry M. Staw, "The Escalation of Commitment to a Course of Action," *Academy of Management Review* 6, no. 4 (1981): 578.

189 Jerry Ross and Barry M. Staw, "Organizational Escalation and Exit: Lessons from the Shoreham Nuclear Power Plant," *Academy of Management Journal* 36, no. 4 (1993): 701.

190 Rangaraj Ramanujam and Paul S. Goodman, "Latent Errors and Adverse Organizational Consequences: A Conceptualization," *Journal of Organizational Behavior* 24, no. 7 (November 2003): 826, doi: 10.1002/job.218.

191 Rogers et al., *Report of the Presidential Commission on the Space Shuttle Challenger Accident, Volume 1*, 121, Chapter VI: An Accident Rooted in History.

192 Ibid.

193 Ibid.

The SRB O-ring issue, along with NASA executive's failure to heed the warnings of its engineers, constituted a grievous encroachment into a component of the launch sequence, one of the most dangerous operational periods in a Shuttle mission. Cleavages between NASA engineers and NASA executives to some extent validated what Greitemeyer, Schulz-Hardt, and Frey had written about in their team experiments when studying both homogeneous and heterogeneous schools of thought; when a conflict of beliefs existed (a dissimilar arrangement), an escalation of commitment also exists, albeit to a lesser extent than in undiversified bodies.[194] Although clear evidence of dissent occurred with some members of the SRB engineering group as to the readiness and safety aspects of the O-rings in the SRB field joints, nevertheless, such challenges were repudiated by NASA executives. According to Bowen, an escalation of commitment can be viewed as an effort to interpret an atmosphere of turmoil, where data is questioned, and therefore, remaining on the current path seems to be the best course of action.[195]

Several likely reasons can be advanced that a rejection of minority voices within the SRB work group were dismissed, among those social and political, to allow an escalation of commitment to stay the course with Challenger's SRB design. Socially, a disaster attributed to the SRB, and to a degree the O-rings, could strike a discordant tone with the public about the reliability of the STS, given NASA's previous success with the Apollo and Gemini programs, and additionally, as Vaughan would note, an increased reluctance in third-party vendors to use a platform that has since proven to be unreliable.[196] Politically, NASA was experiencing political pressures with diminishing budgets, as well as seeking public confirmation from the Reagan administration for the STS and had hoped such overt support would translate into Congressional backing of the NASA program.[197] NASA would receive a public endorsement from President Reagan after the safe landing of STS-4 on July 4, 1982. For NASA to reject a design that had

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194 Tobias Greitemeyer, Stefan Schulz-Hardt, and Dieter Frey, "The Effects of Authentic and Contrived Dissent on Escalation of Commitment in Group Decision Making," *European Journal of Social Psychology* 39, no. 4 (June 2009): 641, doi: 10.1002/ejsp.578.

195 Michael G. Bowen, "The Escalation Phenomenon Reconsidered: Decision Dilemmas or Decision Errors?" *The Academy of Management Review* 12, no. 1 (1987): 63.

196 Vaughan, *The Challenger Launch Decision*, loc. 1492.

197 Ibid., loc. 824.

been used previously, coupled with compressed launch schedules, in addition to political alliances that linked the STS to the White House seemed irrational, which caused an escalation of commitment to support the current SRB design.

In light of the major themes discussed in this chapter, the U.S. fire service as a representational high-risk vocation inevitably includes several analogous issues related to normalized deviance. Primarily, the notion of production over safety could be perceived as a typical construct in the mind of the firefighter. Perhaps because the firefighter has historically been trained to engage threats as a normal course of action, without performing an *adequate and comprehensive* risk analysis to determine to what degree firefighters will negotiate their safety to save lives [Emphasis added]. The idea of a desire path comes into play at this point. A desire path is basically forging a non-traditional and deviant path that gets one from point A to point B in an alternative way, punctuated by shorter distance or less obstacle-laden than the normative path as designed; a shortcut. Within the fire service, following desire paths could pose increased danger, as they oftentimes require sacrifices of personal safety or allow the person to adopt "tunnel vision" to achieve goals, a true fulfillment of production over safety paradigms. Endorsing production over safety in the fire service places firefighters at increased risk of accepting decreased safety margins in exchange for increased production.

An additional idea examined in the chapter with relevance to the fire service that gives contextual understanding for normalizing deviance is Perrow's interaction/coupling chart (see Figure 5). Perrow placed various high-risk occupations on his chart by gauging each vocation's characteristics as linear or complex, as well as loosely or tightly coupled. Although the fire service is not listed in this chart, arguments can be made that the fire service is both complex and loosely coupled and can be placed in quadrant 4 of Perrow's chart. The fire service is decidedly more complex than linear, as multiple components are operating in concert to achieve multiple goals simultaneously, at various levels of leadership. Likewise, the fire service is also loosely coupled. The multiple fire apparatus that are interchangeable and replaceable in the event of loss or malfunction within the larger incident evidences loose coupling for the fire service. Concurrently, understanding that multiple fire apparatus, each composed of three to four firefighters responding to

common emergency incidents, underscores the diversified mindsets that arrive and rapidly implement a plan. The commonality between fire service members can eventually engender a desire to stand out amongst fellow firefighters by performing in a manner characterized by words like “brave” or “courageous.” Classical contrasts between “truck men” (those assigned to a fire truck who perform actions related to the burning structure) and “hose draggers” (those on a fire engine who go inside to fight the fire) materialize in an effort for supremacy by performing admirably under austere conditions. Distinctions and accolades for being “real firefighters” within fire districts emerge as badges of honor bestowed by fellow firefighters. Explanation of Perrow’s chart helps to clarify how the fire service is both complex and loosely coupled and how labeling such characteristics aids in understanding how such qualities can prompt normalized deviance.

Likewise, the supposition that structural secrecy can actually nurture budding facets of normalized deviance within the fire service is distressing. The fire service and its culture provide one of the most proliferative environments for structural secrecy in which abnormal behaviors can become embedded. Fire stations are not just places of work but is also a place where firefighters prepare and eat meals for others, sleep, and relax with other firefighters. As a result of this closeness in social interactions, strong social bonds are formed. Relationships born out of such familiarity, coupled with mitigating hazardous emergency incidents by a mutual reliance on each other for safety, help fashion normative prescriptive behaviors of right and wrong according to the closed group. These tight-knit groups can become uncoupled from truly normal and acceptable behaviors, susceptible to adopting abnormal behaviors as normal, when operating in isolation or under a fire company officer who disregards certain safety practices over extended periods of time. Interactions between other firefighters reveal the contrast between current understandings of how operations are conducted within their small group as opposed to how the majority performs similar tasks. The ability of small workgroups to develop normative values that run counter to larger organizational values and standards, in part due to the autonomous nature of fire stations, can help encourage normalized deviant attitudes to materialize.

To remain objective in analyzing either an occupation or specific organization, evaluative criteria are developed to remain neutral. Prior to conducting a review of particular incidents that may reveal a normalization of deviance; certain biases must be acknowledged and addressed. Reviewing past disasters and incidents from the present generate what Dekker calls a hindsight bias.[198] The term suggests that the investigator possesses an almost limitless amount of information about the disaster in both the pre- and post-event periods, which gives the examiner a decisive advantage about facts leading up to the event, a comprehensive understanding of the totality of the event, as well as an understanding of what key players overlooked and what they should have done.[199] Rankin et al. believe that an examiner having such perfect knowledge about a disaster should also be cognizant of the boundaries that should impact commentaries on disaster analysis.[200]

The evaluative analysis tool that is applied to this project incorporates five different groups, each known as a metric category. The five metric categories are production over safety, safety, work group dynamics, satisficing, and escalation of commitment. Categories contain statements related to key qualities of organizational normalization of deviance in high-risk occupations. The analysis tool approaches each metric from a qualitative viewpoint, with responses consisting of either yes or no. It is noteworthy that two metric categories, production over safety and safety, although they share a common safety theme, the production over safety metric seeks to reveal how organizational production stress impacts safety paradigms. Scoring for the tool consists of a series of yes and no answers that require further analysis to verify current or emergent patterns of normalized deviance. The tool is designed to give the examiner general answers to overarching themes related to organizational deviance.

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198 Sidney W. A. Dekker, "Reconstructing Human Contributions to Accidents: The New View on Error and Performance," *Journal of Safety Research* 33, no. 3 (2002): 373.

199 Dekker, "Reconstructing Human Contributions to Accidents: The New View on Error and Performance," 373.

200 Amy Rankin et al., "Resilience in Everyday Operations: A Framework for Analyzing Adaptations in High-risk Work," *Journal of Cognitive Engineering and Decision Making* 8, no. 1 (2014): 79.

Moreover, the evaluative analysis tool can be applied to various organizational levels. Previous analysis has shown a general disconnect between executive and workgroup levels, and perhaps, a utilitarian instrument can assist in breaking down organizational barriers if both executive and workgroup members incorporated the tool. Viewpoints from both perspectives may provide compelling evidence of normalized deviance, as both an insider's view (workgroup member) and an outsider (executive) outlook can be compared for what is actual versus what is perceived within an organization. The evaluative analysis tool, shown in Table 1, is provided as follows as a reference.

Table 1. Evaluative Criteria for Normalized Deviance

Evaluative Criteria	Metric Category
There is a stated or implied tradeoff of safety measures in order to meet production goals.	Production over Safety
A "checks and balances" framework has been established in high-risk occupations that verify that safety procedures are followed.	Production over Safety
Work group safety compliance is an active process, with complacent safety attitudes properly addressed.	Safety
Notification processes exist to alert management of unsafe or dangerous operations.	Safety
Work group "norms" have been established that are contrary to organizational production goals.	Work Group Dynamics
Work group "norms" are consistent and measurable to industry standards.	Work Group Dynamics
Organizational "short cuts" are resultant of unauthorized, alternative process altogether, with shortcuts being either overtly or covertly practiced.	Work Group Dynamics
Work groups strive to find an optimal solution to problems, as opposed to an adequate solution to operational issues.	Satisficing
Criteria exist in which a course of action can be abandoned, given that rational and supportive evidence exist.	Escalation of Commitment

In conclusion, this chapter has sought to develop the notion that high-risk occupational workgroups advance towards a state of normalized deviance, perchance out of exigent circumstances or a perceived need to barter away safety for the sake of production. One way of compromising operational standards within high-risk workgroups is through adopting a satisficing mindset; however, the exercising of such beliefs does not necessarily establish participants as amoral calculators, as the intent does not appear malicious, but rather simply a means to an end. Also, strides have been taken to evaluate how an escalation of commitment of resources to a failed design (as seen in the NASA's SRB O-Ring flaws) places high-risk organizations on a course to failure by maintaining a particular course of action. Finally, evaluative criteria were developed to review objectively certain domains of high-risk occupations that are consistent with characteristics of organizations associated with a normalization of deviance. Implementing the analysis tool towards a vocation known for performing at the edge of safety can authenticate whether such organizations in fact are susceptible to normalizing deviant behavior or are currently functioning in this social frame of mind.

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V. THE NORMALIZATION OF DEVIANCE THROUGHOUT THE FIRE SERVICE

The fire service is not immune to the latent capacity to normalize deviance. It is abundant in traditions that permeate through fire departments, from pride in personnel moustaches deemed "salty" to the folklore to pushing new fire apparatus into an existing station. While the previous actions are harmless and even encourage camaraderie, some traditions, such as driving to a fire at reckless speeds or tolerating the circumvention of procedures designed to protect firefighters, might actually be encouraged, which permits a degenerate safety culture. Implied sanctioning of such actions, and their foundational behaviors rooted in social traditions, can bring about organizational normalization of deviance in one of the most revered professions.

Firefighters in the United States acknowledge the hazards that accompany their chosen profession, from operating in untenable environments without protective gear to entering into violent situations with irate citizens, all with the same state of mind, to bring order to a chaotic environment by evaluating the situation and intervening to mitigate an incident to an optimal state. Incidents, such as structure fires, require large numbers of trained personnel to perform in a coordinated fashion within a compressed timeframe to save lives and property, as well as protect the environment. Traditionally, firefighters are assigned to a fire apparatus (engine, truck, ambulance, battalion chief, etc.) and are collectively called a "company." Typically, the individuals who comprise a company are close-knit, as members live at the fire station the time that they are on duty. Such closeness in all situations, whether in cooking meals together to literally rescuing a fellow member from a dangerous situation, allows enduring relationships. Hence, fire stations become a second home to many who share triumphs and tragedies alike with other company members.

Within a fire service organization, certain companies project an image of courageous grit with borderline reckless behaviors all the while justifying actions based on outcomes. Within the same organization, companies also exist that adopt a more guarded approach to accomplishing tasks, through less ostentatious actions. As a result,

an ethos emerges, as well as group identities within a company's battalion. Both companies, despite being in the same fire district, represent distinct cultural differences at the group and organizational levels. The greatest contrast between these two kinds of fire companies is in their perspective of what promotes a safety culture.

Despite valiant efforts to promote safety within the fire service, several conflicting statistics and safety-related issues suggest that normalized deviance might exist in the U.S. fire service. Ronald Siarnicki, the Executive Director of the National Fallen Firefighters Foundation (NFFF), stated in a keynote address that around 100 firefighters per year die in the line of duty.[201] This claim is supported by the U.S. Fire Administration (USFA) Line of Duty Death (LODD) statistics shown in Figure 7.

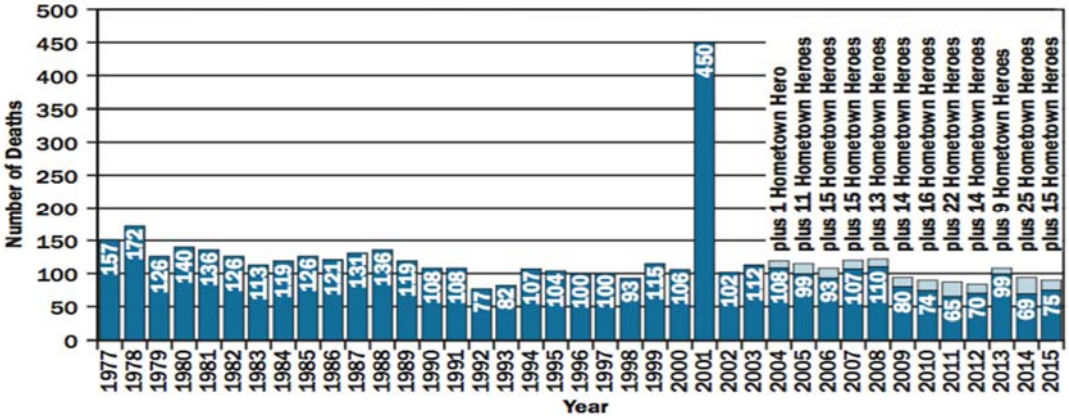

Figure 7. Firefighter Line of Duty Deaths, 1977–2015[202]

An unusually elevated number of LODD appear in the 2001 totals, which can be attributed to the terrorist attacks in New York City on September 11, 2001.

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[201] Ronald J. Siarnicki, "Reducing Firefighter Line of Duty Deaths and Injuries: The Role of Leadership and Management," Keynote Address of International Fire Service Journal of Leadership and Management Research Symposium on July 8, 2006, Tulsa, Oklahoma, 3, http://www.ifsjlm.org/sites/default/files/past-edition-pdfs/IFSJLM_Vol2_Num1.pdf#page=9.

[202] Source: U.S. Fire Administration, *Firefighter Fatalities in the United States in 2015* (Emmitsburg, MD: U.S. Fire Administration, 2016), 5, https://www.usfa.fema.gov/downloads/pdf/publications/ff_fatalities_2015.pdf. See Figure 1. On-Duty Firefighter Fatalities (1977–2015).

Fire service organizations in the United States profess that the trained firefighter of 2017 operates at a higher level of safety than in years past. Assertions esteem the greatness of improved firefighter protective gear (sometimes called turnout or bunker gear) that is lighter and allows for greater thermal protection.[203] Donning and wearing self-contained breathing apparatus (SCBA) allows today's firefighter to operate in a toxic environment.[204] Thermal-imaging cameras (TICs) allow firefighters to literally discover a fire's origin, as well as heat signatures of potential victims through thick, obscuring smoke.[205] Finally, the individual firefighter receives training on the social framework of modern fire ground operations; the ICS, where the solitary firefighter learns the role of being a member within a team of teams, understanding its modular fashion, and its use of ordinary language.[206] In closing, advancements to equip the single firefighter better through protective gear, as well as new and improved tools, should correlate to decreased firefighter injuries. Yet, a 2015 (NFPA report claims that 29,130 incidents of firefighter injuries occurred at the scene of structure fires, which represents 42.8% of the overall 68,085 total injuries.[207]

The idea of "the cost of doing business" demands the lives of approximately 100 firefighters annually is simply unacceptable. Bruce Tenniswood places firefighting progress into perspective when he writes, "We train on safe procedures, we document that training, and then we make safety a part of our daily routine. And then we kill or injure ourselves at the same rate that we have for the past 30 years!"[208] It is therefore

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[203] Paul Hasenmeier, "The History of Firefighter Personal Protective Equipment," *Fire Engineering*, June 16, 2008, http://www.fireengineering.com/articles/2008/06/the-history-of-firefighter-personal-protective-equipment.html.

[204] Ibid.

[205] "5 Most Groundbreaking Firefighter Technologies," FireRescue1, accessed September 11, 2017, https://www.firerescue1.com/fire-products/Personal-protective-equipment-ppe/articles/2034823-5-most-groundbreaking-firefighter-technologies/.

[206] "Emergency Management and the Incident Command System," Public Health Emergency, accessed September 11, 2017, https://www.phe.gov/Preparedness/planning/mscc/handbook/chapter1/Pages/emergencymanagement.aspx.

[207] Hylton J. G. Haynes and Joseph L. Molis, *U.S. Firefighter Injuries—2015*, Research No. FF110 (Quincy, MA: National Fire Protection Association, 2016), 3.

[208] Bruce Tenniswood, "Have We Made Progress?" *Fire Engineering*, 2, December 7, 2009, http://www.fireengineering.com/articles/2009/12/have-we-made-progress.html.

arguable that despite advanced and improved protective gear, fire science discoveries, and technological advancements, an imperceptible driving force still remains within the fire service that can be ascribed to continued injuries. In addition, Houska claims a cultural issue of virile mores are resistant to conversion to a safety-centric firefighting culture.[209] Consequently, defending the customs, traditions, and conduct of fire companies or members within fire service organizations attributable to firefighter injuries and LODDs can plausibly lead to normalizing deviance.

Applying the work of Moore-Merrell et al., six specific activities of organizational performance in the fire service are examined for conduciveness to fostering a normalization of deviance.[210] Ash and Smallman, touching on the Moore-Merrell et al. conclusions, calculated that 44% of all LODDs, in the years studied, were attributable to these six issues.[211] The execution of these actions places the person, company, and the representative organization at risk of an accident, and can denote a "cutting of corners" mindset that can bring about a normalized deviant frame of mind. A primary activity contemplated is one that is critical to all members of the fire service, and in particular, the incident commander, that of decision-making. First responders are routinely called upon to render assistance to the public in times of need. With this responsibility comes decision-making authority in how to mitigate an incident, but what defines "decision-making"? Klein, Calderwood, and Clinton-Cirocco answer this question when they wrote, "We define decision making as the selection of one option from a set of two or more options."[212] Incident commanders in the fire service engage decision-making abilities prior to arriving at the scene of an incident and depend on a

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[209] Brian Houska, "Speaking of Safety: How Safe Is Firefighting?" *Fire Engineering*, 2, May 14, 2010, http://www.fireengineering.com/articles/2010/05/houska-speaking-of-safety.html.

[210] Lori Moore-Merrell et al., *Contributing Factors to Firefighter Line-of-Duty Injury in Metropolitan Fire Departments in the United States* (Washington, DC: International Association of Fire Fighters, 2008), 17, https://www.researchgate.net/profile/Chloe_Slocum/publication/237280119_CONTRIBUTING_FACTORS_TO_FIREFIGHTER_LINE-OF-DUTY_INJURY_IN_METROPOLITAN_FIRE_DEPARTMENTS_IN_THE_UNITED_STATES/links/554a10590cf29ff75c75ee07.pdf. See Table 4, Cluster 4.

[211] John Ash and Clive Smallman, "A Case Study of Decision Making in Emergencies," *Risk Management* 12, no. 3 (2010): 186, http://www.jstor.org.libproxy.nps.edu/stable/40660682.

[212] Gary Klein, Roberta Calderwood, and Anne Clinton-Cirocco, "Rapid Decision Making on the Fire Ground: The Original Study Plus a Postscript," *Journal of Cognitive Engineering and Decision Making* 4, no. 3 (September 2010): 186, doi: 10.1518/155534310X12844000801203.

host of factors, such as the potential rescue of occupants versus time of day. As an example, a fire in an elementary school during the summer months where occupancy levels are expected to be at their lowest requires a different decision-making profile than a reported fire when school is in session.

The ability to make fire ground decisions is further constrained by pressures in under less than optimal conditions. Launder and Perry refer to research by Klein, Calderwood, and Clinton-Cirocco, which reveals that incident commanders routinely make 78% of decisions in under a minute.[213] Ideally, decision-makers would be presented with a range of viable options to mitigate an incident successfully, along with an understanding of ramifications, both positive and negative, as well as both short- and long-term effects like disruption timeframes that equate to specific monetary loss. Unfortunately, the fire ground incident commander has literally seconds to make decisions about incidents that experience rapid complexity. Incident COMMAND decisions can have far-reaching ramifications, good or bad, which affect citizens, firefighters, and themselves, as well as damage to property.

Compressed timeframes, in conjunction with other relevant factors, can have an appreciable effect on formal decision-making abilities and constructs, as Howell's experiments suggest.[214] McLennan and Omodei, referring to Orasanu and Connolly's 1993 work, entitled *The Role of Prepriming in Recognition-Primed Decisionmaking*, list seven influences on the ability to make real-world judgments:

- poorly structured problems
- uncertain, changing environments
- shifting, ill-defined, or competing goals

[213] David Launder and Chad Perry, "A Study Identifying Factors Influencing Decision Making in Dynamic Emergencies Like Urban Fire and Rescue Settings," *International Journal of Emergency Services* 3, no. 2 (October 7, 2014): 144, doi: 10.1108/IJES-06-2013-0016; Klein, Calderwood, and Clinton-Cirocco, "Rapid Decision Making on the Fire Ground," 192.

[214] William C. Howell, *Task Influences in the Analytic-Intuitive Approach to Decision Making* (Houston, TX: Rice University, Department of Psychology, 1984), 21, http://www.dtic.mil/docs/citations/ADA149870.

- action/feedback loops which link changes in the situation to prior decisions
- time-pressure
- high stakes
- decisions being made within a context of organizational rules, roles, and norms[215]

Hammond et al. suggested that decision-making models fell into two categories, analytical and intuitive determinations.[216] McLennan et al. would draw similar conclusions on this dualistic model.[217] Analytical determinations entails a more formalized and calculated course of action, based on a more thorough processing of information, with an emphasis on maintaining a more rational approach to decision-making.[218] The same authors utilize Khaneman and Tversky's description of intuitive decision-making as more amorphous and borderline unconventional, in that it is devoid of analytical approaches.[219]

Within the intuitive framework of fire ground decision-making, the concept of the recognition-primed decision model (RPDM) emerges. RPDM, as described by Klein, Calderwood, and Clinton-Cirocco highlights the value of identification over the more laborious analytical methodology of decision-making when compressed time frames do not permit such drawn out thought processes.[220] A fascinating revelation by Klein and

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215 Jim McLennan and Mary M. Omodei, "The Role of Prepriming in Recognition-Primed Decisionmaking," *Perceptual and Motor Skills* 82, no. 3_suppl (1996): 1060.

216 Kenneth R. Hammond et al., *The Relative Efficacy of Intuitive and Analytical Cognition: A Second Direct Comparison*, Report Number 252 (New York: Radio Corp of America New York Advanced Communications Lab, 1984), http://www.dtic.mil/docs/citations/ADA142866.

217 Jim McLennan et al., "Good, Poor, and Disastrous Small-Unit Command: Lessons from the Fireground," in *39 The International Applied Military Psychology Symposium, Brussels* (Brussels: 39 The International Applied Military Psychology Symposium, 2003), 3, https://www.effectivecommand.org/Content/docs/ReferenceArticles/Good,%20Poor,%20and%20Disastrous%20Small-Unit%20Command%20%20Lessons%20from%20the%20Fireground%20(2003).pdf.

218 Hammond et al., *The Relative Efficacy of Intuitive and Analytical Cognition*, 3.

219 Ibid., 6.

220 Klein, Calderwood, and Clinton-Cirocco, "Rapid Decision Making on the Fire Ground," 186.

Calderwood is that veteran fire ground incident commanders counted on their capacity to identify circumstances and conditions that would give rise to a strategy and adjust as necessary.[221] To clarify the thought more, Klein, Calderwood, and Clinton-Cirocco writes, "The majority of the decisions were characterized not by option consideration but by the FGCs [Fire Ground Commanders] recognizing the situation as an example of something they had encountered many times before. In other words, there was evidence for a matching process rather than a calculational [sic] process."[222] In summary, Klein and his associates argue that fire service incident commanders oftentimes make decisions from an RPDM perspective and draw on past experiences and similarities in incidents to dictate a particular course of action.

Fire ground decision-making authority within an organization can have direct applicability to ushering in a normalization of deviance in the workplace by making decisions that contribute partly to a production over safety mindset. Incident commanders fashioning tactics and strategies from the aforementioned RPDM perspective draw conclusions about previous incidents of comparable scope and circumstances. Yet, in the event that decisions and strategies are inappropriate, the likelihood exists that initial actions are deemed to be less than optimal or perhaps dangerous when based on flawed previous experience. Actions, such as requesting firefighters perform unsafely or breach SOPs to achieve objectives, could result from initially improper requests to begin with. Direct orders can be perceived as normal, as commands are coming directly from a superior officer. Additionally, a higher-ranking officer who arrives at the incident and assumes the incident commander role can change strategies without the consent of the previous incident commander. This conflict of strategies can lead to organizational work group confusion. It is feasible that workgroups may revert to satisficing to achieve future objectives, and thus reinforce a localized social norm, albeit one that is substandard at best.

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[221] Gary A. Klein and Roberta Calderwood, "Decision Models: Some Lessons from the Field," *IEEE Transactions on Systems, Man, and Cybernetics* 21, no. 5 (1991): 1020, http://ieeexplore.ieee.org/abstract/document/120054/.

[222] Klein, Calderwood, and Clinton-Cirocco, "Rapid Decision Making on the Fire Ground," 193.

A second fire service activity that can take on precepts of normalized deviance is a lack of communication. Within the ICS, communications are sent from the INCIDENT COMMANDER either directly to the recipient in small incidents, or through an operations section, then to branches, divisions, and groups, as depicted in Figure 8. The ICS is hierarchical, with members reporting to a single person in their chain of command. In environments like those experienced in the fire service, orders from the incident commander must be clear and concise. A strong command presence can induce correct behavior, while simultaneously reducing workgroup drift by setting clear expectations of definitive roles.

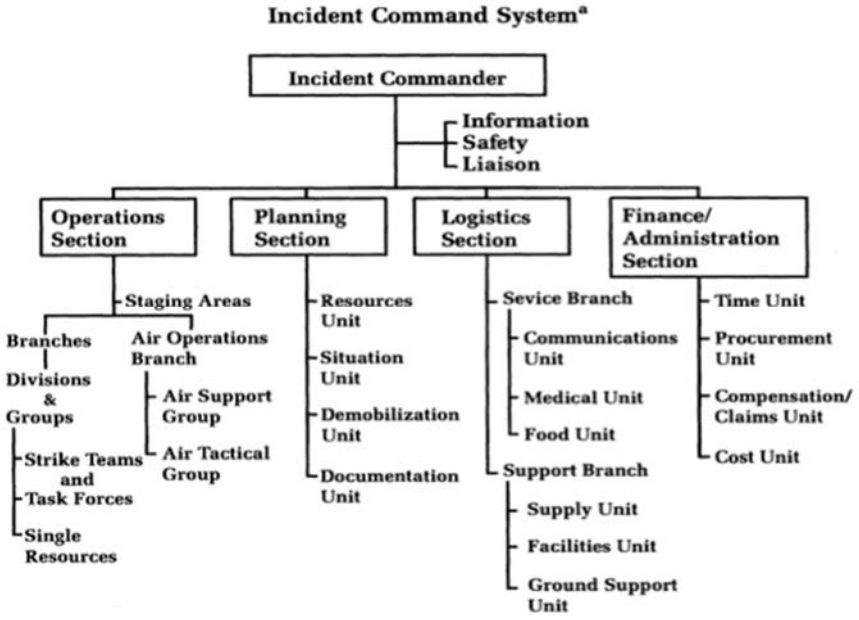

Figure 8. ICS Flowchart[223]

Intradepartmental communications are crucial to defend against normalized deviance. Roberts, Bea and Bartles speak to the high importance of organization-wide communications by reviewing accidents incurred by HROs.[224] Reinforcing organizational safety expectations through frequent communications instills in employees

[223] Source: Bigley and Roberts, "The Incident Command System," 1283.

[224] Roberts, Bea, and Bartles, "Must Accidents Happen?" 74.

firm limitations as to what is acceptable safety behavior. In the absence of established safety policies or procedures, firefighters might improvise safety measures in lieu of clear direction. Organizational safety voids are breeding grounds for organizational drift and deviant safety behaviors, as workgroups develop social norms as to what constitutes safe performance.

The next activity considered refers to violations of SOPs or organizational procedures. It is clear that violating fire department policies or SOPs could prove dangerous to the employee or workgroup. For this reason, the NFPA has created over 300 standards to assist firefighters in performing in a manner that promotes a best practices approach.[225] Why would employees however deem that performing unsafely is a rational course of action? Zohar and Luria explore the concept of melioration bias, where they proclaim, "Melioration bias concerns the tendency to assign greater weight to short-term results when choosing among action alternatives, while self-relevant negative-events bias concerns the tendency to under-estimate the likelihood of being adversely affected by rare negative events (i.e. 'it will never happen to me' syndrome)."[226] Pessemier alludes to the work of Zohar and Luria and adds to the debate by arguing that in the event that the hazardous action has a good result, as well as not winding up causing an accident, that such conduct is regarded as productive, and actually invigorates such a predisposition.[227] In light of understanding melioration bias, it appears that the allure is for firefighters to achieve goals by weighing dichotomous actions by taking the "short path" (and thereby disregarding SOPs and policies) that offers a quick result, whereas the "long path" (and the safer course of action) results in an anticlimactic conclusion.

It is important to remember that the social image of firefighters, amongst themselves, as well as with the public, is one defined and rooted in courage by setting aside personal safety for others, and risk-taking beyond what is reasonable. In this

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[225] "List of NFPA Codes and Standards," National Fire Protection Association, accessed September 17, 2017, http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards.

[226] Dov Zohar and Gil Luria, "The Use of Supervisory Practices as Leverage to Improve Safety Behavior: A Cross-Level Intervention Model," *Journal of Safety Research* 34, no. 5 (2003): 568.

[227] Pessemier, *Improving Safety Performance by Understanding Perceptions of Risk and Improving Safety Management Systems*, 2.

context, a clear tendency exists for firefighters as social groups to promote SOPs and policy violations. As a result, supervisors are tasked with enforcing SOPs and when they might be viewed as an annoyance, with compliance perceived as an impediment to completing important tasks. A classic example of melioration bias in the fire service includes not properly wearing all assigned PPE. The research of Kahn et al. revealed that firefighters who do not don all their PPE provide justification for doing so, as some claim the gear impedes true life-saving actions by hindering movements.[228] While PPE violations might be thought of as justifiable, coupled with both a successful outcome in addition to no firefighter injuries, such apathy towards wearing required PPE can lead to deviant and systematized behavior.

According to the International Association of Fire Fighters (IAFF), injuries that occur while at a structure fire, as evidenced by Figure 9, underscore the significance of wearing the correct PPE ensemble to minimize or avoid inhalation and toxic smoke exposures or thermal burns.

[228] Steven A. Kahn et al., "Firefighter Safety: Rampant Unsafe Practices as Documented in Mainstream Media," *Journal of Burn Care & Research* 35, no. 5 (August 2014): 426–7, doi: 10.1097/BCR.0000000000000016.

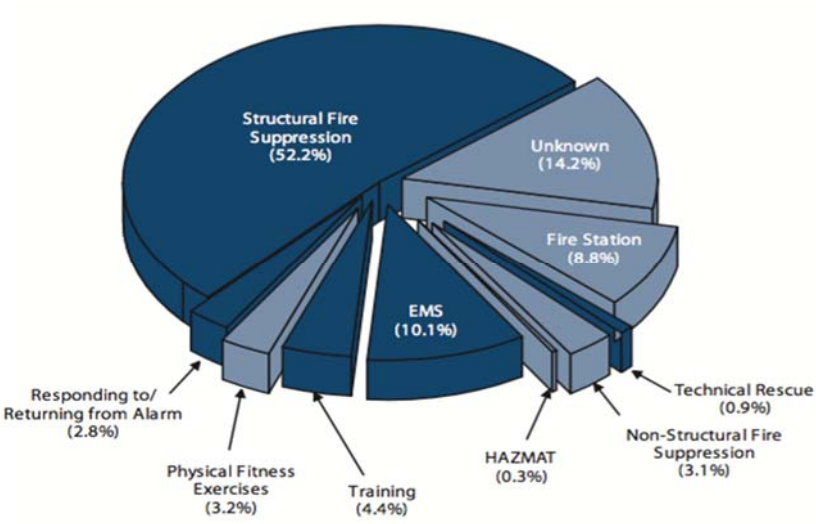

Figure 9. Firefighter Activity at Time of on Duty Injuries[229]

A 2004 RAND Corporation report entitled *Emergency Responder Injuries and Fatalities* summarizes data from a 1998 National Fire Incident Reporting System (NFIRS) in Figure 10. Color-coded boxes reveal a graded scale of occurrence, from highest to lowest. In conclusion, embracing melioration biases, in conjunction with a general disdain of fire department SOPs and procedures, can lead workgroups and eventually organizations unknowingly to assume an operational mode of normalized deviance, as outcomes are producing results minus any negative consequences.

[229] Source: International Association of Firefighters, *2000 Death and Injury Survey* (Washington DC: International Association of Firefighters, 2000), 6, http://www.iaff.org/hs/PDF/2000%20D&I.pdf. Listed as Distribution of Line of Duty Injuries by Activity.

Firefighter Injuries (Fireground activity)	Cause of Injury: Fell, jumped	Caught, trapped	Struck by or contact with object	Exposure to fire products	Exposure to chemicals	Physical stress, over-exertion
Fire attack, search and rescue	Trauma Cuts/bruises	Burns Trauma	Cuts/bruises Trauma Burns	Burns Respiratory Heat stress	Respiratory	Trauma Heat stress Cardiac Respiratory
Ventilation and forcible entry	Trauma		Cuts/bruises Trauma	Respiratory Heat stress		Trauma Heat stress
Salvage and overhaul	Trauma		Cuts/bruises Trauma			Trauma Heat stress Cardiac
Incident scene support activities	Trauma Cuts/bruises		Cuts/bruises			Trauma Heat stress Cardiac
Riding on or driving apparatus	Trauma		Trauma Cuts/bruises Burns			Trauma

Highest incidence | High incidence | Moderate incidence | Low incidence

SOURCE: Based on data from the NFIRS 1998 Firefighter Casualty Module.

NOTES: Black cells indicate at least 150 reported injuries (10 percent of the total); dark-gray cells 36 to 66 injuries (2 to 4 percent); and light-gray cells 15 to 28 injuries (1 to 2 percent). Injuries with cause or activity unreported or reported as "other" are not included. Because of sample size, differences between some dark-gray and light-gray and some light-gray and white cells may not be statistically significant. Incident scene support activities include water supply operations and picking up and moving tools.

Figure 10. Firefighter Activity and Injury Cause Matrix[230]

Next, a normalization of deviance in the fire service can be promoted through infractions of protocols. Protocol is defined by the Oxford Living Dictionaries as "The accepted or established code of procedure or behaviour [sic] in any group, organization, or situation."[231] Fire service organizations routinely establish protocols when strict adherence to a task is desired. Moore-Merrell et al. refocus the meaning of protocols by announcing that they are an essential element of tactical executions.[232] Regrettably, SOP and protocol are used interchangeably; however, distinctions do exist.

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230 Source: Ari N. Houser et al., *Emergency Responder Injuries and Fatalities: An Analysis of Surveillance Data*, TR-100-NIOSH (Santa Monica, CA: RAND, 2004), 45. See Figure 4.8. Injury Incidence Matrix for Moderate and Severe Firefighter Fireground Injuries by Cause and Activity.

231 *Oxford Dictionaries|English*, s.v. "protocol," accessed September 17, 2017, https://en.oxforddictionaries.com/definition/protocol.

232 Moore-Merrell et al., *Contributing Factors to Firefighter Line-of-Duty Injury in Metropolitan Fire Departments in the United States*, 13.

An SOP provides specific instruction about how to complete a task or utilize a specific piece of job-related equipment, as well as dictating when *not* to perform an action. Other included aspects might be generalized rules of use, distinct terminology, as well as any permitted discretion or latitude in executing the procedure under certain circumstances. Protocols, on the other hand, are more rigorous and inflexible. Unlike the SOP, which can allow for some adaptability to circumstances, the protocol contains uncompromising sets of rules designed to take the operator from the first to last step. In the first responder community, protocols are typically prevalent within the emergency medical services (EMS) domain, where treatment guidelines related to patient care tend to be stringent. Organizational deviance in the fire service through violating SOPs, while harmful, may appear innocuous when compared to organizational deviance to protocols. Protocols carry the connotation of being intransigent; under no circumstances are they to be violated. SOPs, given the conditions are ideal, allow for a manipulation of rules that protocols simply prohibit. Therefore, it is in the breach of protocol by actions that have been normalized that seems more repulsive and unforgiving.

An additional factor is the potential for human error, one in which Moore-Merrell et al. make clear is the gaffe made by a person, not arising from defective tools or unsatisfactory processes.[233] For many years, the idea of accident causation was based on human error, as well as imagined levels of uncertainty that humans factored into safety margins, according to Dekker's review of James Reason's theories.[234] Modern beliefs about accident causation, and particularly how human error factors into the equation, are radically different, as human error is seen more as a manifestation of organizational problems, and *not* as a cause.[235] [Emphasis added] Barton and Sutcliffe concur with Dekker when they wrote that human error occurs at the operational end of an accident chain.[236] So, how does human error factor into organizational normalization of deviance?

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[233] Moore-Merrell et al., *Contributing Factors to Firefighter Line-of-Duty Injury in Metropolitan Fire Departments in the United States*, 14. See Human Error by Firefighter or Officer (HE).

[234] Dekker, "Reconstructing Human Contributions to Accidents," 372, Introduction.

[235] Ibid.

[236] Barton and Sutcliffe, "Overcoming Dysfunctional Momentum," 1328.

To answer this question in regards to the fire service, Moore-Merrell et al. sought to find determinants through examining numerous cases of firefighter injuries, with one of the leading causes listed as "human error."[237] While injury patterns characterized by human error alone may not suggest normalized deviance at an organizational level, such lapses in judgment may indicate that those same firefighters committing errors may have developed a melioration bias that can lead to work groups drifting into failure, as well as influencing other work groups at incidents to do the same. Sheridan, referring to his own earlier work on human error exploration, concedes, "Mental workload, emotional stress, or physical incapacitation of one kind or another surely contributes to error."[238] Yet, Sheridan concludes wrongdoing that is contributable to a human at the operational level is not the solitary reason for errors; rather, he ascribes flawed processes, methodologies, and leadership at supervisory levels are just as culpable.[239]

Moreover, strong, modern counterarguments exist to those that would lay blame at the feet of human error. Concerning the fire service, when reflecting on events that happened, investigators have the luxury of the full knowledge of events that transpired, something that the perpetrators committing the "human error" did not know at the time, as their knowledge was finite, what Pruchnicki calls a "local rationality."[240] Possessing the firefighters' facts (as they knew them in the moment of decision), in conjunction with a multitude of other factors, known or unknown to the decision-maker, plays upon and influences the firefighters' decision capabilities in an already complex environment, which is labeled as "human error." Elizabeth West makes the argument that complex organizations possess the aptitude to achieve objectives that are outside the reach of a

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[237] Moore-Merrell et al., *Contributing Factors to Firefighter Line-of-Duty Injury in Metropolitan Fire Departments in the United States*, 2. Human error was attributed to 10.65% of the total 3450 injury cases studied.

[238] Sheridan, "Risk, Human Error, and System Resilience," 420.

[239] Ibid.

[240] Shawn Pruchnicki, "Understanding Human Error," *Fire Rescue*, 5, January 31, 2017, http://www.firerescuemagazine.com/articles/print/volume-12/issue-1/firefighter-safety-and-health/understanding-human-error.html.

single person, in which case the errors of a solitary employee are not relatable to a lone actor.[241]

The final assertion, a lack of situational awareness, can support an organizational normalization of deviance in the fire service. Robert Dubé defines situational awareness (SA) as "being aware of everything that's happening and could happen during your arrival on scene, initial and ongoing size-up, operational period and overhaul and rehab period."[242] Maintaining a constant SA is exceedingly crucial to employees engaged in high-risk occupations, and as Kunadharaju, Smith, and DeJoy call attention to, ordinarily takes a "hazard avoidance" posture.[243] However, the firefighter, like other first responders, responds to what the same authors referred to as "hazard engagement."[244] Firefighters place themselves into an interventionist role and seek to initiate a sequence of events that theoretically has an immediate, positive impact on a deteriorating situation. Therefore, SA is a requisite trait for firefighters to draw upon continually, as well as something that requires constant training to maintain proficiency. Dubé reports that in 2006, firefighters documenting near-miss accounts claimed that losing SA was the top reason for potential accidents.[245]

Forfeiting SA for the firefighter can prove tragic for themselves, other firefighters, or perhaps civilians. Actions as simple as opening a door or breaking out windows without the SA of how those acts will impact others can dramatically increase the negative impact on other fire ground operations. A tragic but classic example of losing SA that impacted operations and lives was the Charleston, South Carolina Sofa Super Store fire that occurred on June 18, 2007. Nine firefighters died in the structure fire

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[241] Elizabeth West, "Organisational Sources of Safety and Danger: Sociological Contributions to the Study of Adverse Events," *Quality and Safety in Health Care* 9, no. 2 (2000): 120, http://qualitysafety.bmj.com/content/qhc/9/2/120.full.pdf.

[242] Robert Dubé, "Situational Awareness Ensures a Safe Operation," Fire Rescue, 1, January 31, 2008, http://www.firerescuemagazine.com/articles/print/volume-3/issue-2/firefighter-safety-and-health/situation
nal-awareness-ensures-a-safe-operation.html.

[243] Kunadharaju, Smith, and DeJoy, "Line-of-Duty Deaths among U.S. Firefighters," 1171.

[244] Ibid.

[245] Dubé, "Situational Awareness Ensures a Safe Operation," 1.

in a commercial building. In the aftermath, an exhaustive study conducted by the National Institute of Standards and Technology (NIST) would disclose the following in the findings section of a 2011 technical study:

- During the early stages of the fire (10 minutes to 15 minutes after fire department arrived), the heat release rate of the fire in the rear of the main showroom was slowed by the lack of air; that is, the fire was underventilated.

- Front windows were broken or vented by the fire department to improve visibility.

- Fire spread extremely rapidly from the rear to the front of the showroom as additional air flowed through the broken windows, feeding the fire in the rear of the showroom.[246]

While the firefighters ventilating the windows were supposedly taking steps to assist other firefighters (by creating a path for smoke release through broken windows), the action actually had the negative effect of adding air to an underventilated fire in the rear of the building. The NIST report's recommendations section, section 6.3, advocates the following:

> Develop guidelines as to how and when ventilation should be implemented during a fire; provide education to fire fighters on the science of fire behavior in vented and non-vented structures and how the addition of air can impact the burning characteristics of the fuel; and provide training to fire fighters on different types of ventilation (vertical, horizontal, or positive-pressure) and integrate into daily operations on the fire ground.[247]

The perpetual loss of SA or "tunnel vision" by firefighters can become increasingly problematic as no negative impacts are realized. Dismissing active

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[246] Nelson P. Bryner et al., *Technical Study of the Sofa Super Store Fire-South Carolina, June 18, 2007*, NIST-SP1118 Volume I (Gaithersburg, MD: National Institute of Standards and Technology, 2011), xix, http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1118v1.pdf. See under Findings in the showrooms section. Also see pages 6–10—6–11 under section 6.2.7 Emergency Response (vi) Ventilation.

[247] Ibid., 6–13. See Recommendation 6.

engagement of SA in seemingly insignificant actions, such as those of lesser degrees of imminent danger, may produce a dull and latent response to future, and perhaps more precarious situations that require an amplified SA. Porter, Bliss, and Sleet relates a strong SA to accident foresight by invoking Reason's SCM; occurrences are "holes" through which negative events penetrate weakened organizational defenses.[248] Porter and his colleagues also claim [the highest] "Level 3 SA is necessary for people to anticipate the holes aligning."[249] When a fire service organizational work group depreciates the value of SA by underestimating its value or application in the workplace, by normalizing a downplayed attitude, this group's inability to engage an adequate level of SA properly in a hazardous situation becomes potentially life threatening.

Additional concepts that deserve inquiry as to the normalization of deviance in the fire service are the ideas of goal seduction and situation aversion. Goal seduction, according to Maglio et al., is a driving force towards dangerous practices at the expense of operating safely.[250] Classical actions, such as driving excessively over the speed limit, as well as reckless driving in general to a fire, can be an example of goal seduction. The allure of the goal for firefighters consists of getting to the scene to save people from harm.[251] The same authors also declare that firefighters are routinely confronted with "strong situations," whereby decision-making actions are impacted by the tensions associated with fire ground decisions that influenced those judgments.[252] Bearman, Paletz, and Orasanu assert that strong situations can induce those making determinations by selecting either goal seduction or situation aversion.[253]

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248 Porter, Bliss, and Sleet, "Human Factors in Injury Control," 95.

249 Porter, Bliss, and Sleet, "Human Factors in Injury Control," 95.

250 Michael A. Maglio et al., "Situational Pressures that Influence Firefighters' Decision Making about Personal Protective Equipment: A Qualitative Analysis," *American Journal of Health Behavior* 40, no. 5 (September 1, 2016): 556, doi: 10.5993/AJHB.40.5.2.

251 Christopher Bearman and Peter A. Bremner, "A Day in the Life of a Volunteer Incident Commander: Errors, Pressures and Mitigating Strategies," *Applied Ergonomics* 44, no. 3 (May 2013): 489, doi: 10.1016/j.apergo.2012.10.011.

252 Ibid.

253 Chris Bearman, Susannah B. F. Paletz, and Judith Orasanu, "Situational Pressures on Aviation Decision Making: Goal Seduction and Situation Aversion," *Aviation, Space, and Environmental Medicine* 80, no. 6 (June 1, 2009): 556, doi: 10.3357/ASEM.2363.2009.

On the other hand, situation aversion, as described by Maglio et al., "is motivation *away* from safe behavior."[254] Those employing situation aversion shun safety due to its disapproval in social settings like the workplace, as embracing safety can be viewed as undesirable.[255] Such a motivating factor is relevant in the fire service, as situation aversion possibly can prevent a firefighter from acting in a safe manner out of trepidation and backlash from other members within workplace social groups.[256] Situation aversion can feasibly be amplified within an entire workgroup that decides to forego safety, PPE usage for example, so as not to appear weak in front of other groups, even though the situation and SOPs dictate its use. Whether a person or group using goal seduction or situation aversion leverages one over another is still debatable, as Bearman and Bremner point out, both may work in unison at times or separately.[257] The brief analyses of both goal seduction and situation aversion have bearing on organizational deviance in the fire service. Strong situations will certainly present themselves to firefighters called upon to make critical decisions, and any negative impingement upon thought processes through goal seduction or situation aversion constructs can erode safety-centric decision-making.

Any normalization of deviance within the modern U.S. fire service possibly can be initiated from within both organizational and safety cultures that can undermine fire departments. Pessemier and England recall the herculean efforts of the collective fire service to transform itself, from innovations in tools, tactics, fire apparatus, and PPE, to standards that seek to influence and alter firefighter behaviors through a deeper understanding and importance of physical fitness and emergency management techniques.[258] Maybe retired Phoenix Fire Chief Alan Brunacini was correct when he stated, "For 200 years, we've been providing a service at the expense of those providing a

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[254] Maglio et al., "Situational Pressures that Influence Firefighters' Decision Making about Personal Protective Equipment," 556.

[255] Ibid.

[256] Maglio et al., "Situational Pressures that Influence Firefighters' Decision Making about Personal Protective Equipment," 556.

[257] Bearman and Bremner, "A Day in the Life of a Volunteer Incident Commander," 494.

[258] Pessemier and England, "Safety Culture in the U.S. Fire Service," 11.

service."[259] In addition, perhaps one of the most salient quotes about the modern fire service comes from Houska when he wrote, "The biggest fact to face is that the U.S. fire service is a 19th century organization operating in the 21st century, so our priority should be strategic reorganization from the bedrock up."[260] To be relevant and successful in the modern era, the U.S. fire service must undertake its biggest challenge; that of changing the very culture of the fire service to impede the injuries and deaths of more firefighters.

Change is simply tough and stressful. People usually find change to be somewhat painful, so trying to change an entire organization is exponentially more challenging. Going a step further, attempting to effect change to cultural beliefs within an organization seems to be a monumental task, given that this level of transformation includes fundamental behavioral changes in how employees and managers view work itself, as well as adjusting to an overall new culture that drives decisions-making and how the organization is viewed, both internally and externally, according to Rashid, Sambasivan, and Rahman.[261] Executing change within an organization consists of three facets: "organizational, personal, and technological."[262]

What defines organizational culture? Marcoulides and Heck, recounting Schein's earlier definition, state, "patterns of shared values and beliefs over time which produce behavioral norms that are adopted in solving problems."[263] Organizations certainly develop unifying beliefs over time that extend deep into an organization to allow certain instinctive behaviors to settle in as natural, which aid in defining, shaping, and fortifying those cultures. Balthazard, Cooke, and Potter claim that an organization's function is directly associated with the organizational culture to the extent that if a culture of an organization refuses to embrace safety, that this refusal may be reflected in

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[259] David F. Peterson, "21st Century Firefighting," Firehouse, 1, September 2, 2009, http://www.firehouse.com/article/10473347/21st-century-firefighting.

[260] Houska, "Speaking of Safety," 2.

[261] Rashid, Sambasivan, and Rahman, "The Influence of Organizational Culture on Attitudes toward Organizational Change," 162.

[262] Ibid.

[263] George A. Marcoulides and Ronald H. Heck, "Organizational Culture and Performance: Proposing and Testing a Model," *Organization Science* 4, no. 2 (1993): 211.

counterproductive organizational results.[264] It should come as no surprise that business culture and business execution are linked, with culture stimulating performance. When applying this concept to the fire service organization, as explained by Pessemier and England, the culmination of a fire department's safety culture is one characterized by risky behavior as a normal way of doing business.[265]

The fire service in the United States, as a high-risk organization, places great significance on the safety of its members by advancing the idea of creating a safety culture. A declaration of what frames a safety culture, as well as its relationship is fundamental to understanding its implications within the fire service. The term "safety culture" first appeared in an International Nuclear Safety Advisory Group (INSAG) report, in reference to the 1986 Chernobyl nuclear accident.[266] What however defines a safety culture? In her PhD dissertation, Freaney applied a safety culture definition by Weigmann et al., which states:

> The enduring value and priority placed on and public safety by everyone in every group at every level of an organization. It refers to the extent to which individuals and groups will commit to personal responsibility for safety, act to preserve, enhance and communicate safety concerns, strive to actively earn, adapt and modify (both individual and organizational) behavior based on lessons learned from mistakes, and be rewarded in a manner consistent with these values.[267]

This stated definition seems comprehensive from the standpoint that safety culture is viewed as existing in a state that is constantly evolving. Cooper addresses this quality after reflecting on Pierce's work, when he claims safety culture is not confined to some organizational void; rather, it interacts with and is interacted upon by organizational

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[264] Pierre A. Balthazard, Robert A. Cooke, and Richard E. Potter, "Dysfunctional Culture, Dysfunctional Organization: Capturing the Behavioral Norms that Form Organizational Culture and Drive Performance," ed. Alan Goldman, *Journal of Managerial Psychology* 21, no. 8 (December 2006): 710, introduction, doi: 10.1108/02683940610713253.

[265] Pessemier and England, "Safety Culture in the U.S. Fire Service," 12.

[266] International Nuclear Safety Advisory Group and International Atomic Energy Agency, ed., *Basic Safety Principles for Nuclear Power Plants: 75-INSAG-3 Rev. 1*, Rev, INSAG 12 (Vienna: International Atomic Energy Agency, 1999), 3, preamble.

[267] Christine Freaney, "Safety Culture and Safety Behaviors among Firefighters" (PhD diss., University of Tennessee, 2011), 3, http://trace.tennessee.edu/utk_graddiss/969/.

frameworks and activities at all levels of an organization.[268] If this is the case, then organizational safety culture can be viewed as collaborating with organizational culture and established norms, which makes it unique to that organization with the ability to undergo conversions as the organization experiences change. Reason adds to this evolving concept of safety culture by expressing that progression is sluggish and dependent upon a number of components, such as the temperament of management, prior workplace actions, and reactions to work climates.[269] Similar to Reason's understanding of persuading factors but speaking in more overarching suppositions about safety culture, Pessemier writes, "Safety culture is influenced by psychological, behavioral, and situational variables."[270]

As Reason and Pessemier have concluded that safety culture has the ability to be shaped by several components within an organization, does a safety culture have reciprocal impacts on those interfacing with its visible characteristics, namely safety policies, procedures, and guidelines? Unequivocally, the ultimate aim of any organizational safety control mechanisms, expressed through organizational policies, etc., is the safety of its members. Hence, safety culture is designed to unseat risky behavior patterns that drive organizational culture by changing cognitive and operational dispositions in personnel, as Pessemier suggests are needed.[271] Understandably, organizational culture change is challenging for any organization, for as Wiegmann et al. point out, employees tend to merge their personal identity with organizational culture to the degree that such organizational norms carry over into how people analyze and frame their understanding with a correlative result of elevating organizational allegiance.[272]

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[268] M. D. Cooper, "Towards a Model of Safety Culture," *Safety Science* 36, no. 2 (2000): 113, http://www.behavioral-safety.com/articles/Towards_a_model_of_safety_culture.pdf; F. David Pierce, "Does Organizational Streamlining Hurt Safety and Health?" *Professional Safety* 43, no. 12 (December 1998): 36–40.

[269] James Reason, "Achieving a Safe Culture," *Work and Stress* 12, no. 3 (1998): 293, http://www.tandfonline.com/doi/abs/10.1080/02678379808256868.

[270] William Pessemier, "Developing a Safety Culture in the Fire Service," *International Fire Service Journal of Leadership and Management* 2, no. 1 (2008): 11, http://www.ifsjlm.org/sites/default/files/past-edition-pdfs/IFSJLM_Vol2_Num1.pdf#page=9.

[271] Ibid.

[272] Douglas A. Wiegmann et al., "Safety Culture: An Integrative Review," *The International Journal of Aviation Psychology* 14, no. 2 (2004): 121.

Presumably in no other vocation does an inextricable link exist between the individual and organizational culture as it does within the first responder community, especially with firefighters. This strong affiliation between organizational culture and firefighter identity is encapsulated arguably nowhere better than in cinema, where the 1991 movie *Backdraft* has one of its characters, Ronald Bartel, stating, "The funny thing about firemen is… Night and day they are always firemen."[273] Thus, Wiegmann's et al. concepts on links between identities immersed in organizational culture seem at home in the U.S. fire service.

What does the framework between organizational culture and identity look like? Hatch and Schultz proposed that relationships, reciprocal in flow, exist between organizational identities, organizational image (an external component), and organizational culture (an internal component).[274] Pessemier, in a later article, showed a simplified visual of what he termed an "organizational identity dynamics model," which is shown in Figure 11.

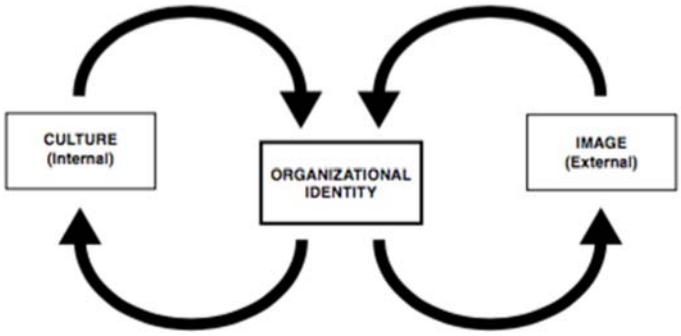

Figure 11. Organizational Identity Dynamics Model[275]

[273] "Backdraft," IMDb, accessed September 19, 2017, http://www.imdb.com/title/tt0101393/quotes.

[274] Mary Jo Hatch and Majken Schultz, "Relations between Organizational Culture, Identity and Image," *European Journal of Marketing* 31, no. 5/6 (1997): 361, http://www.emeraldinsight.com/doi/pdf/10.1108/eb060636.

[275] Source: Pessemier, "Developing a Safety Culture in the Fire Service," 11. See Figure 2 entitled Organizational Identity Dynamics Model.

The model in Figure 11 provides an illustrative view of how organizational identity is dependent on both internal, as well as external factors. Culture, as an internal organizational aspect, is the collective beliefs shared by employees tied into self-identity, as Pessemier argues.[276] External to the organization is organizational image, which are the views and opinions of the organization by key players.[277]

Both organizational and safety cultures serve as the locomotion for organizational success. In other words, what the organization believes, as well as how it behaves in relation to being safe, can act as determinants in the organization effectually moving forward. The fire service has certainly witnessed attempts to advance an organizational safety culture, although persistent injuries to firefighters suggest that a normalization of deviance might be contending with those efforts. In spite of numerous changes, the fire service organizational culture, as well as its safety culture, seems unyielding to authentic change. Organizational modification within the fire service will require a reassessment of how firefighters view themselves in relation to themselves, other members of the fire service, their department, and the public they serve. As long as melioration bias exists to reinforce the "it won't happen to me" mindset of the firefighter, in conjunction with an intertwining between organizational identity and organizational culture that is encouraged by an external image that promotes risky behavior, an undercurrent of normalized deviant behaviors will continue to exist within the fire service culture.

[276] Pessemier, "Developing a Safety Culture in the Fire Service," 11.

[277] Ibid.

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VI. ANALYSIS OF THE DALLAS FIRE RESCUE DEPARTMENT FOR POTENTIAL NORMALIZATION OF DEVIANCE

The U.S. fire service is composed of both career (paid) and volunteer fire departments, with a portion of departments consisting of a combination fire department of paid members working together with volunteers. According to a NFPA report, as of 2015, almost 30% of all U.S. fire departments are career-based.[278] The DFRD in Dallas, Texas is a career fire department that was formally created on July 4, 1872.[279] Currently, the DFRD consist of 58 fire stations that protect over 1.3 million citizens in Dallas, spread out over 340 square miles, as reported by a 2016 U.S. Census Bureau population estimate.[280] While the previous chapter discussed the potential for the fire service by and large to practice a normalization of deviance, this chapter focuses on the potential of organizational deviance solely within the DFRD. A review of internal DFRD documents, and additional external, non-departmental publications, is conducted and the results analyzed to determine if such literature is ancillary to organizational deviance.

The DFRD, similar to any other fire department, executes various emergency functions based on multiple internal documents known as SOPs and MOPs. The DFRD operates under four SOPs and seven MOPs. Two of these SOPs relate to emergency response, while the other two SOPs pertain to special operations and aircraft rescue and fire fighting (ARFF). The seven MOPs cover both administrative operations and some vital emergency procedures that support issues related to emergency response. SOPs and MOPs attempt to provide a framework in which employees can effectively operate and clarify their roles and responsibilities in various emergency situations.

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[278] Hylton J. G. Haynes and Gary P. Stein, *U.S. Fire Department Profile—2015* (Quincy, MA: National Fire Protection Association, 2017), V. See section entitled "The U.S. Fire Department Profile through 2015 Fact Sheet."

[279] "Dallas Fire-Rescue Department," City of Dallas, accessed September 24, 2017, http://www.dallasfirerescue.com/leadership_history.html. See A History of the Dallas Fire-Rescue Department.

[280] "Quick Facts: Dallas City, Texas," United States Census Bureau, accessed September 24, 2017, https://www.census.gov/quickfacts/fact/table/dallascitytexas#viewtop. See under the People and Geography sections.

The DFRD AAR is an additional internal record designed to provide a comprehensive report. The AAR is a formal, written account that provides a more thorough and detailed assessment of all facets of an incident to which the DFRD responded. According to the DFRD SOP Emergency Response Bureau (ERB), Section 131.02, completed AARs are forwarded to the assistant chief of the ERB for final review and subsequent posting to the DFRD's internal document system (IDS) for department-wide analysis.[281] The following section, Section 131.03 of the same DFRD ERB SOP, clarifies benchmarks by which AARs are mandatory, including:

- Incidents that are three alarms or greater or present extraordinary circumstances.
- Incidents that require unusual tactics, e.g., high angle rescue, helicopter rescue, etc.
- Incidents involving significant injuries or death of firefighters.
- Mass casualty incidents
- Any other incident at the discretion of the incident commander or higher-ranking officer in the department.[282]

A total of 43 DFRD AARs, spanning the years 2011 through August 2017, were examined and such criteria as initial arrival conditions, primary actions taken, injuries, and areas of improvement were reviewed to name a few. The objective was to classify DFRD AARs by expressed areas of improvement by those tasked with finishing the report. Concerns were classified into 10 categories, and are depicted by a prepared radar graph in Figure 12. A key objective was to identify latent propensities within DFRD AARs that suggest organizational drift, and potentially normalization of deviance by

[281] Dallas Fire Rescue Department, *Standard Operating Procedures 100.00 Emergency Response Bureau* (Dallas: Dallas Fire Rescue Department, 2016). See Section 131.02, Responsibility. Revised November 7, 2016.

[282] Ibid. See Section 131.03, Scope.

repeatable offenses that are confirmed by the AARs. All 10 domains of the radar graph have a common denominator of safety.

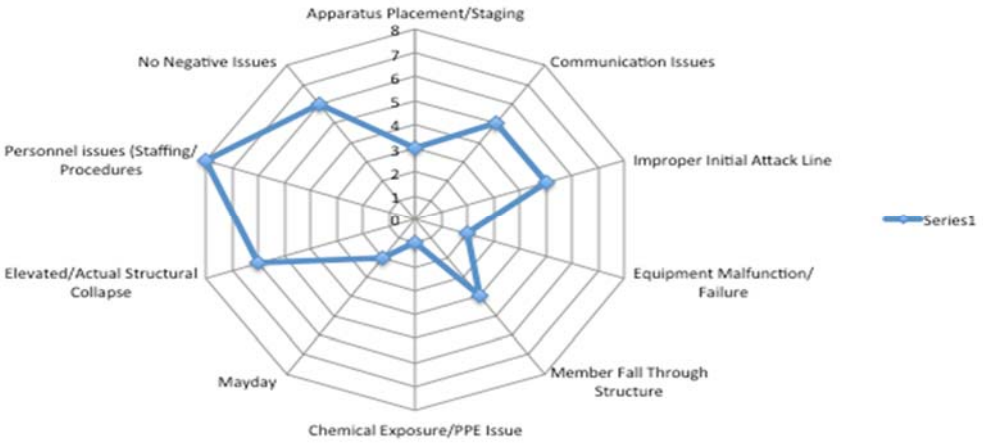

Figure 12. DFRD AAR Areas of Improvement Summary, 2011–2017[283]

The most prevalent topic revolved around personnel issues, and is noted in eight of the 43 AARs (18.6%). Personnel issues comprise a variety of subtopics, from multiple fire apparatus in the same area of the city "riding short" (a DFRD colloquialism where less than a full complement of four firefighters, for up to four hours, responds to incidents with only three members), to a loss of situational awareness that resulted in a firefighter injury, as well as damage to DFRD equipment. Unfortunately, two of the AARs examined are in relation to the LODDs of Lieutenant Todd Krodle and Fire Rescue Officer William S. Tanksley.

Despite only one occurrence (2.33%), the "Chemical Exposure/Personal Protective Equipment (PPE) Issue" event noted in Figure 12 is quite significant for a number of reasons. First, scenarios involving hazardous materials that have breached their containment vessel are rather infrequent and oftentimes make remediation efforts at such incidents unsafe and are a complicating element for the incident commander. Veritably, a response operation at such a scene increases the risk to firefighters, as the

[283] Adapted from Dallas Fire Rescue Department, *DFRD AAR Areas of Improvement Summary, 2011–2017* (Dallas: Dallas Fire Rescue Department, 2017).

Federal Emergency Management Agency (FEMA) concludes.[284] Occurrences connected with hazardous materials can be traditionally classified as low probability/high risk events, connoting that these events are uncommon, yet when they do occur, responders, civilians, and the environment are subjected to an elevated risk.

Next, the chemical that the four DFRD firefighters were exposed to in the aftermath of a structure fire is granulated chlorine, a dangerous chemical capable of causing a buildup of fluid in the lungs, nausea and vomiting, as well as a burning sensation of mucous membranes, according to the Centers for Disease Control and Prevention (CDC).[285] What is noteworthy is that the AAR reports that a small room containing a known hazardous material, which had been previously identified and pointed out, (and had inadvertently spilled its granular chlorine contents) was entered by firefighters wearing improper PPE.[286] The same report states that one member wore structural firefighting gear with a SCBA, while the other three exposed firefighters only wore firefighting gear without respiratory protection.[287] Shortly thereafter, three members not wearing SCBA began experiencing symptoms consistent with chlorine exposure, which required transportation to a hospital for evaluation.[288]

Given that chlorine was present and visually identified, a quick review of the Department of Transportation's (DOT) emergency response guidebook (ERG), Guide 124, reveals the following recommended and appropriate guidelines: wear SCBA, use chemical protective clothing, and provides a warning that structural firefighting gear

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[284] U.S. Fire Administration, *Risk Management Practices in the Fire Service*, FA-166 (Emmitsburg, MD: U.S. Fire Administration, 1996), https://www.usfa.fema.gov/downloads/pdf/publications/fa-166.pdf.

[285] "Facts about Chlorine," Centers for Disease Control and Prevention, accessed September 28, 2017, https://emergency.cdc.gov/agent/chlorine/basics/facts.asp. See immediate signs and symptoms of chlorine exposure.

[286] Battalion Chief 07A, *After Action Report of Structure Fire at 11611 Dennis Rd. Dallas, Texas* (Dallas: Dallas Fire Rescue Department, 2016), 9. EMS, under section entitled: "Describe What Went Well and What Could Have Gone Better."

[287] Ibid.

[288] Ibid.

offers minimal safety.[289] The application and proper usage of the ERG is a required skill by the Texas Commission on Fire Protection (TCFP) for persons operating at both the hazardous materials awareness level, as well as the hazardous materials operations level.[290] According to the DFRD SOP 205.00, "All Department members who are certified firefighters and perform firefighting duties will be trained at the First Responder Operations Level during the rookie academy."[291] Likewise, to meet the requirement of the U.S. Department of Labor, OSHA CFR, specifically 1910.120(e)(3)(ii), the DFRD personnel must receive 24 hours of initial training.[292] This federal mandate is supported in the DFRD SOPs as well.[293] It is unknown whether the incident commander or other firefighting companies consulted the DOT ERG as a reference for incidents involving hazardous materials.

As this incident and the remaining AARs suggest, several DFRD workgroups have potentially adopted practices that promote a drift towards failure as discussed in previous chapters. The aforementioned example indicates that the DFRD workgroup compartmentalization of abnormal practices, such as entry into a conceivably hazardous or immediately dangerous to life and health (IDLH) environment without proper PPE can have disastrous consequences. It is arguable that the aforementioned instance was due in part to adhering to the concept of production over safety. Additionally, the idea of

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289 Pipeline and Hazardous Materials Safety Administration, *2016 Emergency Response Guidebook* (Washington, DC: United States Department of Transportation, 2016), 186, https://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Hazmat/ERG2016.pdf. Under Public Safety section, specifically protective clothing.

290 Texas Commission on Fire Protection, *Skills Manual, Chapter Six, Hazardous Materials*, NFPA 472, 2013 edition (Austin, TX: Texas Commission on Fire Protection, 2015), 6–10, 24–29, http://www.tcfp.texas.gov/manuals/curriculum_skills/hazardous_materials_skills.pdf. See Hazardous Materials Awareness Performance Standards, DOT Emergency Response Guidebook, Skill #1. See Hazardous Materials Operations Performance Standards. Analyze, Plan, Implement, and Evaluate Response Objectives, Skill #1.

291 Dallas Fire Rescue Department, *Dallas Fire Rescue Department Special Operations Standard Operating Procedures* (Dallas: Dallas Fire Rescue Department, 2016), 41. See Section 205.00, Certification Levels, A.2.a.

292 "Hazardous Waste Operations and Emergency Response—1910.120," Occupational Safety and Health Administration, accessed September 28, 2017, https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9765. See Initial training at 1910.120(e)(3)(ii).

293 Dallas Fire Rescue Department, *Dallas Fire Rescue Department Special Operations Standard Operating Procedures*, 41. See Section 205.00, A.2.

possible goal seduction related to completing the assigned task of the truck company and loss of situational awareness to hazards in the immediate area were not fully appreciated and factored into the risk analysis. Only six AARs reported no area of improvement or negative aspects related to the incident (13.9%). The audited DFRD AARs have presumptively given an honest and possibly unfiltered level of introspection within specific DFRD incidents, a cardinal aspect of AARs, according to one of the 16 life safety initiatives of the National Fallen Firefighters Foundation's *Everyone Goes Home* program.[294]

A second source of internal DFRD data evaluated for potential confirmation of normalized deviance is an Excel database consisting of a list of DFRD on-duty injuries spanning the years 2000 through August 2017. The database contains a total of 1,982 injury claims, which have been sorted into 15 injury types by percentages, represented in Figure 13.

[294] "After Action Review," Everyone Goes Home, accessed September 29, 2017, https://www.everyonegoeshome.com/16-initiatives/13-psychological-support/action-review/. See Life Safety Initiative number 13: Psychological Support, subsection After Action Review.

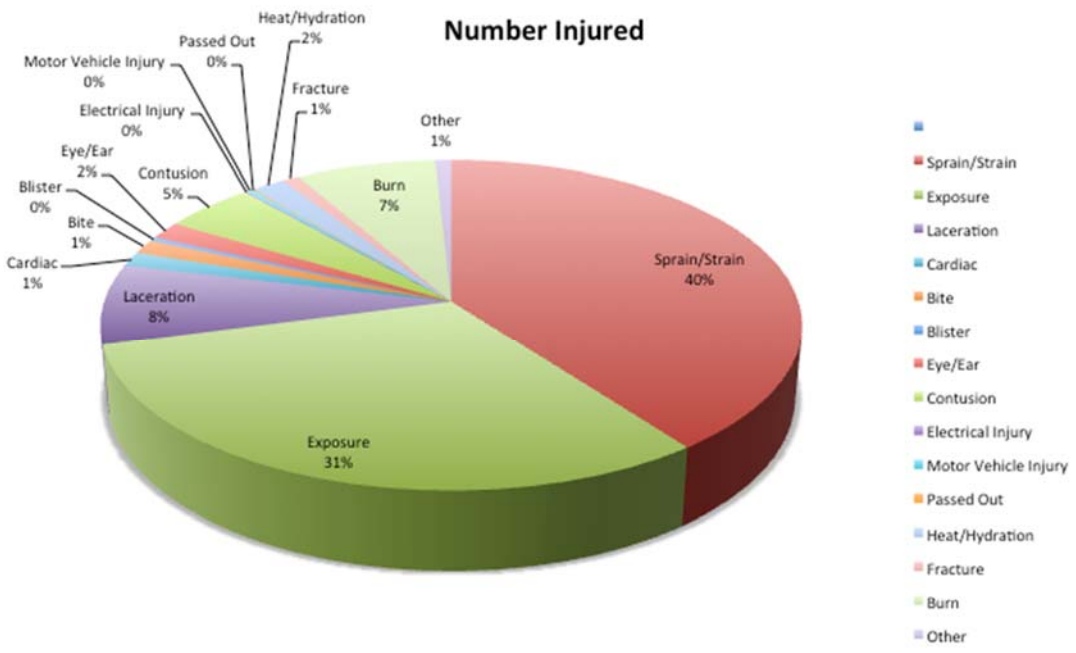

Figure 13. DFRD Injury Data from 2000 through August 2017[295]

An examination of the data presented in Figure 13 shows the majority (40%) of injuries are due to sprains and strains of either extremity or general muscle strains. However, an alarming statistic is located within the second highest category (31%), classified as "exposures." Usage of the term in the context of Figure 13, as well as for this discussion, is intended to be all-inclusive, from exposure to dangerous chemicals or productions of combustion in smoke from a structure fire, to a paramedic's exposure to an infectious disease.

Yet, it is a subset of the exposure category, exposure to dangerous or toxic materials at fire-related incidents, those outside the scope of emergency medical incident exposures, which deserves attention. Figure 14 analyzes assorted hazardous materials that DFRD members claim to have been exposed to while responding to emergency incidents. A total of 231 claims of smoke and various chemical exposures out of the total 616 total exposures account for 37.5% of the total exposures gleaned from the original DFRD

[295] Adapted from Jamilia Quaite, email message to author, September 12, 2017. The author created the graph in Excel after collecting data from information contained in an Excel file from the Dallas Fire Rescue Safety Division.

database. The most numerous exposures reported were from asbestos exposures, followed by products of smoke produced from a structure fire. Bear in mind that the statistics are from those who formally claim exposure to a material, and do not include undisclosed exposures, which are arguably happening. In closing, the harmful exposure subsection of the greater exposure category is quantifiable and concerning.

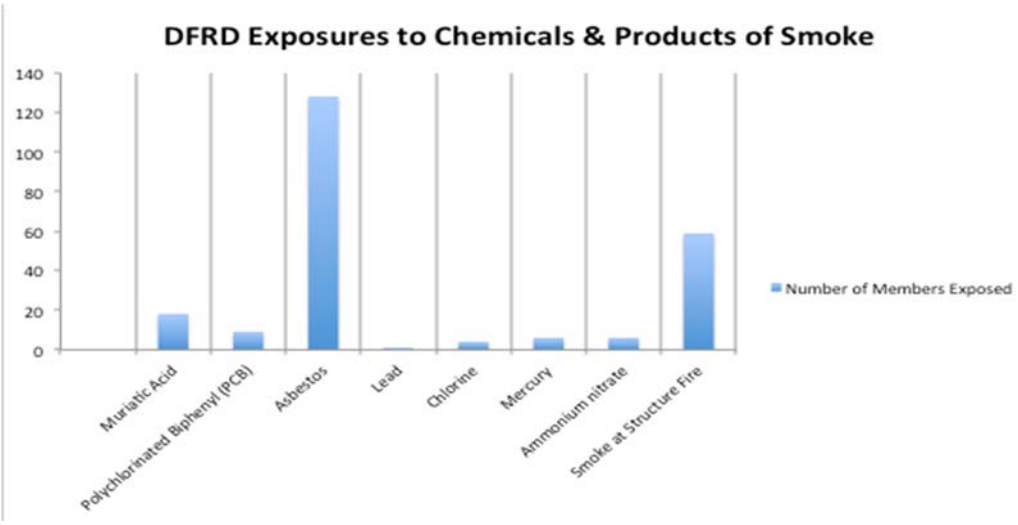

Figure 14. DFRD Smoke and Chemical Exposures[296]

An extensive study by Weiss and Miller demonstrated the presence of carcinogenic materials (cancer-causing) and toxic gases and substances in the overhaul period of a structure fire.[297] Overhaul is a term used for the period of time after a fire has been extinguished in which firefighters open up void spaces, such as walls and attic spaces to search for, and extinguish, small sources of fire or hot embers distributed in the

[296] Adapted from Jamilia Quaite, email message to author, September 12, 2017. The author created the bar graph after collecting data from information contained in an Excel file from the Dallas Fire Rescue Safety Division. It is a further breakdown of occupational exposures to particular products "chemicals and products of smoke."

[297] Deric C. Weiss and Jeff T. Miller, *A Study on Chemicals Found in the Overhaul Phase of Structure Fires Using Advanced Portable Air Monitoring Available for Chemical Speciation* (Salem, OR: State of Oregon Fire Service Policy Council, 2011), 10, http://cerexms.com/pdfs/Air%20Monitoring%20Report%20-%20Final.pdf.

initial fire attack, as stated in a 2011 *Fire Engineering* article.[298] Weiss and Miller's research confirmed two particularly harmful materials present in post-structure fire smoke are the heavy metals arsenic and mercury.[299] OSHA has deemed both heavy metals to be harmful to humans.[300] Supporting this claim of the hazards of contaminants in smoke, a 2010 report from Underwriters Laboratories, Inc., Fabian et al. state in the executive summary that firefighters are routinely exposed to four classes of respiratory poisons classified as: "asphyxiants, irritants, allergens, and carcinogens."[301] Figure 14 communicates that 59 DFRD employees have reported exposure to smoke and its byproducts related to firefighting activities, which may contain similar toxicants, perhaps even additional hazardous materials present at unknown levels.

Thus, can the data from Figures 13 and 14 reveal any detectable levels of organizational drift or normalization of deviance? The last several years have revealed occult dangers of contaminants in smoke during both initial fire suppression phases and the overhaul period, as affirmed by previous scientific studies mentioned. Armed with this knowledge, the DFRD SOP 100.00, ERB, seems rather archaic in its approach to limiting an employee's exposure to toxic smoke, when it is written:

> Overhauling: The company officer will determine the degree of protection needed to assure the safety of the firefighters during overhaul operations. Face shields, goggles, SCBAs, and PASS [Personal Alert Safety System] devices will be utilized where warranted. If the company officer allows firefighting coats to be removed during overhaul, at the officer's discretion PASS devices will be worn on the member's belts.[302]

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298 "Overhaul and Extension," *Fire Engineering*, accessed October 1, 2017, http://www.fireengineering.com/articles/2011/01/sheridan-overhaul.html.

299 Weiss and Miller, *A Study on Chemicals Found in the Overhaul Phase of Structure Fires Using Advanced Portable Air Monitoring Available for Chemical Speciation*, 10.

300 "Toxic Metals," Occupational Safety and Health Administration, accessed October 1, 2017, https://www.osha.gov/SLTC/metalsheavy/.

301 Thomas Fabian et al., *Firefighter Exposure to Smoke Particulates* (Northbrook, IL: Underwriters Laboratories, 2010), ii, https://pdfs.semanticscholar.org/157e/6dc272dba2e5fcc4e77212fca302ab96e28f.pdf. See Executive Summary, Introduction.

302 Dallas Fire Rescue Department, *Standard Operating Procedures, 100.00 Emergency Response Bureau* (Dallas: Dallas Fire Fighters Association, 2012), 159, http://dffa.org/docs/100ERB.pdf. Section 115.00, Personal Protective Attire, subsection Attire at Fire Emergencies, section E, Overhauling.

Therefore, the question looms over every incident in which DFRD members are exposed to the byproducts of smoke; under what scientific criteria is the DFRD company officer making a *logical* determination to direct members under their command to discard both dermal and respiratory levels of protection (emphasis added)? Section A of the same DFRD SOP claims that all members will operate with SCBAs and PASS devices in an atmosphere "charged with smoke and/or toxic gasses or vapors. SCBA and PASS devices will be worn and utilized until the area has been ventilated. The IDLH atmosphere completely purged of any toxic gasses, and all possibility of a backdraft explosion eliminated."[303]

While such rules exist to protect the firefighter, the 59 smoke exposures documented in Figure 14 suggests that some members have adopted an alternative threshold whereby they expose themselves to products of combustion through either inhaling smoke or toxins or dermally by absorption through the skin. The Texas Commission of Fire Protection (TCFP) tracks firefighter exposures to smoke in what it terms "smoke-gas inhalation," and cites a total of 107 exposures from the years 2012–2015.[304] Whether such exposures are isolated to particular workgroups was not disclosed in the received informational database. Figure 14 also reveals additional DFRD member exposures to other highly dangerous materials, from mercury and lead to ammonium nitrate and muriatic acid. At the least, organizational drift towards failure seems unmistakable due to an inordinate number of documented cases where members have presumably bypassed SOPs that exist for their safety.

The next set of internal documents examined for normalized deviance is the DFRD MOPs. As stated earlier, the DFRD conducts daily operations, both emergency and non-emergency responsibilities, using seven MOPs:

- MOP 200.00—Administration

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[303] Dallas Fire Rescue Department, *Standard Operating Procedures, 100.00 Emergency Response Bureau*. See Attire at Fire Emergencies, subsection A, Structure fires.

[304] Texas Commission on Fire Protection, *Texas Commission on Fire Protection Injury Report, January 1, 2015 to December 31, 2015* (Austin, TX: Texas Commission on Fire Protection, 2015), 8, http://www.tcfp.texas.gov/injuries/TCFP_Injury_Report_2015.pdf. See Table 6, Types of Injury, 2012–2015.

- MOP 300.00—Department Operations
- MOP 400.00—Pay and Personnel
- MOP 500.00—Internal Investigations and Discipline
- MOP 600.00—Emergency Response Procedures
- MOP 700.00—Code of Conduct
- MOP 800.00—Vehicles, Facilities, and Equipment

An exhaustive inquiry into each of the seven DFRD MOPs has revealed no empirical evidence of normalized deviance constructed into any procedures or policies. However, it is conceivable that individual members, or perhaps a small group of individuals, have violated one or more of the MOPs for reasons unknown to other members of the DFRD or available in the public record. In essence, the reviewed MOPs seem to encourage proper procedural adherence strongly, which is consistent with foundational documents of the fire service, such as NFPA standards.

Any semblance of organizational drift or perceived misdeed could stem from within the DFRD MOP 600.00, Emergency Response Procedures, particularly Section 607.00—Respiratory Protection Program. DFRD members assigned to an emergency apparatus (engine, truck, rescue (ambulance), or battalion chief vehicle to name a few) are required to perform a daily operational check of their SCBA upon placing their firefighting gear on their assigned spot on the apparatus. The SCBA is an integral component of the firefighter's PPE, as it provides the highest level of respiratory protection to the user. The procedure for performing the daily inspection and operational check is also outlined in a 13-step process in section 607.00.[305] Additionally, each member must complete a DFRD Form 136, officially titled Daily Inspection Checklist-Form 136. Form 136 is a paper-based form with a duplicate copy that also lists the 13-

[305] Dallas Fire Rescue Department, *Dallas Fire Rescue Manual of Procedure 600.00 Emergency Response Procedures* (Dallas: Dallas Fire Rescue Department, 2012). See Section 607.00, Subsection C, Daily Inspection "Item Numbers"—DFR Form 136.

step process to ensure that all steps are completed. After all steps have been physically performed and successfully passed, members complete the form by placing their signature in the signature column. Forms have 31 spaces, one for each corresponding day of the month in which the form is completed.

The end of month procedures for Form 136, which applies to both station and company officers (those person(s) in charge of the apparatus), are also listed in Section 607.00.[306] The MOP states that the responsibility for authenticating the proper completion of the daily operational checks (Form 136) for all SCBAs falls to the previously mentioned supervisors, stating, "No date will be left without an entry."[307] In the event that incomplete documentation on a previous and specific date is discovered, what is the company officer or station officer to do? To send in partially completed official DFRD forms, such as Form 136, is unacceptable according to the aforementioned statement about deficient documentation. Is the officer to complete the form, which constitutes a clear violation of the City of Dallas personnel rules, which states, "Dishonesty is exemplified by, but is not limited to, the following violations: cheating, forging, or willful falsification of official city reports or records"?[308] It is understandable the predicament in which supervisors would find themselves. Incomplete documentation discovered on a DFRD Form can cause people to complete the document, so as not to violate the DFRD MOP concerning the intolerance of forms with deficient information. Completing Form 136 by falsifying a city document can be viewed as a normalized deviance within the established DFRD MOP, as completion of the form can be viewed as compulsory.

A fourth source of DFRD internal information is the SOPs. DFRD operations are managed under four SOPs listed as follows:

- SOP 100.00 Aircraft Rescue and Firefighting (ARFF)

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306 Dallas Fire Rescue Department, *Dallas Fire Rescue Manual of Procedure 600.00 Emergency Response Procedures.* See Section B, subsection 3.b.

307 Ibid.

308 City of Dallas, *City of Dallas Personnel Rules 2015* (Dallas: City of Dallas, 2015), 34. See Article V., Rules of Conduct, section 34–36, Rules of Conduct, 8, B.

- SOP Emergency Medical Service (EMS)
- SOP Emergency Response Bureau (ERB)
- SOP Special Operations (SPOPS)

Much like the MOPs considered previously, a thorough search concluded that the concepts and ideas found in the DFRD SOPs appear consistent with fire service related standards of the NFPA and other agencies that routinely weigh in on firefighter safety. The SOPs appear to be free of any divergent policies or procedures that are inconsistent with best practices. Nonetheless, it is plausible that individual members and workgroups may possibly circumvent these established SOPs and conduct emergency operations within the idea of organizational drift that may lead to a confined normalization of deviance in the workplace, such as a fire station. However, it is the conclusion that the DFRD SOPs are faithful to the overarching concepts of fire ground operations, including emergency medical services, emergency response, special operations, and aircraft rescue and firefighting.

The following section exclusively considers documents and other sources of information that fire departments, such as DFRD adhere to, yet are external to the organization, and seeks to clarify possibly embedded concepts of normalized deviance along with potential infractions of these documents by DFRD personnel. Two objectives are considered in light of auditing external information sources. First, are fire service related organizations, those that offer guidance through standards, laws, and best practices, considering the principles of organizational drift and normalization of deviance, resulting in becoming an agent of change, reflected in their respective contributions to firefighter safety? Secondly, have DFRD members or workgroups (such as an entire engine or truck company) disregarded external, organizational-guiding axioms, and what effect, if any, did such actions have on an incident?

The first source material to be examined is the TCFP Fire Department Safety Officer Certification Curriculum Manual. Under “Qualifications of the Incident Safety Officer”, section 1002-4.5, a section discusses the disposition of filling such a position on

the fire ground.[309] The subsection discusses the necessity of an ISO to comprehend varying feelings that firefighters may have concerning their work, along with leveraging the ISO's abilities to frame a healthy, safety-centric mindset and philosophy among firefighters.[310] The section appears to support an idea of not merely a commitment to operating safely, but to a deeper meaning of incorporating safety into all aspects of emergency response by modifying behaviors that drive actions. Likewise, another section of the same manual encourages the ISO to maintain a "cyclic thinking" strategy, where decisions and observable actions are continuously undergoing an assessment process that seeks to support perpetual situational awareness.[311] Finally, the ISO is heavily involved with the post-incident analysis (PIA) from a safety viewpoint, and is required to contribute and submit written documentation stating safety issues discovered at the emergency incident, which are presented in a constructive fashion.[312] To a degree, the ISO position in this document is perceived to act almost as an intercessor between the firefighters who are about to commit an unsafe act, or through a loss of situational awareness, have placed themselves in a risky situation, in which case the ISO has intervened prior to an accident. In closing, the TCFP Fire Department Safety Officer Curriculum Manual seems to epitomize certain aspects of preventing organizational drift into failure, and eventually, accepting deviant behaviors as normal.

A second external source for review is the 2014 DFRD Safety Officer Student Manual presented through a PowerPoint presentation made available from the Fire Department Safety Officers Association. The slide section for Chapter 11 contains a section called "Traps," where one of the mentioned traps of ISOs is becoming "The Bunker Cop," who spends an unreasonable amount of time worried about PPE, which prevents the ISO from seeing the broader view of the incident, as well as creating

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309 Texas Commission on Fire Protection, *Fire Department Safety Officer, NFPA 1521, 2012 Edition, Certification Curriculum Manual* (Austin, TX: Texas Commission on Fire Protection, 2012), 3. See section 1002-4.5.2, subsection 4-Incident Safety Officer Attitude, a–f.

310 Texas Commission on Fire Protection, *Fire Department Safety Officer, NFPA 1521, 2012 Edition, Certification Curriculum Manual*, 3. See section 1002-4.5.2, subsection 4-Incident Safety Officer Attitude, a–f.

311 Ibid., 13. See Section 1002-6.1.5, subsection 2.e, Cyclic Thinking.

312 Ibid., 39–40. See Section 1002-6.7, Post-Incident Analysis. subsections 1002.6.7.1-1002-6.7.2.

firefighter animosity.[313] This position seems to be easygoing on the finer points of safety (PPE compliance), while focusing on more global incident safety issues. Although an ISO should concentrate on larger safety issues concerning emergency incidents, the position must adopt an exhaustive perspective of safety, one that includes reminders about PPE compliance. While the presentation slide seems to suggest against adopting such a restricted role, the previously noted 231 smoke and chemical exposures by DFRD members makes the enforcement of PPE conformity an invaluable aspect. Indubitably, it seems that an ISO enforcing proper PPE usage may theoretically save members from specific physical injuries, as well as perform in a catalyst role, which fortifies acceptable behaviors towards safety concepts in emergency situations.

Another outside source, and a truly indispensable book, is the 6th edition of the textbook *Essentials of Firefighting.* The book is used by the DFRD Training Academy as the foundational text for preparing recruits to transition into firefighters. The first chapter introduces the recruit to the annals of firefighting, as well as the culture of the fire service. As culture relates to organizational deviance, the text discusses what is termed "cultural challenges."[314] One of the conflicts listed discusses the various personalities and viewpoints between young and old firefighters coupled with the idea that similar temperaments are embraced by like-minded persons, while those holding opposing views are oftentimes unwelcome, which causes outsiders to sometimes attempt to act unsafely to impress those of a particular group.[315] Chapter two of the text warns firefighters-in-training about the dangers of exposure to toxicants, such as smoke and other harmful chemical compounds or gases encountered in firefighting incidents, and admonishes the reader to wear appropriate respiratory protection.[316] A comprehensive review of the textbook, focusing on both firefighter and safety cultures, seems to advance the notion that the firefighting culture is undergoing a radical transformation, despite the concession

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[313] Dallas Fire Rescue Department, "Dallas Fire Rescue Department Safety Officer Training Manual" (PowerPoint presentation, Dallas, TX, March 2014), ch. 11, slide number 318.

[314] IFSTA, *Essentials of Firefighting*, 6th ed. (Stillwater, OK: Fire Protection Publications, 2013), 18, ch. 1.

[315] Ibid., 19.

[316] Ibid., 50.

that since 2001, close to 100 firefighters die each year as a result of firefighting, with tens of thousands of injuries annually.[317] In conclusion, the *Essentials of Firefighting* textbook used by DFRD acknowledges continual shortcomings of the fire service, while simultaneously attempting to portray the culture of the fire service as one striving to improve its culture on many fronts.

The next document appears on www.everyonegoeshome.com, which is actually a website devoted to practically every facet of firefighter safety, from advancing the idea of cultural change in the fire service, technological advancements that promote firefighter safety, to psychological assistance to cope with the mental pressures that accompany unspeakable tragedies that firefighters face on a routine basis. The 16 firefighter life safety initiatives were created after a 2004 convention devoted to addressing pragmatic reforms within the fire service, and is established by the National Fallen Firefighter Foundation, (www.firehero.org) an entity created by the U.S. Congress.[318] The first life safety initiative is considered an anchor point on which the remaining 15 initiatives hinge, listed as "cultural change."[319] The initiative states, "Define and advocate the need for a cultural change within the fire service relating to safety; incorporating leadership, management, supervision, accountability and personal responsibility." This introductory initiative includes a sobering statement that is truly nascent, "Within the context of Everyone Goes Home© and the 16 Firefighter Life Safety Initiatives, no advocacy point carries more importance than the need to change the culture of safety from within."[320] So much significance is placed on transformational change in the fire service culture that a U.S. Fire Administration report underscores the significance of the first initiative by

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317 IFSTA, *Essentials of Firefighting*, 47. See Table 2.1 Firefighter Fatalities and Injuries Recorded between 2001–2010.

318 "16 Firefighter Life Safety Initiatives," Everyone Goes Home, accessed September 26, 2017, https://www.everyonegoeshome.com/16-initiatives/. See About Us; "National Fallen Firefighters Foundation," National Fallen Firefighters Foundation, accessed October 4, 2017, https://www.firehero.org/. See About Us.

319 "1. Cultural Change," Everyone Goes Home, accessed September 26, 2017, https://www.everyone goeshome.com/16-initiatives/1-cultural-change/.

320 Ibid.

declaring that devoid of an appreciation of the fire service culture, whatever ground gained in the other 15 initiatives is non-viable and non-feasible.[321]

A thorough review of the Everyone Goes Home website exhibits practically no organizational normalization of deviance or condoning of organizational drift. Conversely, the website, and its many training aids actually seem to amplify efforts that support genuine fire service cultural change that curtails deviant behavior patterns from the individual, company, and organizational levels. One example is found in the AAR section that stresses the relevance of conducting AARs after each emergency incident, regardless of incident complexity or size, emphasizing that firefighters sometimes die at the "ordinary call."[322] Under Initiative 9, Fatality, Near Miss Investigation, a link to a study of the city of Flint firefighter injuries at vacant buildings revealed that "Fire incidents at buildings that were found vacant and unsecured upon firefighter arrival caused by far the most injuries, most lost hours, and highest cost."[323] Minimizing injuries to Flint firefighters prompted a search of other fire department SOPs, including the Fire Department of New York (FDNY), whose abandoned structure policy states, "Members must psychologically adjust to a "no rush" approach. In these buildings, the life hazard is to the firefighter. A slower, more cautious operation is definitely indicated."[324]

Such tactics and fire ground strategies obviously seek to induce behavior modification towards fire ground operations against vacant structures. These adjustments help to fulfill Initiative 9 by lowering near miss incidents by enhancing critical thinking skills. An example of selecting a fire ground action based on a thorough risk assessment at vacant structure fires is discussed in the Flint vacant injury study as a fulfillment of the NFPA standard 1500, Standard on Fire Department Occupational Safety and Health

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[321] U.S. Fire Administration, *National Safety Culture Change Initiative: Study of Behavioral Motivation on Reduction of Risk-Taking Behaviors in the Fire and Emergency Service*, Report FA-342 (Emmitsburg, MD: U.S. Fire Administration, 2015), 3, introduction, https://www.usfa.fema.gov/downloads/pdf/publications/fa_342.pdf.

[322] "After Action Review (AAR)," Everyone Goes Home, accessed October 4, 2017, https://www.everyonegoeshome.com/training/action-review-aar/.

[323] "Initiative 9: Documentation Archives," Everyone Goes Home, accessed October 4, 2017, https://www.everyonegoeshome.com/resource-area/initiative-9-documentation/page/8/. 8 of 9, Links section, Vacant Structure Fires & Firefighter Injuries,

[324] Ibid. See Section 8: Vacant Building S.O.P.s at Other Fire Departments.

Program.[325] The NFPA 1500 standard specifically states, "No risk to the safety of members shall be acceptable when there is no possibility to save lives or property."[326] Such alterations in cognition can actively suppress organizational deviance by consciously selecting a suitable alternative.

The following section seeks to look into specific examples within the DFRD that describes the culture of some individuals operating within a localized workgroup, as viewed through the lenses of organizational drift and the normalization of deviance. The purpose of reviewing such incidents in their aftermath is to gain an understanding of the internal work culture of the DFRD, how such groups process information, and ultimately make sense of how such knowledge leads to specific actions. Moreover, are these actions reasonable and justifiable in light of DFRD policies, external standards, and local, state, and federal regulations? Finally, have "lessons learned" from previous events influenced current decision-making paradigms for future incidents? In effect, has the DFRD genuinely recognized the subtle impacts that organizational drift or an actual normalization of deviance has on its organizational culture?

The first illustration studied is the degree of employee safety at emergency incidents within the DFRD. The first instance involves the LODD of Second Driver Stanley Wilson, which occurred while conducting firefighting activities at a 4-alarm structure fire in the early morning hours of May 20, 2013 in Dallas, Texas. Second Driver Wilson died as a result of injuries sustained by a structural collapse of a second floor walkway (and maybe the third floor) while searching individual apartments for victims with another firefighter in the main building on fire, according to a report by the National Institute for Occupational Safety and Health (NIOSH).[327] Second Driver Wilson likely understood the risk associated with structure fires, as his over 28 years of career

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[325] Everyone Goes Home, "Initiative 9: Documentation Archives," Section 6: NFPA 1500.

[326] "NFPA 1500: Standard on Fire Department Occupational Safety, Health, and Wellness Program," National Fire Protection Association, 28, accessed September 12, 2017, http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1500. See section 8.3.2(3).

[327] National Institute of Occupational Safety and Health (NIOSH), *Firefighter Fatality Investigation and Prevention Program, A Summary of a NIOSH Fire Fighter Fatality Investigation, Career Fire Fighter Killed by Structure Collapse While Conducting Interior Search for Occupants Following 4th Alarm-Texas*, Report #F2013-17 (Washington, DC: Centers for Disease Control and Prevention, 2014), i, https://www.cdc.gov/niosh/fire/pdfs/face201317.pdf. See Executive Summary.

firefighting experience with the DFRD had taught him. Although, the NIOSH report questions whether anybody should have been in the building that would eventually collapse, given the defensive mode of operation in which the DFRD incident commander was working.[328]

One of the fire ground strategies utilized by fire departments is to take a defensive posture. As reported in a FireRescue1 article, defensive tactics are incorporated when the danger is too great to send firefighters inside the structure, due to increased collapse potential, which requires the placement of fire trucks with piped waterways (called a master stream) that can be raised to discharge water from an elevated position from a safe distance to protect surrounding buildings from catching fire.[329] Figure 15 shows an elevated master stream in operation at the fire where Stanley Wilson died. To put the power of a master stream into perspective, a master stream flowing water at 1,000 gallons per minute adds 8,330 pounds per minute to the total weight of a burning structure.[330] The respective NIOSH reports for Stanley Wilson's LODD fire states on page 20 that seven master streams were operating at the time T53 entered the building.[331] Calculations show a potential total discharge of 58,310 pounds of water per minute, which equates to slightly over 29 tons of water per minute. To commit firefighters to a building being assaulted by both a large volume of fire and large water streams reveals a conflict of overall strategies between defensive and offensive profiles, of which the NIOSH investigators allude to in their fourth recommendation concerning the communication of

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328 National Institute of Occupational Safety and Health (NIOSH), *Firefighter Fatality Investigation and Prevention Program, A Summary of a NIOSH Fire Fighter Fatality Investigation, Career Fire Fighter Killed by Structure Collapse While Conducting Interior Search for Occupants Following 4th Alarm-Texas*, 20. The NIOSH report states that when T53 began a primary search of the fire building, other firefighters were operating in a defensive posture; evidenced by elevated master streams discharging water into the building T53 was conducting a search, an offensive tactic.

329 "Fire Tactic: Offensive vs. Defensive Fire Attack," FireRescue1, accessed October 4, 2017, https://www.firerescue1.com/firefighter-training/articles/499269-Fire-tactic-offensive-vs-defensive-fire-attack/.

330 National Institute of Occupational Safety and Health (NIOSH), *Firefighter Fatality Investigation and Prevention Program, A Summary of a NIOSH Fire Fighter Fatality Investigation, Career Fire Fighter Killed by Structure Collapse While Conducting Interior Search for Occupants Following 4th Alarm-Texas*, 24.

331 Ibid., 20.

current operational strategies, from the incident commander down the chain of command to the firefighter.

Figure 15. Elevated Master Stream in Operation on May 20, 2013[332]

A second mode of attack is known as an offensive mode of operation, based on an article describing this approach.[333] This strategy is perhaps the most familiar to the non-firefighter, and describes actions where firefighters in protective gear, including a SCBA, utilize fire hoses of various diameters and make an aggressive attack into the interior of a structure with the intent of discharging water onto the "seat of the fire." This tactic is used primarily when firefighters receive reports of persons trapped inside and need to be rescued by conducting a search to find persons under austere conditions, or the intent to save the structure itself from succumbing to the fire. In context of the fire in which Stanley Wilson perished, his apparatus, Truck 53, was conducting a search of the

[332] Source: National Institute of Occupational Safety and Health (NIOSH), *Firefighter Fatality Investigation and Prevention Program, A Summary of a NIOSH Fire Fighter Fatality Investigation, Career Fire Fighter Killed by Structure Collapse While Conducting Interior Search for Occupants Following 4th Alarm-Texas*, 14. Photo courtesy of Dallas Fire Rescue Department.

[333] FireRescue1, "Fire Tactic: Offensive vs. Defensive Fire Attack."

building on fire (an offensive tactic) while defensive operations were underway (multiple master streams actively deployed). As stated earlier, merging both offensive and defensive tactics is extremely hazardous, as firefighters are potentially operating in a building that for all intents and purposes has been written off, demonstrated by master streams protecting nearby buildings exposed to the main fire building. The incident commander initiates the offensive tactic when a possibility exists to save both lives and property, even though it exposes firefighters to a greater degree of danger by working inside a burning structure.

The fire that claimed the life of Stanley Wilson, according to the two NIOSH investigators filing their report, stemmed principally from multiple failures of the DFRD incident command to apply proven leadership principles at the incident scene, from its initial stages up until the structural collapse and immediate "mayday" called by Stanley Wilson's partner who was assisting in the search.[334] Key recommendations expressly stated in the NIOSH report that address incident command issues and areas of improvement at the Stanley Wilson fatality fire incident are the following:

- Recommendation #1: Fire departments should ensure that the incident commander establishes a stationary command post, maintains the role of director of fireground operations, and does not become involved in fire-fighting efforts.

- Recommendation #2: Fire departments should ensure that the incident commander conducts an initial size-up and risk assessment of the incident scene before interior fire-fighting operations begin.

- Recommendation #4: Fire departments should develop, implement and enforce clear procedures for operational modes. Changes in modes must be coordinated between the incident command, the command staff and fire fighters.

[334] National Institute of Occupational Safety and Health (NIOSH), *Firefighter Fatality Investigation and Prevention Program, A Summary of a NIOSH Fire Fighter Fatality Investigation, Career Fire Fighter Killed by Structure Collapse While Conducting Interior Search for Occupants Following 4th Alarm-Texas*, ii. See Key Recommendations.

- Recommendation #5: Fire departments should ensure the pre-designated ISO assumes that role upon arrival on the fireground.

- Recommendation #8: Fire departments should ensure that pre-determined assignments are assumed and staffed.[335]

The incident commander at the fire, Deputy Chief Bobby Ross, possessed more than 30 years of fire service experience. The NIOSH LODD report, Report # F2013-17, dated November 25, 2014, reveals that "The Incident Commander (IC) had more than 30 years of experience and training on topics including Incident Command System 100-400, Incident Safety Officer, instructional techniques for company officers, and National Incident Management System NIMS 701-704."[336] Although the NIOSH report asserts that Deputy Chief Ross has achieved several fire service accomplishments, including a state certification for ISO, a review of public records located on the Texas Commission on Fire Protection's website, (http://www.tcfp.texas.gov/certification/certification_verification_4.asp) reveals that Deputy Chief Ross was issued the ISO certification 10 days after the Stanley Wilson LODD fire.[337] An internally initiated DFRD investigation report lists the incident commander as Deputy Chief Bobby Ross.[338] This same report goes on to state that 806 (DFRD Division 1 Deputy Chief's radio call sign) did not give an updated "size-up," (a verbal report of current conditions of the fire and a brief progress report), nor did he assume command (as incident commander) at the fire.[339]

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335 National Institute of Occupational Safety and Health (NIOSH), *Firefighter Fatality Investigation and Prevention Program, A Summary of a NIOSH Fire Fighter Fatality Investigation, Career Fire Fighter Killed by Structure Collapse While Conducting Interior Search for Occupants Following 4th Alarm-Texas*, 16.

336 Ibid., 1. See Training and Experience.

337 "Texas Commission on Fire Protection Certification Verification Page," Texas Commission on Fire Protection, accessed October 4, 2017, http://www.tcfp.texas.gov/certification/certification_verification_4.asp. See Certification verification report for Bobby Darnell Ross.

338 Dallas Fire Rescue Department, *Dallas Fire Rescue Department, Investigation Report Firefighter Fatality-Stanley Wilson May 20, 2013 6-Alarm Condominium Fire Hearthwood North Condominiums 12363 Abrams Road, Dallas, Texas* (Dallas: Dallas Fire Rescue Department, 2014), 22, https://www.scribd.com/document/240210705/Dallas-Fire-Rescue-Line-of-Duty-Death-Report-on-Stanley-Wilson.

339 Ibid.

Actions and inactions by those fulfilling the incident commander role at the fire where Stanley Wilson perished should be deeply concerning from an organizational drift perspective, and possibly showing normalized deviance. The deputy chief who would become the incident commander failed to follow basic tenets of the ICS, as well as violating several components of DFRD's MOPs volumes 600 and 700, including:

- "The Deputy Chief will give a verbal size-up upon arrival."[340]
- "Prevent members from exposure to unnecessary danger while on duty."[341]
- "Any action that places any person in greater danger than is necessary for the proper performance of duties."[342]

In light of the LODD of Second Driver Stanley Wilson, concepts related to strong organizational drift emerge. First, the concept of Reason's Swiss cheese model, where organizational defenses are the slices of cheese, and the "holes" are weaknesses within those defenses, through which hazards progress until an accident occurs is evident in this incident. Massive fire ground confusion, coupled with a lack of adherence to basic principles of the ICS, as well as DFRD MOPs, and competing strategies (offensive and defensive strategies and tactics), led to an error (sending T53 crew into a hazardous environment) that passed through organizational defenses and caused a fatal accident. Also, contributing to the confusion was the delay in assigning an ISO, one of the most dynamic defenses to fire ground accidents.

The next example of normalized deviance within the DFRD concerns compliance with required standards related to PPE available to firefighters, specifically what is known as a "N95 mask." The N95 mask is a particle type respirator that offers a level of respiratory protection against commonly encountered infectious diseases that can be

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[340] Dallas Fire Rescue Department, *Dallas Fire Rescue Manual of Procedure 600.00 Emergency Response Procedures*. See Section 601.03, subsection E, Size-up.

[341] Dallas Fire Rescue Department, *DFRD Manual of Procedures 700.00 Code of Conduct* (Dallas: Dallas Fire Rescue Department, 2012). See Section 709.16, subsection Officers and Supervisors.

[342] Ibid. See Section 710.02, Dereliction of Duty, Subsection C.

inhaled by first responders by filtering particles in the environment. An example of such diseases includes measles, tuberculosis and meningitis amongst others.[343] Since the N95 mask is a type of respirator, a federal requirement mandates that the employee using the N95 mask is indeed wearing the correct size mask, which is validated by a process known as fit testing. This section explores the degree that the DFRD is compliant with fit testing guidelines, and whether current levels of conformity suggest an organizational level of deviance.

Firefighters in the DFRD do not just fight fires; they respond to other calls for help when citizens are experiencing numerous forms of medical emergencies, from chest pain to seizures, as well as trauma caused from motor vehicle accidents or falls. On certain occasions, incidents involve patients with infectious diseases who have the capability to transmit infected respiratory droplets from patients to first responders by sneezing or coughing. In those cases, it is highly advisable that the DFRD members take respiratory precautions by donning a particulate filtering type mask as an additional layer of protection coupled with the standard disposable examination gloves worn. The N95 mask is available for DFRD members to order in three sizes (small, medium, and large) for field use under the DFRD IDS EMS supply order page. Yet, a perplexing question still exists, which size N95 mask is a DFRD member supposed to use and what process assists the member in making an educated determination so that the best fit is obtained? Certainly, with several diverse facial types, it is reasonable to think that a "one size fits all" approach is incongruent as an acceptable practice. A picture of the Moldex® N95 mask is shown as a reference in Figure 16.

[343] "Infectious Diseases—A to Z List," State of Rhode Island, Department of Health, accessed October 5, 2017, http://www.health.ri.gov/diseases/infectious/.

Figure 16. Moldex N95 Particulate Respirator[344]

A thorough search of all seven DFRD MOPs and four SOPs produced zero results that mentioned any standardized or mandated process to ensure that DFRD members follow a procedure to obtain either a best or proper fit for the N95 particulate mask. In the absence of a DFRD policy to guide members into some semblance of compliance, what are acceptable actions on the part of the DFRD members? In the event that members of the DFRD were exposed to an infectious disease, those members and their supervisors are required to complete documentation to record the event for investigative and potential worker's compensation purposes. Documentation consists of various internal DFRD documents, including:

- Dallas Fire Department Form 362: Employee Injury Investigation Form
- City of Dallas Supervisor's Injury Investigation Report Form RM1A
- DFR Form #356 Dallas Fire-Rescue Communicable Disease Notification Form

The required documentation at no time asks if the exposed members used *properly sized* PPE. Therefore, is it through conjecture and assumptions that members are always in compliance with DFRD policies regarding PPE usage, particularly the N95 mask?

OSHA has definitively answered the question regarding what constitutes the procedure to be followed for proper sizing of an N95 mask through one of its standards,

[344] Source: "Moldex® 1500 N95 Series," Moldex, accessed August 16, 2017, http://www.moldex.com/non-product/niosh-ratings/1500.php. 1500 N95 Healthcare Particulate Respirator and Surgical Mask. Shown is 1513 N95-Large.

Title 29 of the Code of Federal Regulations (29 CFR), Standard 1910.134.[345] The OSHA standard demands, "before an employee may be required to use any respirator with a negative or positive-pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used."[346] Again, a complete search was conducted of DFRD's SOPs and MOPs, particularly MOP 600.00, subsection 607.00, which describes the tenets of the DFRD respiratory protection program.[347] Bolstering the argument for N95 fit testing is the manufacturer's restrictions of using the product (N95 mask) itself. Moldex® is the current supplier of N95 masks for the DFRD. The two-page fitting instructions contained within the box of N95 masks warns the users that the product must be fit tested in accordance with the OSHA 1910.134 standard discussed earlier.[348]

Moreover, the DFRD has been reminded of the need to come into compliance with OSHA 29 CFR 1910.134 as it relates to N95 fit testing as far back as late October 2014, partly in response to the first documented case of Ebola diagnosed in Dallas, Texas in September 2014.[349] Two healthcare workers treating this initial diagnosed patient would contract the virus as well.[350] In light of the growing Ebola case in Dallas, Texas, coupled with the confirmed transmission of the virus to two healthcare workers, a DFRD member appeared to have reservations concerning DFRD's non-compliance with N95 fit testing, as the employee seemed to equate non-compliance with increased risk to the DFRD employee tasked with wearing a non-tested component of PPE. The DFRD

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345 "Respiratory Protection—1910.134," Occupational Safety and Health Administration, accessed April 20, 2017, https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716#1910. See 134(g)(4). Subsection f.

346 Ibid.

347 Dallas Fire Rescue Department, *Chapter 6 MOP 600.00* (Dallas: Dallas Fire Rescue Department, n.d.) See subsection 607.00, Respiratory Protection Program.

348 Moldex, *Moldex® Disposable Respirators* (Culver City, CA: Moldex, n.d.), accessed August 16, 2017, http://www.moldex.com/pdf/datasheets/respirator_warnings.pdf. See Fitting Instructions, number 5. The instructions also state that the user is required to be fit tested annually.

349 "Cases of Ebola Diagnosed in the United States, Ebola Hemorrhagic Fever," Centers for Disease Control and Prevention, accessed October 5, 2017, https://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/united-states-imported-case.html. See date of September 30, 2014.

350 Ibid. See dates October 10 and October 15, 2014.

member's concern is evidenced by redacted emails sent from the DFRD member to the chain of command, and is seen in Figure 17 (slides 1–3).

On Jan 2, 2015, at 2:06 PM, [redacted] wrote:

[redacted]

Thank you for the opportunity to provide you with information regarding current Dallas Fire Rescue protocols & established guidelines as it relates to Ebola, as well as proper use of N95 mask, notably fit testing.

The Occupational Safety & Health Administration (OSHA) revised its standard on respiratory protection on April 8, 1998. The standard for reference is 29 CFR1910.134, in particular section (f), as it pertains specifically to Fit Testing. The actual standard can be referenced here:

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=standards

Section (f) describes in great detail what type of respirators must be fit tested: both Negative & Positive pressure tight-fitting facepieces. Fit testing falls can be performed by either Qualitative Fit Testing (described as QLFT in the text) where a PASS/FAIL result is obtained. Such a method incorporates a hood that is placed over the head, and a product that can be sensed by taste is sprayed into the hood via a port. Usually, test materials will use Isoamyl acetate (banana oil), saccharin, bitrex, or an irritating smoke. The other test, a Quantitative Fit Test (QNFT in the text) is more familiar as test results must achieve a certain "fit factor." I believe this type of testing is currently used for positive-pressure facepieces, and is administered from SCBA Technicians on an annual basis. The standard also discusses documentation for such tests, etc. Here is a link to a Youtube video that briefly shows the testing procedure:

https://www.youtube.com/watch?v=D38BjgUdL5U&context=C3b699ffADOEgsToPDskKPkZEHASCZs4BC6yQpRtNc

As a member of Dallas Fire Rescue [redacted] I have never been fit tested for an N95 mask. It should be noted that there is overwhelming documentation to support the following observation.

Observation #1: It is my belief that Dallas Fire Rescue currently is in violation of CFR1910.134 as it pertains to fit testing of negative pressure facepieces (N95 masks).

Currently, the N95 mask in stock at fire stations is the Ivovel 1500 Series N95 mask. On the side of the box of masks, under the area entitled FITTING, the following statement is printed:

"If you cannot obtain a proper fit do not enter the contaminated area. OSHA regulation 29 CFR 1910.134(f) requires that the user must be fit tested before being assigned a respirator."

Slide 1 of 3.

It should be noted that on October 16, 2014 I notified via email correspondence [redacted] about the OSHA standard and N95 fit testing not being performed. I received a reply on October 20, 2014 (with cc's to [redacted] that they are aware and are developing a plan to address fit testing. When I attended the required Ebola PPE training (I went on a makeup day at [redacted]), I inquired with [redacted] who was teaching the class, about Fit Testing. She advised me that "there was an exemption for fire departments" to the OSHA standard that I quoted, as it pertains to fit testing. I advised her there was no such exemption that I could find in the printed standard. I also called the on shift SDO, [redacted] with my concerns. I followed up by contacting [redacted], voicing my concerns as well. I went the extra step of contacting [redacted] informing him of such actions. I was informed by him that he would bring this item to [redacted] attention at their next scheduled meeting. I have heard no response as of yet.

Furthermore, in [redacted] mass email sent to all fire stations entitled: "Medical PPE Training Program-Make up Sessions December 15-19, 2014 & December 23, 2014" there were four attachments to this email. The third attachment, entitled: "OSHA_FS-3761_PPE_Selection_Matrix_-_Ebola" states on page one (3rd bullet point):

"Employers must comply with OSHA's standards on Bloodborne Pathogens (29 CFR 1910.1030), PPE (29 CFR 1910.132), Respiratory Protection (29 CFR 1910.134), and other requirements."

In addition, the [redacted] bulletin, entitled "TB 14-007 PPE" lists the Centers for Disease Control (CDC) as a resource. One of those resources will lead you to the following CDC link:

http://www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html

Under "Recommended Personal Protective Equipment" the first bullet point states:

"PAPR **or** N95 Respirator. If a NIOSH-certified PAPR and a NIOSH-certified fit-tested disposable N95 respirator is used in facility protocols, ensure compliance with all elements of the OSHA Respiratory Protection Standard, 29 CFR 1910.134 , including fit testing, medical evaluation, and training of the healthcare worker."

Slide 2 of 3.

I also spoke with [redacted] about fit testing N95 masks. [redacted] stated when [redacted] was asked initially that [redacted] felt those masks did not need to be fit tested. I sent him the link to the standard, and we discussed the testing for a brief time. [redacted] stated he did not know about its application to N95 masks.

Now this issue of non-compliance was not unique to Dallas Fire Rescue alone. The Chicago Fire Department's [redacted] stated that Chicago Fire Department had not fit tested its members in several years. Here is the link for your review:

http://www.nbcchicago.com/investigations/Firefighters-Raise-Concerns-Over-Mask-Safety-279572382.html

In conclusion, I believe we have a similar goal: that every firefighter goes home safe. I feel that without OSHA mandated fit testing guidelines being followed, we are placing our members at risk. Besides the standard being required testing, and could be reviewed by OSHA at any time for compliance, it is an unsafe practice to continue to neglect fit testing. I feel disappointed in my efforts to affect a change that will protect our members. I feel a greater degree of disappointment that this has been an issue since 1998, and has yet to be properly addressed and incorporated into our Manual of Procedures. Accountability begins with myself, and I am sworn to protect myself and the members under my command. I take that responsibility seriously. With Dallas being the epicenter of Ebola entering the United States, it is incumbent upon Dallas Fire Rescue to set a standard of excellence, and that begins with proper personal protective equipment, and furthermore, that we follow OSHA standards for fit testing. Fit testing with a result of PASS gives confidence to the members utilizing such items that they indeed do provide a level of protection.

Thank you for your time in this matter. I hope the provided information is useful. I would be happy to speak further with you about this matter, as well as help you in any way resolve this. Please feel free to contact me at the station or at home.

Thank you,

[redacted]

Slide 3 of 3.

Figure 17. Redacted Email from DFRD Member to DFRD Chain of Command[351]

[351] Source: DFRD Member to DFRD Chain of Command, redacted email message to author, January 2, 2015.

Logical conclusions can be drawn from the above argument that the DFRD is potentially derelict in complying with a federal regulation connected with occupational safety in the workplace, as it pertains to normalization of deviance within the DFRD. Recalling the conclusions of Starbuck and Milliken concerning organizational deviance, the authors claim, "Organizations often interpret past successes as evidencing their competence and the adequacy of their procedures, and so they try to lock their behaviours [sic] into existing patterns."[352] At face value, the current versions of DFRD's MOPs and SOPs in reference to OSHA 29 CFR 1910.134 seem deficient in its present state, in conjunction with a DFRD member's petition to DFRD leadership to protect its members by observing current laws. The current stalemate between compliance and non-compliance, with current DFRD policies suggesting non-compliance, hints at an organizational level of approval with the status quo; a surreal rejection that the organization exists in an incubation period of near misses, where DFRD members don non-tested masks in potentially infectious atmospheres, perhaps in truly lethal environments like Ebola, with an accident waiting to happen.

A final illustration of latent organizational drift and deviance within the DFRD lies within its special operations division, and in particular, the DFRD's urban search and rescue (USAR) team, known as Texas Task Force-2 (TTF-2). TTF-2 is designated as a Type I task force under the National Incident Management System (NIMS) typing system, consisting of a 70-person team with six specialized areas.[353] The specific instance chosen to demonstrate the mentioned concepts was a response to a natural disaster that occurred on December 26, 2015 in Garland, Texas, a city contiguous to the city of Dallas, Texas. Issues related to emergency response and operational safety at an emergency incident would reveal a mindset presumably driven by an acknowledgement of safety in name only, and not in practice. An assessment of transpired events in the aftermath of the response could be viewed as confirmed normalization of deviance within

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[352] Starbuck and Milliken, "Challenger," 319.

[353] Federal Emergency Management Agency, *Typed Resource Definitions, Search and Rescue Resources*, FEMA 508-8 (Washington, DC: Federal Emergency Management Agency, 2005), 36, https://www.fema.gov/pdf/emergency/nims/508-8_search_and_rescue_resources.pdf. See Type I.

TTF-2, as official responses to noted critiques seemed to be met with justifications that failed to address the overall safety of TTF-2's most valuable asset, its members.

Multiple tornadoes touched down in the Garland area on a balmy December night, killing a total of 13 people, and causing massive structural damage to several residential neighborhoods, a large apartment complex, and a nearby trailer park. Garland emergency response leadership leveraged the capabilities of TTF-2, and a request was issued for their assistance in conducting search and rescue (SAR) operations in some of the hardest hit areas. TTF-2 maintains a fleet of heterogeneous apparatus designed to meet the operational needs of the various workgroups within the task force, from vehicles equipped to carry canine units, to flatbed trailers with portable generators and personnel tents constructed on site to act as a base of operations. One of those vehicles is the hazardous materials (HazMat) vehicle, which contains PPE, equipment in which to conduct decontamination operations, along with various monitors that take atmospheric readings of the air in a potentially hazardous area to determine the safety of task force members and those being rescued. All the equipment is assigned in a ready state at a location on the west side of Dallas in a secured location.

When TTF-2 is activated and deploys, its members are required to report to this pre-incident staging location to check out and load equipment that is on chargers, or needs loading upon activation orders. The equipment travels in a convoy style arrangement to the incident location, and returns as well. On the activation in December 2015, somehow the HazMat vehicle was loaded up but never left the staging location, and thus, all the necessary equipment was unavailable to the task force. TTF-2 is staffed with 10 HazMat technicians, who have specific roles on the task force, according to the national Urban Search and Rescue Response System's Concept of Operations, Annex B:

- Two HazMat team managers to provide safety to SAR operations by conducting and assessing atmospheric monitoring readings to ensure the safety of the task force.

- Two HazMat specialists who are attached to reconnaissance teams, as well as structural triage engineers who provide constant atmospheric monitoring for hazards.
- Four HazMat specialists with one assigned to each of the four rescue squads to provide atmospheric monitoring for hazards.
- Two HazMat specialists to establish and maintain decontaminations operations in a safe area.[354]

Without the HazMat vehicle, the HazMat technicians are unable to perform atmospheric air monitoring of potentially hazardous atmospheres, conduct decontamination operations, or truly act in a role to provide safety parameters or recommendations in which the other task force members operate. Depriving the HazMat technicians of the capability to monitor the surrounding atmosphere and conduct decontamination, by leaving vital and necessary equipment, goes against the very mission of USAR operations in a contaminated environment.[355] In the Garland tornado incident, the HazMmat technicians who responded to the scene did so without any of their equipment; tools crucial to keeping the task force, survivors, and others in the area safe from hidden or unknown hazards in collapsed structures.

After TTF-2 had completed their assignments of searching partially or completely destroyed buildings, a DFRD memorandum was drafted by one of the HazMat team managers who responded in the waning moments of the incident. The internal memorandum spoke to the inherent dangers of continuing SAR operations in the absence of HazMat specialists to monitor the air quality of collapsed structures prior to SAR teams entering the structures to look for survivors. The content of the letter suggests an indifference towards the HazMat component of TTF-2, by those in TTF-2 leadership. The memorandum also seeks to defend its position based on the concept of operations

[354] National Urban Search and Rescue Response System, *Concept of Operations Annex B-US&R Operations in a Contaminated Environment* (Washington, DC: Federal Emergency Management Agency, 2013), 4. See Section 1–6, Staffing.

[355] Ibid., 1. See Section 1–2, Mission.

document referred to earlier as a foundational document through which task force operations can be viewed as dangerous, as no qualification or quantification of hazards can be determined without HazMat monitors. The memorandum is shown in Figure 20 in six slides.

Memorandum

[redacted]

DATE January 9, 2016

TO [redacted] (Through Channels)
Special Operations

SUBJECT Urban Search & Rescue (USAR) Operations Safety Concerns

This memorandum is in regards to the Texas Task Force 2 (TTF2) response to the recent tornadoes that struck the Garland, Texas area on 12/26/15. In particular, the hazards associated with compromised structures in a high-occupancy area.

As you will recall, an EF-4 tornado struck in a predominantly residential area, affecting one and two story residences, two story apartments, and a mobile home park. Texas Task Force 2 was activated as a requested asset in the early morning hours of 12/27/15. The Task Force, TTF2, deployed from Hensley Field. I was unable to meet the 0500 muster time to Hensley Field, and therefore did not deploy (although I would later deploy after confirming with [redacted]. As I understand, Hazmat Specialist deployed to Hensley Field and proceeded to perform equipment checks, and load all pertinent equipment onto the designated USAR Hazmat Rig. [redacted] one of the Hazmat Specialists at Hensley, was designated as the acting Hazmat Manager, as no Hazmat Manager initially deployed from Hensley Field. The Task Force deployed to the affected area, where four Search Teams were deployed.

The following are my actions in response to this deployment. I was contacted via text message by [redacted] around 1100 on 12/27/15, inquiring about my status. I responded that I could deploy at the current time, 1100. He stated that he would mention it to [redacted] (the Task Force Leader). I received an email from [redacted] to contact him, and would be deployed. I responded to [redacted] and was shuttled to an affected area, to meet up with Squad Three,

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who I understand, had been operating without a Hazmat Specialist. I obviously came to the area at the end of the Search phase, as within 15 minutes, all four Squads returned to a staging area for rehabilitation. While still in the disaster area, Hazmat Specialist [redacted] informed me that none of the Hazmat Specialists had monitors because the "Hazmat Rig was left at Hensley Field."
Upon returning to the staging area, I met up with the acting Hazmat Manager [redacted] He stated that the USAR rig was loaded up, but was left at Hensley Field. He stated that he reached out to an officer on a Garland Fire Department quint to see if they had any monitors that could be used in the Reconnaissance and Search phases of the incident. That officer stated that they only had Carbon Monoxide (CO) monitors. He asked that same officer about the Garland Health Department's Hazmat Team, but discovered their team is primarily an environmental type of response team, and didn't have monitors that would be utilized in an Urban Search & rescue environment. The officer also stated that Garland "uses Dallas' Hazmat Team for responses."

At the demobilization meeting, of which I attended, I let Acting Hazmat Manager [redacted] speak on behalf of Hazmat, as it relates to lessons learned, positives and negatives. The rationale is that he had been the managerial component for Hazmat during most of the incident. He did state to all members that the Hazmat USAR Rig was loaded, but not brought to the incident scene. The person leading the meeting (Assistant TFL [redacted] stated that was "unacceptable." I couldn't agree more. After the meeting broke, I made immediate contact with both Logistics Managers [redacted] & [redacted] concerning this matter of not deploying a necessary piece of equipment.
I was informed by Lieutenant [redacted] that "He knew Hazmat was out here, and thought that was enough." It should be noted that indeed Hazmat 3 was assigned as a mutual aid to Garland (see Visinet Incident number [redacted]).
Yet, here are the facts concerning this mutual aid Hazmat Incident. Hazmat 3 was assigned to investigate a reported gas leak at 20:53:38. They arrived at 21:19 and staged at a pre-designated staging area. They would stage the entire

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duration, clearing from the incident at 03:33. It should be noted that TTF2 didn't muster at Hensley Field until 0500, approximately 1.5 hours after Hazmat 3 had cleared the incident scene. So there was no Dallas Fire Hazmat presence when TTF2 arrived. I was unable to speak to the Safety Officer, [redacted] or the TFL [redacted] after the demobilization meeting. After speaking to the Logistics Managers, it is my belief that both returned to the Base of Operations.

With these details in mind, and speaking as a Hazmat Manager, I feel it is prudent, and within my purview, to speak to the possible errors that were made, and the imminent dangers that members were placed in, as it relates to the Hazmat component of USAR Operations.

First, I must address my reference to specific Federal Emergency Management Agency (FEMA) standards. The FEMA Annex B Concept of Operations in a Contaminated Environment- October 2013 will be utilized. For your reference, the link to this Annex B is here: http://www.responsesystem.org/SiteAssets/Pages/US%26R-Documents/Ops%20Man%2012-001%20%E2%80%93%20Annex%20B%20%E2%80%93%20CONOP%20%E2%80%93%20US%26R%20Operations%20in%20a%20Contaminated%20Environment%20(Oct%202013).pdf

Page 1 under subsection 1-2-Mission states: "This objective can be accomplished through the application of limited monitoring, detection, and contamination reduction capabilities." Then, section 1-3-Situation states: "The health and safety of rescuers is of paramount concern and is the primary focus of the task force Hazmat Specialists." With a Task Force member's safety of paramount concern, was the designated Safety Officer aware that Reconnaissance and Search & Rescue Squads were entering structures that had not been cleared of hazards by Hazmat Specialists? Did the Incident Action Plan include searches downrange of structures without atmospheric monitoring? Was the Site Safety Plan modified to reflect the absence of required atmospheric

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monitoring of structures and their surrounding environment, as outlined clearly in Annex B (addition of the ICS-208HM form into the Site Safety Plan)? Was the Task Force Leader advised of such a deviation from accepted and normal procedures, and agreed to such? Hazards such as radiological, combustibility (Lower Explosive Limit-LEL), & Oxygen concentration must be monitored prior to entry into a structure, amongst other hazards. To not perform such monitoring, is in direct conflict with the aforementioned Annex B, (page 20, section IV), under duties of the Hazmat Specialist. It is my understanding that [redacted] had shut down main feeder lines into residential areas, but that is no guarantee that natural gas had bled completely out of ruptured lines, and that no pockets of natural gas existed in void spaces of compromised and destroyed structures. There were approximately 200 structures that TTF2 performed some form of hasty or comprehensive search, and each of these without any atmospheric monitoring? In any form, how is it acceptable to allow and/or order members into such an unknown environment in which conditions are potentially Immediately Dangerous to Life & Health (IDLH)? We do know that [redacted] serves the communities that TTF2 searched, and included ruptured gas lines in residential areas. Also, the mobile home park searched included above-ground propane storage tanks. What was the structural integrity of such tanks, and were feeder lines ruptured, requiring TTF2 members to approach from an uphill and upwind direction? At a direct, point of contact level, and in a supervisory role, how did Squad Leaders determine that an atmosphere and environment, and a structure was safe to enter? Based on what qualitative or quantitative assessments of Oxygen levels, LEL, Carbon Monoxide, Hydrogen Sulfide, & Volatile Organic Compounds (VOC)? Were members entering either an oxygen-deficient or oxygen-enriched atmosphere? As a Hazmat Manager, I cannot imagine that both the Safety Officer and Task Force Leader would unilaterally agree to conduct Urban Search and Rescue Operations without performing atmospheric monitoring. It is incomprehensible from a Fire Service perspective as well, and is a basic concept of both risk assessment and hazard mitigation strategies from an emergency response agency.

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Another issue that I would like to address is the deployment of designated resources for a USAR response. I am unable to understand how an entire apparatus was overlooked in the response convoy. Is this a Planning issue? I do not know when Logistics realized that the Hazmat USAR rig was left at Hensley Field, but were any efforts made to get the rig delivered to the incident scene? The rig carries a cadre of Personal Protective Equipment (PPE), Decontamination equipment, as well as detection and monitoring equipment. In the event that members (including Canine resources) needed any level of decontamination, TTF2 members would have to rely on another agency to accomplish such a basic function. I was told by [redacted] that a possible reason is that there were no "Dallas drivers" available. In a Task Force comprised of mostly Dallas Fire Rescue members, not one could be utilized to drive? I simply find it difficult to believe this was the case. Also, it seems rather redundant in retrospect to have TTF2 rely on having Dallas Fire Rescue Hazardous Materials Response Team as a resource, when we have a designated Hazmat USAR rig, with equipment and staffing to complement it. As stated earlier, Hazmat 3 wasn't even in the City of Garland or even in a staging location when a Logistics Manager thought they were. The Task Force's reliance upon outside agencies to take the place of, or even augment Hazmat USAR responsibilities, is revealing of many issues within Texas Task Force 2.

I feel such issues & deficiencies deserve immediate attention. Safety and incorporating safe practices in the USAR environment gives members a greater sense of security, enabling members to work with a level of confidence that the environment has been screened for dangers. To do less, is to do a disservice to members of TTF2, and breaks with accepted practices of risk management and hazard mitigation & hazard assessment.

As a Manager, I understand that highlighting deficiencies is not enough. Therefore, I offer the following proposed actions to improve operations and safety

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from a Hazmat perspective. First, speak to all TTF2 members via monthly training about the incorporation of Hazmat into Reconnaissance and Search practices. Next, follow up with Managers, Safety Officers, and TFL's about Hazmat's integrated role in developing and implementing the Site Safety Plan, Incident Action Plan, and perform a Tabletop exercise to reinforce Hazmat into the various stages of an incident, from pre-planning to incident termination. Then, follow up with Logistics about procedures for insuring the Hazmat USAR rig is deployed with all other apparatus from Hensley Field, including written contingency plans in the event the rig can't deploy.

In closing, I thank you for your understanding and patience in this rather lengthy memo. Its intent was to show an increasing level of disconnect between at least two components of the USAR program. Secondary to that, is to adequately document deficiencies related to accepted FEMA USAR Team best practices, outlined in Annex B, Concept of Operations. The Hazmat Specialist should be viewed as an integrated safety officer, embedded within Search teams. Currently, we seem to be viewed as a "check box" on a long list of required items needed to deploy. That is the reality from my perspective, and this memo conveys my thoughts alone.

I would be happy to speak to anyone in the Chain of Command concerning this memorandum, if warranted.

Respectfully submitted,

[redacted]
Hazmat Manager, [redacted]
Texas Task Force-2
Urban Search & Rescue

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Figure 18. Urban Search and Rescue Operations Safety Concerns[356]

The memorandum is rather direct and seems to endeavor to reinforce the purpose of HazMat specialists and HazMat managers on TTF-2, which is to keep the task force members safe by verifying that the operating environment is safe, and provide a continuous and consistent presence in the event that conditions deteriorate. From an organizational drift and normalized deviance perspective, the memorandum seems to

[356] Source: Texas Task Force 2 Hazmat Manager to Texas Task Force 2 Program Manager, redacted email message to author, January 9, 2016.

imply the idea of "production over safety" as normal in this incident, by entering structures that may possibly contain hazards, such as ruptured natural gas lines and task force members putting themselves at increased risk without monitors to verify the absence (or presence) of HazMat. The concept of operations iterates multiple times that the security and safety of task force personnel is of paramount importance.[357] Furthermore, and as the memorandum speaks to, was the designated safety officer, and the task force leader, advised of the HazMat vehicle not being located on site, and under what pretext can the safety officer, in good conscience, send task force members into possibly hazardous structures without air monitoring? Overall, the memorandum appeared to reinforce the concept of operations for USAR operations in a contaminated environment particularly related to keeping the task force safe as a local workgroup.

The response to the HazMat manager's memorandum from the DFRD's USAR program manager offers insight into the operational mindset of how critiques are accepted and processed, despite the criticism coming from a fellow task force member. The reply listed eight deployment issues that had a bearing on the eventual exclusion of the HazMat vehicle from the equipment convoy. Yet, the last point perhaps is significant. The last issue states, "There is a general lack of understanding of the concept of operations for US&R operations in potential hazardous materials environments. Some of this is due to the fact that the majority of our training has focused on rescue operations and search operations."[358] This rebuttal clarifies the position of HazMat operations and concerns within TTF-2; namely, that other operations take precedence and priority in training over HazMat operations, and how these operations, based on keeping all members safe, are not given a higher ranking. It is therefore understandable that since HazMat concerns receive a lower priority in training that these transfer over to actual deployments, to the increased jeopardy of all task force members.

In summary, numerous documents and published materials related to the fire service culture have been investigated to determine if the materials functioned in either

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[357] National Urban Search and Rescue Response System, *Concept of Operations Annex B-US&R Operations in a Contaminated Environment*, 2. See Section 1–5, Assumptions.

[358] Program Manager, "Response Memo—US&R Safety Concerns" (official memorandum, Dallas: Texas Task Force-2, February 3, 2016), 2, no. 8.

antagonist or protagonist roles as it corresponds to organizational drift or normalization of deviance within the DFRD. Starting with a review of the DFRD after action reports (AARs), research suggests a possible organizational drift exhibited through common errors noted in AARs. A second DFRD internal source of information is an injury database that ranked injuries into 15 classes, with an expanded discussion on exposures to potentially harmful products that pointed to a lackadaisical use of protective gear. Next, a review of both the DFRD's MOPs and SOPs was conducted to search for any normalized deviance in the procedures.

Next, an analysis of documents outside of the DFRD was conducted to probe for similar characteristics. The first two sources canvassed concern the integral role of the ISO position, and the manuals used for training DFRD personnel. The next item is the textbook used by the DFRD in its training of new recruits. A following source involved reviewing the Everyone Goes Home website, which is profoundly influential to fire department safety programs, including the DFRD. The final section of the chapter seeks to show through specific examples in the DFRD's history how organizational drift and potentially normalized workgroup deviance factored into decision-making that placed DFRD members in eminent danger or possibly were a contributing factor in a DFRD LODD. Whereas many vocations seek to circumvent risk in the workplace, firefighters and other first responders, including police officers and EMS workers, actually seek to locate and interact with the hazards to diminish their impact on the situation. Members of the DFRD respond to emergency situations guided and dependent on both internal and external documents that help craft and define components of response frameworks, which are theoretically devoid of subtle influences of processes that seek to promote organizational drift or normalized deviance.

VII. CONCLUSIONS AND RECOMMENDATIONS FOR THE U.S. FIRE SERVICE REGARDING THE NORMALIZATION OF DEVIANCE

Every strike brings me closer to the next home run.

~ Babe Ruth

In light of the previous chapters that have examined root causes of organizational drift that lead to a normalization of deviance within the fire service, and specifically the DFRD, this chapter develops conclusions based on the data provided in earlier chapters. Additionally, three specific policy recommendations are presented that fundamentally seek to impede or altogether avert the damage that such phenomena can have on the fire service. The conclusions drawn from the research are intended to reveal the complex nature of the problem facing the modern fire service in general, and are likely present in all fire service organizations to one degree or another. Firefighting agencies committed to protecting its employees, as well as maintaining a respectable level of organizational health, are indubitably introspective as a matter of self-preservation. The following conclusions are designed to reveal the current state of organizational attitudes that pervade the U.S. fire service.

A. CONCLUSIONS

(1) Conclusion Number 1

"Near-miss" reporting, as a self-evaluative method, has been generally undervalued by organizations from its ability to gauge resiliency effectiveness, as well as prevent future incidents or accidents, and its underreporting deprives organizations like the U.S. fire service of learning opportunities.

In the hierarchy of accident causation as described in Chapter III, near misses are an antecedent to an incident in which organizations can learn from events, as well as personnel actions and reactions that lead up to the near miss, yet are hardly reported as no actual injury occurred. Since the near miss incurs no loss to the employee (through injury

time or financial loss through medical expenses) or organizational loss (like equipment), any lessons learned by the employee remain localized. The true value in a near miss event is realized when the facts surrounding the event are shared on a global scale, so that those in similar situations in the future can be cognizant of action sequences and their potential outcomes. Likewise, the near miss offers a trial run of organizational resiliency frameworks, without experiencing an actual loss from employee injuries, as well as financial or materiel damage. In light of the negative implications that a near miss should reveal to an organization, the overall effect should be seen as an educational experience that is capitalized on. Organizations whose members operate in dangerous atmospheres, such as firefighters, can gain tremendous value from near miss events, as areas such as situational awareness, decision-making paradigms, and judgment parameters can be reconciled with other firefighters.

(2) Conclusion Number 2

Production goals and safety measures are antagonist agents against one another, which compromise the employee, as well as the establishment of irrational societal norms cultivated within the local workgroup.

Organizations are enterprises that meet needs through the offering of goods or services to consumers. While the safety of the employees should be of paramount importance to the organization, the businesses must produce their products, which can expose their employees to ever-changing levels of risk. This project has investigated how production pressures within organizations can induce personnel to cut corners in regards to performing safely to produce at a certain level. This concept was exemplified in the 6-page memorandum found in Chapter VI where members of TTF-2 entered compromised structures without safety checks by personnel to achieve tactical goals. The overarching idea expressed in the production over safety argument is that management signals to produce can be misconstrued or decoded as sanctioned behavior as no adverse effects were encountered while cutting corners.

(3) Conclusion Number 3

The U.S. fire service culture has consistently proven ineffectual at modifying its safety culture, as evidenced by persistent annual casualty rates, due in part to a lack of SA.

While the U.S. fire service produces a modern firefighter who integrates technology and science into decision-making algorithms, the fact remains that firefighters are still encountering LODD, in part due to a loss of SA. A specific instance where SA was lost, leading to a LODD, was in the example of DFRD second driver Stanley Wilson. Recalling that case, the IC clearly lost SA early in the incident by becoming involved in fire-fighting efforts, as well as allowing a building search while operating in a defensive mindset, both of which were indicated in the NIOSH LODD report.[359] The theory of goal seduction may possibly also be a contributing factor to loss of SA, and interplays with the production over safety concept discussed earlier.

(4) Conclusion Number 4

The assessed documents reveal that the DFRD engages in organizational drift and possibly practices a normalization of deviance within isolated workgroups.

The information concerning the DFRD in Chapter VI offers a glimpse into specific operations from a pragmatic point of view, and is not intended to describe all DFRD operations. The intent is to bring to light instances where the organizational drift towards failure was clearly displayed. Additionally, a normalization of deviance does appear to occur within the EMS division, where perpetual non-compliance with the CFR regarding respiratory standards remains, which endangers employees by failing to adhere to a standard designed to protect personnel. Whether individual fire companies, housed at fire stations throughout the city of Dallas, are practicing normalized deviance in response to emergency incidents is unfounded, and outside the scope of this project.

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[359] National Institute of Occupational Safety and Health (NIOSH), *Firefighter Fatality Investigation and Prevention Program, A Summary of a NIOSH Fire Fighter Fatality Investigation, Career Fire Fighter Killed by Structure Collapse While Conducting Interior Search for Occupants Following 4th Alarm-Texas*, ii. See Key Recommendations.

B. RECOMMENDATIONS

The following three recommendations are devised to ameliorate both manifest and latent root causes of organizational drift and normalized deviance in the DFRD. While recommendations are offered namely to the DFRD, broad application to the fire service in general is possible and aspires to provide a simplified roadmap that disrupts organizational drift and arrests patterns conducive to normalized deviance. The recommendations are also sequential as arranged to reveal a developmental strategy for potential implementation. The first recommendation speaks to motivating the fire service to embrace the principles of resilience engineering (RE) that performs as a cornerstone of high-reliability organizations (HROs). Next is a strong suggestion to develop and implement a local "near miss reporting system," so that regional near miss event information can be captured, evaluated, and processed for the copious lessons that exist in such instances. Finally, the last recommendation describes a process by which local fire service organizations like the DFRD can initiate the process of collecting post-incident safety data from more everyday incidents, much like the AARs in the aftermath of large-scale events. In conclusion, the recommendations suggest that the fire service thoroughly leverage the components of HROs to its advantage and then to offer two regional methods to seize data and ultimately to maximize the information for organizational safety advantages.

(1) Recommendation Number 1

The DFRD should appropriate components of HROs through elements of RE into its operational constructs and overall accident prevention planning frameworks in furtherance of measurable organizational safety.

This first recommendation for the DFRD is not so much the application of an original idea, but rather the resurrection and tactical execution of dormant characteristics of HROs. Therefore conjecturally, the DFRD suffers from an identity crisis, one in which it does not realize its potential abilities. Roberts Bea, and Bartles describe three ways in which HROs can become more dependable as an organization, (1) vigorously discover what an organization does not understand, (2) structure a cost/benefit model that reminds

personnel of the toll of failure compared against the gains of organizational stability, and (3) continuously advise employees of organizational game plans through lateral communications, as well as their specific roles within the plan that are conveyed horizontally between members.[360] As stated earlier, the capacity to perform these indispensable measures already lies within the DFRD in dormancy. Therefore, the guidance is to devise a written strategic plan, within a defined timeframe, that clearly defines and articulates the processes that will achieve the three methods for improvement. Allocating internal DFRD resources to such ends maximizes the effectiveness of the workforce and allows knowledgeable employees to uncover weaknesses within their normal environments, foster a cross-pollination of ideas and thoughts, breakdown interagency cultural barriers that stifle growth, and promote a silo effect within organizations.

The DFRD could benefit from a slightly different perspective about the elemental components of HROs, but clearly in unison with the Roberts Bea, and Bartles' article that consists of four conclusions offered by Rochlin, La Porte, and Roberts. The conclusions of Rochlin La Porte, and Roberts concerning HROs promote: (1) The mandate of safety from organizational leadership is vital, (2) redundancy as an essential component, (3) reliance on a distributed employee network to handle some arduous cases with authority actively as organizational values have been instilled, and (4) organizational enlightenment through experimentation with lesser effects to preclude greater threats in the future.[361] Slight differences in findings primarily include the need for redundancy and a more expanded view of decentralization and its overall effect on a system. The DFRD to a degree is a decentralized organization that empowers the IC with decision-making authority at incident scenes.[362] The concept of redundancy is also somewhat established

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[360] Roberts, Bea, and Bartles, "Must Accidents Happen?" 71.

[361] Gene I. Rochlin, Todd R. La Porte, and Karlene H. Roberts, "The Self-Designing High-Reliability Organization: Aircraft Carrier Flight Operations at Sea," *Naval War College Review* 51, no. 3 (Summer 1998): 98.

[362] Dallas Fire Rescue Department, *Dallas Fire Rescue Manual of Procedure 600.00 Emergency Response Procedures*. See Section 601.01 and 601.02, Incident Commander.

through the completion of DFRD fire apparatus "fill-ins" in resource-depleted areas when other fire-fighting equipment is utilized at larger incidents.[363]

Next, the DFRD can benefit from within its own ranks by engaging the principles found in RE. Hollnagel seeks to reclaim what has been a general misapplication of the term "resilience" in an organizational context when he writes, "RE has from the very beginning maintained that resilience is a characteristic of how a system performs, not a quality that the system as such has or possesses. Resilience is functional and not structural."[364] Such disparity of terms is critical to understanding the role that resilience plays in preventing normalized deviance, as resilience is essentially a measurable performance metric that can gauge the robustness of an organization quantitatively, as opposed to a semi-qualitative understanding that claims possession is equal to effectiveness. Dekker et al. agrees with Hollnagel in redefining resilience to take on a positive connotation, whereby resilience defines what is good about organizational skillsets and their flexibility in stressful situations, as opposed to eliminating adverse events.[365] Such efforts actively seek to prevent accidents from happening.

Unfortunately, accidents will occur, and oftentimes organizations concentrate exclusively on what went wrong as the foundation of accident causation. Besides, an awareness of what went wrong aids investigators into promoting actions that seek to prevent future and similar episodes. An orthodox risk matrix, provided by Hollnagel, is shown in Figure 19.

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[363] Dallas Fire Rescue Department, *Dallas Fire Rescue Department Emergency Response Bureau Standard Operating Procedures* (Dallas: Dallas Fire Rescue Department, 2016). See Section 100.11.B, Category B Box-Radio Communications/Response Anomalies.

[364] Erik Hollnagel, "RAG-The Resilience Analysis Grid," in *Resilience Engineering in Practice: A Guidebook* (Farnham, Surrey, UK: Ashgate Publishing Limited, 2011), 275, Introduction.

[365] Dekker et al., *Resilience Engineering*, 3, Executive Summary.

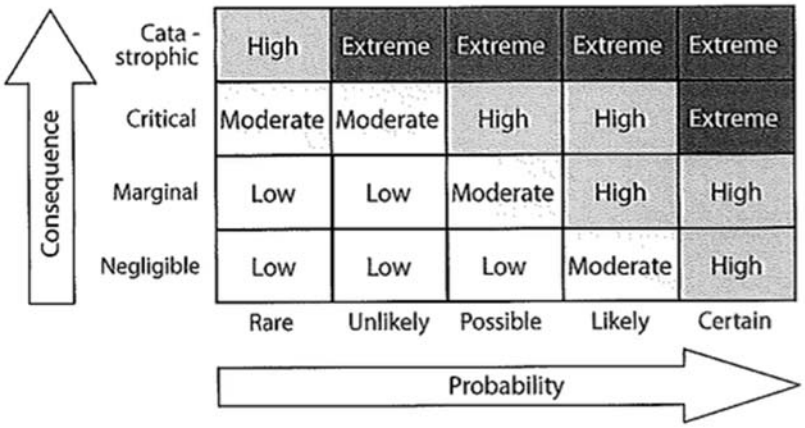

Figure 19. Traditional Risk Matrix Model[366]

In this model, the degree of risk is dependent upon two variables, consequence on the vertical axis, and probability on the horizontal axis. It is upon this influential model that many organizations base their prescriptive risk models for operating in potentially hazardous environments. Those whose risk is deemed to be in the extreme or even high categories tend to be avoided at all cost, and therefore safer alternatives are opted for to achieve tactical goals. Any increase in either consequence or probability theoretically pushes the boundaries of safety into undesirable realms of risk.

A limiting factor in using such a model, one indicated by Hollnagel, is that this model solely considers errors in incidents.[367] Therefore, this begs the question of when does an organization routinely examine what it does right? To bolster this point, Hollnagel adds, "It is furthermore reasonable to expect that things normally will go right, that they will turn out as planned or intended, and that it is unusual for things to go wrong."[368] Without a doubt, organizations experience more things that go right than wrong, yet how much time is spent studying *how* and *why* things go right in

366 Source: Erik Hollnagel, "Prologue: The Scope of Resilience Engineering," in *Resilience Engineering in Practice: A Guidebook* (Farnham, Surrey, UK: Ashgate Publishing Limited, 2011), xxx, http://www.itn.liu.se/mit/education/courses/tnfl05-risk-och-olycksanalys/vecka-49/1.308926/Hollnagel 2011.pdf. See introduction.

367 Ibid.

368 Ibid.

organizations? (Emphasis added) Hollnagel also notes that people historically revert to habituation, where people cease to notice the item or action that they have grown accustomed to sensing or seeing. Continuing in the theme of organizational reviews of what goes according to plan requires the application of an altered risk matrix model, one in which the consequence domain is expanded to consider positive results. For this reason, Hollnagel submits a more detailed matrix in Figure 20.

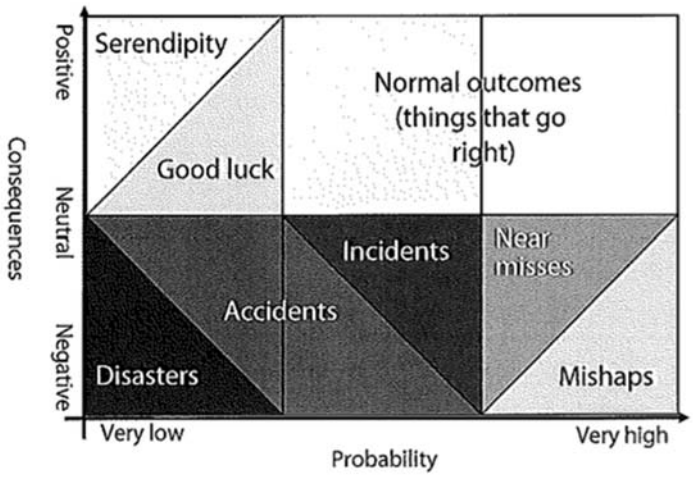

Figure 20. Hollnagel's Revised Risk Matrix[369]

This updated matrix seems to reflect the reality more accurately in which most organizations including the fire service operates, experiencing normal outcomes. Leveraging this revised type of risk matrix may prove beneficial for organizational leadership to understand Recommendation 2. The DFRD can potentially interrupt organizational drift and normalized deviance through a revival of the components of both HROs and RE.

(2) Recommendation Number 2

The DFRD should institute a localized structure of the national "near miss reporting system," to collect anonymous data to be applied to identifying trends,

[369] Source: Hollnagel, "Prologue: The Scope of Resilience Engineering," in *Resilience Engineering in Practice: A Guidebook*, xxx. The figure was originally entitled "Range of Outcomes."

executing training, and providing educational opportunities driven by data native to the DFRD.

Firefighters place themselves in dangerous situations to rescue persons or save property from the destructive forces of fire or other hazards. It is conceivable that some encounters will produce a near miss, when a firefighter come close to suffering an injury, but does not. While an unknown number of these near misses go unreported, since no injury occurred, the firefighters' experience (how they reacted, conditions leading up to the event, etc.) is lost as a teachable moment for others who might experience very similar conditions at some point in the future. However, steps are being taken to quantify the problem and scope the size of common issues through nameless self-reporting websites like www.firefighternearmiss.com. Perhaps, many near misses go unreported potentially due to a lack of understanding that such incidents hold tremendous educational value to making the fire service safer. The aforementioned referenced website started in 2005 and claimed to have documented over 5,000 near miss reports, according to its 2016 annual report.[370] While the website tracks generic statistical information, such as service area (urban or rural, for example), the website currently has no means to bring such information down to a local level, where information particular to an organization can be reviewed by its leadership.

Having said that, the same website took strides to remedy the localized issue in 2017 by providing a customizable program that allows data to become localized and organization-specific, known as the Insight 360 Event Reporting Tool.[371] It is possible however, that the DFRD may be able to create its own internal NMRF for use within its IDS. A customizable NMRF can plausibly produce several positive results for the DFRD. First, the form can be tailored to obtain information that may be specifically plaguing the organization, with input from within the DFRD itself. Next, a localized form can be received and processed in a more expedient fashion than those forms filtered through a

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[370] National Firefighter near Miss Program, *2016 Firefighter near Miss Annual Report* (Fairfax, VA: International Association of Fire Chiefs, 2016), 2, http://firereports.nationalnearmiss.org/Portals/2/EasyDNNNewsDocuments/Annual%20Reports/2016%20Firefighter%20Near%20Miss%20Annual%20Report.pdf. See About the Program.

[371] Ibid., 14. See the New Resources and Updates section.

national collection platform, which decreases the time from reporting to acknowledgement. Finally, implementing the NMRF can serve as a local example to other fire service jurisdictions of the commitment to safety and the strides that the DFRD is willing to undergo, which can influence local partners, as well as enter into a tangible partnership of member safety.

While the NMRF can take several shapes, Figure 21 is an example of a possible primary template to be incorporated. An inspection of this NMRF reveals that the form is submitted anonymously. The promise of anonymity affords the member completing the form a measure of relief from retaliation for reporting near misses that reveal violations of procedures. Obviously, instituting this form requires a policy to outline its scope, purpose, design, and limitations. Training of members to complete the form properly should be conducted to introduce the program formally to all DFRD members, as well as an understanding of how received data will be used. It is suggested that either quarterly or semi-annual reports revealing aggregate data and common themes be produced and distributed. Such information can serve to drive future in-service training sessions that reinforce correct procedures that accurately address received NMRFs.

Dallas Fire Rescue Department
Near-Miss Reporting Form
This Form is to be completed and submitted Anonymously.

Date of Near Miss: _____

Type of Incident (Choose One):
Structure Fire ☐ (Check if Vacant Structure ☐) Motor-Vehicle Accident ☐
Emergency Medical Service ☐ Vehicle Fire ☐ Extrication ☐ Other ☐ Training ☐
Special Operations: USAR ☐ HazMat ☐ Boat Call ☐ ARFF ☐ Wildland ☐

Relationship of the Member reporting the Near Miss? Self ☐ Other ☐

Describe in detail the factors leading up to the Near-Miss event (be as descriptive as possible):

Were there any actions that could have prevented the Near-Miss? If so, please describe.

Return completed form in provided sealed envelope to:

Dallas Fire Rescue Department
Attention: Section Chief/Safety Division
5000 Dolphin Road
Dallas, Texas 75223

Safety Section Only

Date Received: _____ Investigating Safety Chief: _____

Classification: PPE Violation ☐ Safety Violation ☐ MOP or SOP Rule Violation ☐

Figure 21. DFRD Near-Miss Reporting Form

(3) Recommendation Number 3

Given the tremendous value of an AAR as a debriefing mechanism, the DFRD should seek to increase the frequency of documenting AARs on routine incidents that can be shared collectively for the benefit of all members.

A key component for fire service personnel in the immediate aftermath of an incident is to discuss their actions casually amongst other firefighters, which is then formally reported in a written AAR. The AAR provides an official, written account of events that occurred at the scene of an incident, including initial actions, as well as accountability and areas that need improvement. While DFRD SOPs dictate when the completion of an AAR is mandatory, no constraint exists in the same SOP to prevent an IC from voluntarily completing an AAR. In fact, the creation of an AAR is always at the discretion of the IC.[372] The recommendation seeks to increase the frequency of formal AAR reporting procedures to obtain increased data concerning firefighter efforts at routine incidents.

For those incidents in which an AAR is required, the DFRD provides a five-page AAR template for ICs to use in achieving consistency in reporting.[373] A review of the form seems too lengthy for the routine incident, and is impractical to complete in a timely manner for those involved in emergency response. However, an abbreviated version of the AAR can still prove beneficial by collecting and recording pertinent information from ordinary emergency runs. Figure 22 provides an abbreviated, two-page AAR that attempts to document crucial data. The purpose of the required information is intended to collect vital DFRD member actions within the bulk of everyday emergency responses. Unlike the NMRF, this condensed AAR is required information that is completed by the IC and is not confidential. Whether this abridged AAR is placed on a DFRD apparatus mobile data computer (MDC) for completion while still on scene is the decision of DFRD's leadership. It does seem logical to have the mobile capability to complete the forms at the incident scene.

[372] Dallas Fire Rescue Department, *Standard Operating Procedures 100.00 Emergency Response Bureau*. See Section 131.03, Scope.

[373] Ibid.

Dallas Fire Rescue Department

Incident After Action Report

Apparatus Type: Engine ☐ Truck ☐ Rescue ☐ BC ☐ Date: _____

Time In Current Rank: 1-5 Yrs. ☐ 6-10 Yrs.☐ 11-15 Yrs.☐ 15+Yrs.☐ Time: _____ AM ☐ PM ☐

Type of Incident (Choose One):

Fire-Related ☐ EMS Related ☐ Officer Name:_____

Special Operations ☐ Select Specialty Below:

(ARFF ☐ HazMat ☐ Marine 1 ☐ USAR ☐ Water Rescue ☐ WUI ☐)

Appropriate Actions

As the Incident Commander, list at least three appropriate actions that occurred in this incident:

1. _____

2. _____

3. _____ (List others if necessary)

Proper Personal Protective Equipment Donned by ALL Members for the given Incident Type? (Per current DFR MOP/SOP) Yes ☐ No ☐ Unsure ☐

To your knowledge, were any injuries reported to the Incident Commander as a result of non-compliance with PPE use? Yes ☐ No ☐

Do you feel that current DFR Procedures adequately address issues related to this type of Incident? Yes ☐ No ☐ Unsure ☐

If "No," what changes should be made? _____ (Use Additional Sheet if Necessary)

Was there a Designated Safety Officer at this Incident? Yes ☐ No ☐ Unsure ☐

Do you believe the Safety Officer limits your performance level at Incidents? Yes ☐ No ☐

Describe any additional actions either taken or observed that you consider appropriate:

_____

_____

_____(Use Additional Sheet if Necessary)

Inappropriate Actions

Slide 1 of 2.

_____

_____

Did you personally observe any actions of DFR members that you believe were Inappropriate or Unsafe? Yes ☐ No ☐

Please Explain:

_____

What specific action(s) did you witness that were Inappropriate or Unsafe?

_____

_____(Use Additional Sheet if Necessary)

Was the Inappropriate or Unsafe Action terminated when discovered? Yes ☐ No ☐

Overall, for this incident, do you perceive DFR as an organization that practices "Safety First," or "Get the Job Done"?

Safety First ☐ Get the Job Done ☐

Additional Comments:

_____

_____ (Use Additional Sheet if Necessary)

It is essential that company officers understand that the completion of this form is not punitive. The sole intent of this form is for informational purposes only, and will not be used in any disciplinary proceedings.

Slide 2 of 2.

Figure 22. After Action Report

Integrating the AAR into daily operations throughout the DFRD should ideally be implemented in a phased-in approach after appropriate training and policy that clarify and define the reasoning behind such changes. It is suggested that all companies required to complete the forms begin with a small number of required forms to complete per shift, such as one third of all incidents. With time and increased proficiency in completing the forms, the percentage of required documentation increases until 100% of incidents are documented. The timeframe should be clearly defined with target dates for total implementation expressly given. Information in completed forms can be extrapolated to discover common occurrences of negative issues for further evaluation and potential training modules at a later date. Future iterations of the form, for increased brevity or wholesale changes to the form, should be strongly considered as needed.

It can be acknowledged that the three recommendations offered may be met with noticeable resistance from DFRD members. In addition, it is reasonable to assume that discharging the NMRF and AAR programs are expected to generate a financial cost by way of personnel to process received information and computer equipment to process and securely store acquired data. Furthermore, it is understood that such implementations may have ramifications for appointed officials in the event that widespread instances of near misses reflect unfavorably on the confidence levels of DFRD emergency personnel. Assuredly, exuberant levels of safety infractions, coupled with documentation attesting to that fact, may almost necessitate a written plan of action to ameliorate both the frequency and severity of infractions and near misses. This plan of action should include a timeline in which to achieve a quantifiable level of reduced notifications through NMRF reporting and other instituted control measures to gauge the impact and effectiveness.

Hesitation in form completion by DFRD members may pose an initial problem for using the NMRF for fear of reprisal, despite policy implementation that communicates otherwise. Simultaneously, it is plausible that the submission of these same forms may possibly reveal a lackadaisical attitude towards safety in general, which can be rampant throughout the organization. The result of near miss reporting may close the gap between what an organization *thinks* is happening as opposed to what is *actually* occurring within its ranks. Information gleaned from NMRFs could prove invaluable in future injury

prevention efforts. Measuring the cost between a member's satisfactions with the status quo about safety and preventing a member's accident, where the potential for loss of life exists, is still a worthwhile enterprise. In the event that only one recommendation can be chosen for implementation, the NMRF recommendation provides the most immediate increase in functional knowledge that has the ability to drive changes in behaviors. Raising near miss awareness and serial reporting as a constructive necessity within fire service organizations through NMRF instruments or other accounting methodologies will be paramount in determining whether those same organizations can adopt emerging data sources to their advantage.

C. FUTURE RESEARCH

It is strongly recommended that future research into the normalization of deviance within the fire service be considered. Particularly, further examination may include a more in-depth and detailed exploration of how accumulated data from high-risk occupations can be gathered, evaluated, and leveraged to pinpoint further normalized deviance within workgroups. For the fire service, the concept of collecting aggregate data on near misses for analysis and educational purposes is still in its infancy. Additionally, a comparative review between the traditional risk matrix model and Hollnagel's revised risk matrix model may prove beneficial for organizations by improving the sensemaking capabilities for its members engaged in events resulting in near misses. Such a philosophy would certainly be predicated on the role that RE tenets play in the modern fire service. If the persistent trends of annual firefighter fatalities are to be decreased to a perceptible degree, the fire service culture must be examined for dysfunctional behaviors that have classically been acknowledged as mainstream thought that has been potentially naturalized into a firefighter's decision-making skillset.

This thesis aspires to support firefighters by assisting their entire organizations through identifying behaviors antithetical to fostering best practices. It is understandable that the ideas contained in this thesis may possibly present themselves as revolutionary or too lofty for some. Yet, consider the words of Machiavelli, when he writes,

> Let him act like the clever archers who, designing to hit the mark which yet appears too far distant, and knowing the limits to which the strength of their bow attains, take aim much higher than the mark, not to reach by their strength or arrow to so great a height, but to be able with the aid of so high an aim to hit the mark they wish to reach.[374]

The phrase "caring, serving, and protecting" is written on the side of all front line emergency response vehicles in the DFRD fleet. While firefighters are committed to this motto for the citizenry served, an internal commitment to care, serve, and protect the first responder should be discoverable in actions and attitudes throughout dynamic fire service organizations. The trajectory of this thesis, much like the archer's arrow, is to reach its intended target through aiming for a higher understanding of the fire service culture.

[374] Nicolo Machiavelli, *The Prince*, Electronics Classics Series, trans. W. K. Marriott (State College, PA: Pennsylvania State University, 2001), 28–29.

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