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THESIS

**PRE-INCIDENT PLANNING FOR THE LOS ALAMOS
NATIONAL LABORATORY**

by

Troy L. Hughes

December 2017

Thesis Co-Advisors:

Lauren Wollman
Erik Dahl

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**PRE-INCIDENT PLANNING FOR THE LOS ALAMOS NATIONAL
LABORATORY**

Troy L. Hughes
Fire Chief, Los Alamos County Fire Department, New Mexico
B.A., Doane College, 2005
M.A., Doane College, 2008

Submitted in partial fulfillment of the
requirements for the degree of

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December 2017**

Approved by: Lauren Wollman, Ph.D.
Co-Advisor

Erik Dahl, Ph.D.
Co-Advisor

Erik Dahl, Ph.D.
Associate Chair for Instruction
Department of National Security Affairs

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ABSTRACT

The Los Alamos Fire Department (LAFD) provides emergency response services to the Los Alamos National Laboratory. The laboratory places high expectations on the delivery of these services; over a twenty-year period, however, multiple third-party evaluators identified problems with the LAFD's pre-incident planning process. This thesis investigated pre-incident planning improvement methods and found that the LAFD plans for the Los Alamos National Laboratory lacked information and collaborative efforts. A review of related literature and best practices from other national laboratory sites and accredited fire departments provided potential solutions. This research recommends that the LAFD establish a working group to improve the pre-incident planning process at Los Alamos National Laboratory, using the best practice examples as guidelines.

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TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	RESEARCH QUESTIONS.....	3
B.	RESEARCH DESIGN.....	3
C.	UPCOMING CHAPTERS.....	5
II.	LITERATURE REVIEW.....	7
A.	PRE-INCIDENT PLANNING STANDARDS AND ORDERS.....	7
B.	BEST/COMMON PRE-INCIDENT PLANNING PRACTICES.....	10
C.	EMERGENCY PLANNING IN THE UNITED KINGDOM.....	13
D.	REPORTS ON PRE-INCIDENT PLANNING IMPROVEMENT EFFORTS.....	15
E.	DECISION MAKING UNDER PRESSURE.....	18
F.	CONCLUSION.....	20
III.	PREVIOUS EVALUATIONS OF LAFD PRE-INCIDENT PLANNING.....	21
A.	1995: BEATTY, HARVEY AND ASSOCIATES.....	21
B.	2004: HUGHES ASSOCIATES, INC.....	21
C.	2009: LOS ALAMOS SITE OFFICE.....	22
D.	2009: DEPARTMENT OF ENERGY INSPECTOR GENERAL.....	22
E.	2009: BASELINE NEEDS ASSESSMENT.....	24
F.	2011: LOS ALAMOS SITE OFFICE.....	25
G.	2013: DOE OFFICE OF ENTERPRISE ASSESSMENTS.....	26
H.	2014: DEPARTMENT OF ENERGY.....	26
I.	2014: BASELINE NEEDS ASSESSMENT.....	26
J.	2016: LOS ALAMOS SITE OFFICE.....	27
K.	2013 AND 2016: INSURANCE SERVICES OFFICE.....	29
L.	CONCLUSION.....	29
IV.	LAFD PRE-INCIDENT PLANNING 2017.....	35
A.	OVERSIGHT AND STAFFING.....	35
B.	FIRE CHIEF’S DIRECTIVE.....	35
C.	TECHNOLOGY.....	36
D.	NEW FACILITY PRE-INCIDENT PLAN DEVELOPMENT.....	38
E.	UPDATING AND MAINTAINING EXISTING PRE- INCIDENT PLANS.....	38
F.	PRE-INCIDENT PLAN DATA.....	40
G.	COLLABORATION WITH LANL STAFF.....	41

H.	CONCLUSION	41
V.	BEST PRACTICES IN PRE-INCIDENT PLANNING	43
A.	NATIONAL LABORATORY FIRE DEPARTMENTS	43
1.	Idaho National Laboratory (INL)	43
2.	Oak Ridge National Laboratory (ORNL).....	46
3.	Brookhaven National Laboratory (BNL)	48
4.	SLAC National Accelerator Laboratory	50
B.	INTERNATIONALLY ACCREDITED FIRE DEPARTMENTS.....	51
C.	CONCLUSION	53
VI.	ANALYSIS AND RECOMMENDATIONS.....	55
A.	RELIABLE ACCESS	55
B.	QUICK ACCESS TO CRITICAL DATA	56
C.	DATA	57
D.	STANDARDS AND ORDERS, AND ENFORCEABLE POLICIES	58
E.	COLLABORATION.....	59
F.	MULTI-LEVEL PRE-INCIDENT PLANNING	61
G.	TECHNOLOGY	62
H.	STANDARDS FOR MAPS, DRAWINGS, AND SYMBOLS.....	65
I.	SECURITY OF INFORMATION.....	66
J.	TRAINING, EXERCISES, AND AFTER-ACTION REPORTS	67
K.	CONCLUSION	68
	LIST OF REFERENCES	71
	INITIAL DISTRIBUTION LIST	77

LIST OF TABLES

Table 1. Pre-incident Plan Update Completion Rates, 2010–2017.....39

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LIST OF ACRONYMS AND ABBREVIATIONS

AHJ	authority having jurisdiction
BNL	Brookhaven National Laboratory
DOE	Department of Energy
FCD	Fire Chief's Directive
INL	Idaho National Laboratory
ISO	Insurance Services office
LAFD	Los Alamos Fire Department (New Mexico)
LANL	Los Alamos National Laboratory
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
ORNL	Oak Ridge National Laboratory
OUO	official use only
UCNI	unclassified controlled nuclear information

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EXECUTIVE SUMMARY

The Department of Energy (DOE) operates seventeen national laboratories across the United States. These laboratories conduct scientific research across a wide spectrum of topics, including the environment, health, computing, and national security. Los Alamos National Laboratory (LANL) focuses on national security. LANL was established in 1943, and its staff work to “provide the best scientific and engineering solutions to the nation’s most crucial security challenges.”¹ LANL is infamously known as Site Y for the Manhattan Project: the newly established laboratory was asked to design and build the world’s first atomic bomb.

The Los Alamos Fire Department (LAFD) provides emergency response services to LANL. The department staffs five response stations with a minimum of thirty-seven emergency responders on duty at all times. The high level of performance expected of LANL researchers translates to a commensurate expectation of LAFD. This expectation is written into a cooperative agreement between LAFD and DOE, which requires LAFD to be a “nuclear-grade” fire department that delivers “enhanced fire department services.”²

The cooperative agreement defines the services the LAFD must deliver to LANL, including the “development and maintenance of pre-incident plans (PIPs) consistent with National Fire Protection Association (NFPA) 1620 standards for LANL buildings.”³ Since at least 1995, outside evaluators representing DOE and the National Nuclear Security Administration (NNSA), or contractors representing LANL, have cited concerns with the LAFD’s pre-incident planning process. This thesis was designed to gain a better understanding of the problems associated with the LAFD pre-incident planning process and to identify potential solutions for process improvement.

¹ “Our History,” Los Alamos National Laboratory, accessed October 8, 2017, <http://lanl.gov/about/history-innovation/index.php>.

² National Nuclear Security Administration, “Cooperative Agreement No. DE-NA0002067” (internal document, County of Los Alamos, October 1, 2013).

³ National Nuclear Security Administration.

The literature review examined NFPA standards and DOE orders related to pre-incident planning. The *NFPA 1620: Standard for Pre-incident Planning* is quite comprehensive, but offered little advice relevant to pre-incident planning at a national laboratory; the standard does not take into account the processes or information protection needs of a national defense laboratory. DOE orders offered very few specifics related to pre-incident planning, though some orders did specifically call for a criticality expert to review pre-incident planning documents when appropriate. These orders also suggested that plans should be constructed and maintained to facilitate a collaborative effort. Specifically, input should be “complemented by input from the site fire protection engineering staff, facility subject matter experts, and emergency responders.”⁴ The literature review also examined best-practice articles from fire department trade journals. Many of the articles focused on introducing technology into the pre-incident planning process. Other written work reviewed included papers written by National Fire Academy students, and an after-action report from Charleston, South Carolina, that highlighted the grave consequences of inadequate pre-incident planning. The statute governing pre-incident planning in the United Kingdom was also reviewed. This statute mandates participation in the planning process; collaboration is essentially forced upon any agency that would respond to an incident at a planned facility. Finally, the rapid decision-making process employed at emergency incidents was reviewed to illuminate how incidents are handled in stressful environments.

Following the literature review, the thesis researcher assembled all past written evaluations of the LAFD pre-incident planning process. Findings across the twenty years of evaluations consistently called for more information in pre-incident plans and greater collaboration with LANL when developing and maintaining the plans. LAFD’s current pre-incident planning process was then evaluated; findings echoed the insufficient information and poor collaboration from LANL found in previous assessments. An additional finding not mentioned in previous assessments, however, was a significant problem with access to pre-incident plans on Toughbook laptop computers. Only 25

⁴ U.S. Department of Energy, *Fire Protection*, DOE-STD-1066-2012 (Washington, DC: DOE, 2012).

percent of the laptops that contained LAFD pre-incident plans could provide access to the information.

Next, the thesis research examined best practices from fire departments that serve national laboratories and internationally accredited fire departments. Research showed that the pre-incident planning practices in these departments were worthy of benchmarking. The information in the plans was far more detailed than in LAFD plans and supporting graphics were far superior. The best-practice processes also exhibited greater collaboration with the facility staff. Another common best practice was categorizing pre-incident plans based on risk and hazards within the facility. The higher-risk facilities received a more detailed pre-incident planning process. Facilities with fewer hazards received a limited pre-incident plan. These departments also set a minimum level for pre-incident planning, allowing them to forgo the planning process for lower-hazard buildings. By eliminating lower-hazard facilities from the pre-incident planning workload, planners could budget more time to improve plans for higher-hazard facilities.

The research conclusion recommends increased collaboration between LAFD and LANL, and more reliable access to LAFD plans. New technology and paper copies for backup are specific recommendations for improving access. Further, LAFD—or any department working toward improvement—should use the best practices identified in this research to improve their pre-incident planning process; when implementing changes, departments can use these practices as benchmarks for their pre-incident planning processes.

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I. INTRODUCTION

The Department of Energy (DOE) operates seventeen national laboratories across the United States. These laboratories conduct scientific research across a wide spectrum of topics, including the environment, health, computing, and national security. Los Alamos National Laboratory (LANL) focuses on national security. LANL was established in 1943, and its staff work to “provide the best scientific and engineering solutions to the nation’s most crucial security challenges.”¹ LANL is infamously known as Site Y for the Manhattan Project: the newly established laboratory was asked to design and build the world’s first atomic bomb.

The Los Alamos Fire Department (LAFD) provides emergency response services to LANL. The department staffs five response stations with a minimum of thirty-seven emergency responders on duty at all times. The high level of performance expected of LANL researchers translates to a commensurate expectation of LAFD. This expectation is written into a cooperative agreement between LAFD and DOE, which requires LAFD to be a “nuclear-grade” fire department that delivers “enhanced fire department services.”² The terms “nuclear-grade” and “enhanced” clearly imply something beyond normal or average, but the agreement provides no guidance for precisely measuring these attributes.

In an attempt to meet these high expectations, LAFD participates in the Center for Fire Accreditation International’s evaluation. Agencies that score high enough on this evaluation achieve accreditation. LAFD is one of fewer than 200 fire departments in the United States that are currently accredited.³ One of the core values in the accreditation process is continuous improvement.

¹ “Our History,” Los Alamos National Laboratory, accessed October 8, 2017, <http://lanl.gov/about/history-innovation/index.php>.

² National Nuclear Security Administration, “Cooperative Agreement No. DE-NA0002067” (internal document, County of Los Alamos, October 1, 2013).

³ “About Accreditation & CFAI,” CPSE, accessed October 7, 2017, <http://www.cpse.org/agency-accreditation/about-accreditation-cfai.aspx>.

Currently, LAFD's pre-incident planning process needs improvement. Pre-incident plans are generated for facilities that are at high risk for emergency situations or conduct unique hazardous operations. These plans are specific to one facility and can be published either electronically or on paper. The level of detail and the plan's format varies between emergency response agencies. Emergency responders use the information contained in pre-incident plans to form strategies for combatting the response challenges associated with the specific facility.

A cooperative agreement defines the services the LAFD must deliver to LANL, including the "development and maintenance of pre-incident plans (PIPs) consistent with National Fire Protection Association (NFPA) 1620 standards for LANL buildings."⁴ Since at least 1995, outside evaluators representing DOE and the National Nuclear Security Administration (NNSA), or contractors representing LANL, have cited concerns with the LAFD's pre-incident planning process.

Concerns have been primarily associated with the plans' insufficient information. Evaluators have also stressed the need for LANL staff to be more involved in the development and maintenance of the plans. When an emergency occurs at a LANL facility, LAFD, a LANL emergency manager, and a representative from the affected facility must work together to manage the emergency. Each responder has a written emergency plan, but the three separate parties' plans are not coordinated with the other groups'. This insufficient coordination prevents the responders from developing a common operating picture. The facility representative or LANL emergency manager may have information vital to LAFD; without this information, LAFD may make misinformed tactical decisions that come with grave consequences.

Previous coordination attempts have been challenged by LANL facilities' sensitive information. Some of the information LAFD needs to meet NFPA 1620 requirements for LANL facility pre-incident plans might be categorized as "official use only" (OUO) or "unclassified controlled nuclear information" (UCNI). While outside evaluators have called for more information within LAFD plans, LANL has at the same

⁴ National Nuclear Security Administration, "Cooperative Agreement No. DE-NA0002067."

time resisted sharing some facility-related information. This hesitation to share information is likely due to LAFD pre-incident plans being contained in a Los Alamos County–managed database rather than within the LANL database. All LAFD emergency responders must hold a DOE Q clearance, which is equivalent to a top-secret security clearance; this shows that the concern with releasing information is not related to the user. LANL officials who do not know enough about or trust the security of the Los Alamos County–owned database are not willing to jeopardize sensitive information related to LANL facilities. Solutions for more effective pre-incident planning will need to identify ways to improve collaboration, determine proper level of information detail, and protect any sensitive information included in the pre-incident plans.

A. RESEARCH QUESTIONS

This thesis research set out to answer the following questions:

- What can be done to improve the LAFD pre-incident planning process?
- What information should be included in LAFD pre-incident plans to ensure they are consistent with NFPA standards and DOE orders?
- What are the common or best practices that other fire departments are using to ensure their pre-incident plans are consistent with NFPA standards and DOE orders?

B. RESEARCH DESIGN

This thesis provides a prescription for changes to the LAFD pre-incident planning process that will improve the process and satisfy the needs of outside evaluators who are charged with periodically evaluating the pre-incident planning process. The thesis development relied on the policy analysis process described by Bardach and Patashnik.⁵ When selecting pre-incident planning process best practices, the researcher followed guidance from Bardach and Patashnik’s “Smart Practices Research” chapter.⁶ Without a national fire department ranking system to guide the selection of “best practices,” the author requested pre-incident planning practices data from other national laboratories and

⁵ Eugene Bardach and Eric M. Patashnik, *A Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving*, 5th ed. (Thousand Oaks, CA: Sage, 2016).

⁶ Bardach and Patashnik, 125.

internationally accredited fire departments. The author made three separate direct email requests for information to multiple DOE national laboratory sites. Responding laboratories included Idaho National Laboratory, Brookhaven National Laboratory, and Oak Ridge National Laboratory. Data related to the pre-incident planning program at SLAC National Accelerator Laboratory was derived from a presentation delivered during the annual Department of Energy emergency management conference held in Las Vegas on May 22–25, 2017, which the author attended. The presentation was given by the laboratory’s assistant fire marshal, Lance Lougee.⁷ References to the SLAC pre-incident planning program are derived from the author’s recollection of the conference presentation.

The research process was designed to create viable recommendations for significant improvements to the current LAFD pre-incident planning program. The recommendations act as a road map for the development, deployment, and maintenance of LAFD’s pre-incident plans for LANL. The recommendations could also apply to other agencies with similar responsibilities to provide emergency services to high-value, high-hazard facilities like LANL.

The intended consumer of this thesis is LAFD leadership and similar emergency response agencies; the thesis is designed to help them establish effective pre-incident plans. The author hopes that this thesis and its recommendations will garner measurable improvements in LAFD’s pre-incident planning process.

To gather evidence necessary for the policy analysis, the author reviewed literature related to pre-incident planning practices found in trade journals and scholarly work from the National Fire Academy. The author also examined LAFD’s current pre-incident planning process, past evaluations of LAFD planning practices, and best-practice examples from other national laboratories and accredited fire departments. The current LAFD pre-incident planning process was then compared to an aggregate of best practices. Specific recommendations for improving the LAFD pre-incident planning process seek to close the gap between the current planning process and best practices.

⁷ Lance Lougee, “Pre-incident Planning for SLAC National Accelerator Laboratory” (presentation, Emergency Management Issues Special Interest Group Annual Meeting, Las Vegas, NV, May 24, 2017).

Other fire departments can also use these findings as a model to compare their pre-incident planning process to best practices.

C. UPCOMING CHAPTERS

The upcoming chapters begin with a review of literature related to pre-incident planning in Chapter II. Chapter III presents previous evaluations of LAFD's pre-incident planning process and establishes common themes. Chapter IV describes and evaluates LAFD's current pre-incident planning process. Chapter V presents best practices in pre-incident planning used by other fire departments, and Chapter VI includes an analysis of the findings and makes recommendations specific to LAFD's pre-incident planning process.

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II. LITERATURE REVIEW

This review examines pre-incident planning literature applicable to LAFD's emergency response for LANL. The review focuses on four primary areas: gaining a greater understanding of NFPA standards and DOE orders related to pre-incident planning, identifying best or common pre-incident planning practices, reviewing similar pre-incident process improvement efforts in the United States and the United Kingdom, and briefly examining how this information is used for decision making during an emergency response.

A. PRE-INCIDENT PLANNING STANDARDS AND ORDERS

In 1987, a large loss fire in an Ohio warehouse sparked the need for a fire department-wide standard for pre-incident planning.⁸ In the aftermath of the fire, representatives from the fire service and insurance industry held a series of meetings that eventually led to *NFPA Standard 1420: Recommended Practice for Pre-incident Planning for Warehouse Occupancies*.⁹ This first pre-incident planning standard was adopted by NFPA in 1993. The standard was expanded in 1998 to include all occupancies and was renumbered as NFPA 1620; the title was also amended, to *Recommended Practice for Pre-incident Planning*.¹⁰ The standard was updated in 2003, 2010, and 2015.

NFPA 1620 was developed by a committee comprising a chairperson, twenty-six committee members, and seven alternates. The committee chair worked for a Bristol-Myers Squibb company; most of the committee members and all of the alternates hailed from business or industry, including many who represented insurance companies. Only five of the thirty-four committee members or alternates were from fire departments or emergency response agencies. None of the members appear to have been connected to a DOE national laboratory. Chapter 1 of this standard clearly indicates that the document is

⁸ National Fire Protection Association (NFPA), *NFPA 1620: Standard for Pre-incident Planning* (Quincy, MA: NFPA, 2015).

⁹ NFPA, *NFPA 1420: Recommended Practice for Pre-incident Planning for Warehouse Occupancies* (Quincy, MA: NFPA, 1993).

¹⁰ NFPA, *NFPA 1620*.

intended “for use by personnel responding to emergencies.”¹¹ It is therefore surprising to see how few of the document’s committee members represented emergency response agencies. Without observing the committee in action, it is not possible to know if the small number of responders created bias; however, the committee’s composition does call the standard’s perspectives and represented interests into question. A literature search yielded no evidence that the committee’s makeup has been previously questioned or discussed (at least not in a searchable media format).

The NFPA 1620 standard provides suggestions for developing a pre-incident plan, describes the necessary contents of a pre-incident plan, and explains how to test a pre-incident plan. The document also discusses how to determine jurisdictional authority. In annex A, section A.1.3.3, the standard indicates that if a fire department voluntarily adopts NFPA 1620 as a standard, then the head of that fire department, or designee, is considered the jurisdictional authority. In this same section, the standard indicates that if NFPA 1620 is legally adopted by a federal, state, or local government body that has regulatory authority over the responding fire department, then that governmental body is considered the jurisdictional authority. This distinction is important because the entity with jurisdictional authority has the final say about what should and should not be contained within pre-incident planning documents.

NFPA 1620—in annex A, section A.1.3.5—recommends that if confidential information cannot be protected, the information can be given to the emergency responders once they arrive on scene. Some of the information needed for the LANL pre-incident planning documents is considered confidential. While NFPA 1620 contains a large volume of significant information, it does not mention with any specificity a national research laboratory that contains radiological, explosive, biological, and chemical hazards. It does speak to classifying laboratories and suggests that each case should be reviewed individually.

¹¹ NFPA, 5.

NFPA 1620 stresses the need to understand the pre-incident plan's intended audience. In annex A, section A.4.6, the standard clearly identifies emergency responders as the plan's primary audience. This section furthermore states:

It is critical that the information presented be relevant, clear, concise, and complete. It is unlikely that emergency responders will have the time to read extensive text. Information should be presented graphically (sketches and pictures) whenever possible. Information that will not be of use to the emergency responders should be reserved for other uses and should not be allowed to clutter the pre-incident plan.¹²

LAFD responders have traditionally resisted lengthy pre-incident plan documents, while DOE and NNSA representatives have consistently called for more detailed information in LAFD pre-incident plans.¹³

The DOE mentions pre-incident planning in DOE Order 420.1C, *Facility Safety*, and in DOE Standard 1066, *Fire Protection*. Order 420.1C requires that pre-incident plans are “established to enhance the effectiveness of manual fire suppression activities.”¹⁴ This order also requires a criticality subject-matter expert to review manual firefighting methods that involve water when the suppression could occur within or adjacent to a moderation-controlled area. DOE Order 420.1C does not specifically reference NFPA 1620 as a guide for pre-incident planning, but it does proclaim that requirements within 420.1C take precedence over all NFPA requirements. DOE Standard 1066 specifically mandates that planners utilize NFPA 1620 when developing pre-incident plans. Further, Standard 1066 indicates that pre-incident plan development guided by NFPA 1620 should be “complemented by input from the site fire protection engineering staff, facility subject matter experts, and emergency responders.”¹⁵ Standard 1066 also cautions that planners should consider the potential for firefighting delays caused by security and nuclear concerns.

¹² NFPA, 17.

¹³ U.S. Department of Energy (DOE), *Fire Suppression and Related Service at Los Alamos National Laboratory*, DOE/IG-0821 (Washington, DC: DOE, 2009), <https://energy.gov/sites/prod/files/igprod/documents/IG-0821.pdf>.

¹⁴ DOE, *Facility Safety*, DOE O 420.1C (Washington, DC: DOE, 2015).

¹⁵ DOE, *Fire Protection*.

NFPA 1620 provides great detail regarding pre-incident plan development. DOE Orders 420.1 C and 1066, however, provide limited detail; DOE order 420.1C contains only three sentences related to pre-incident planning. Nevertheless, the specific requirement for a criticality safety review within or adjacent to moderator-controlled areas must be incorporated into LAFD’s plans.¹⁶ Similarly, DOE Order 1066 contains only two sentences of related text, but requires “input from the site fire protection engineering staff, facility subject matter experts, and emergency responders.”¹⁷

B. BEST/COMMON PRE-INCIDENT PLANNING PRACTICES

Although there is no generally accepted list of pre-incident planning practices, a number of authorities have described different best-practice models for fire departments and other emergency response organizations. According to Lacey and Valentine, who write for *Firehouse* magazine, “Pre-incident planning allows emergency responders to anticipate the resources and procedures needed to meet specific demands within their jurisdictions.”¹⁸ They concisely define the pre-incident planning process as gathering and evaluating information, developing procedures, and keeping the information current.¹⁹ Lacey and Valentine also recommend that response crews tour the facilities (known as a “walk-down”) while gathering pre-incident plan data to become more familiar with the facility’s response needs and challenges.

According to Lacey and Valentine, pre-incident planning consists of four separate functions:

1. Developing positive relationships with building owner/occupants,
2. Conducting pre-incident surveys,
3. Managing pre-incident data, and
4. Developing pre-incident plans.

¹⁶ DOE, *Facility Safety*, II-6.

¹⁷ DOE, *Fire Protection*, 33.

¹⁸ Brett Lacey and Paul Valentine, “Fire Prevention and the Link to Pre-incident Planning,” *Firehouse*, May 6, 2009, <http://www.firehouse.com/article/10471881/fire-prevention-and-the-link-to-pre-incident-planning>.

¹⁹ Lacey and Valentine.

They go on to warn that—as responders will be the ones using the plans—responders should be responsible for developing pre-incident plans. Although prevention staff should assist in the development of the plans, the authors stress that the end-user should drive development. In a concluding note, Lacey and Valentine claim that when departments are short staffed, pre-incident planning becomes a lower priority despite its importance to the responders’ scene safety.²⁰

In a *Carolina Fire Rescue EMS Journal* article, retired New York City firefighter Dennis Amodio makes specific recommendations for pre-incident planning.²¹ Amodio argues that all pre-incident plans should begin with the building’s floor plans. He suggests that computer-aided design drawings may already be available for many buildings, and can be easily incorporated into pre-incident plans, along with photos and videos of the building. He additionally mentions that security camera video feeds can be a resource for responders when a digital format is used in pre-planning. Amodio notes that pre-incident plans can contain a vast amount of difficult-to-obtain data, but suggests that for-hire companies specialize in this type of work for staffs that do not have the resources to compile the information on their own. He further recommends that pre-plans should be utilized in training to build familiarity with the building.

In a 2010 article for *Firehouse* magazine, Bob Galvin examined several fire departments that had successfully incorporated automated technology into the development and maintenance of their pre-incident plans.²² Galvin notes that the Holland, Michigan, Fire Department had been successfully using First Look Pro, a CAD Zone software, since 2007. This pre-incident planning software is linked to a dispatching software, which allows pre-incident planning information for the building to be concurrently displayed with dispatch information on a mobile data terminal screen. This is a time-saving step for the responders: because the pre-incident plan is automatically

²⁰ Lacey and Valentine.

²¹ Dennis Amodio, “An Introduction to Pre-planning for Fire Calls,” *Carolina Fire Rescue EMS Journal*, April 23, 2012, <http://www.carolinafirejournal.com/Articles/Article-Detail/ArticleId/2073/An-introduction-to-Pre-Planning-for-fire-calls>.

²² Bob Galvin, “Sharing Pre-plan Data to Improve Responses,” *Firehouse*, May 5, 2010, <http://www.firehouse.com/article/10467274/sharing-pre-plan-data-to-improve-responses>.

displayed, they do not need to look it up separately. Holland Fire Department has also incorporated a mapping software called First Look Pro Map (also from CAD Zone). This mapping program calculates the quickest route to the location of the emergency and uses a vehicle-locator GPS system to show the progress of the responding apparatus on the displayed map. The responding fire chief can see the location of all units en route to the emergency, which allows the chief to begin assigning specific tasks to each unit depending upon their arrival order. The mapping software, Galvin notes, provides responders an enhanced ability to locate buildings that do not outwardly display a physical address.

In the same *Firehouse* article, Galvin describes how the Keizer, Oregon, Fire District has been using automated pre-plans since 2005. Keizer uses a program called Firehouse Mobile Preplans, developed by FIREHOUSE Software.²³ Similar to the Holland Fire Department's pre-planning software, this software is also linked to dispatching software and automatically displays the pre-incident plan on the responding apparatus's mobile data terminal. This software also has an audible play feature, which can read the pre-plan information out loud through a computer-generated voice while responders are en route to the location. Dispatchers can also access this same pre-plan information, giving them the ability to relay known hazards to the responders who may not have time to review the pre-plan while en route.

In a thesis titled "Collaborative Radiological Response Planning," homeland security master's student Elaine C. Roman explored radiological response planning.²⁴ She strongly recommends following the capabilities-based planning model, which is known for its flexibility.²⁵ Roman does not discuss this model's origin, and a literature search—though it found the model referenced by many authors—did not reveal its original inventor either. The eight sequential steps in the capabilities-based planning model are:

²³ Galvin.

²⁴ Elaine C. Roman, "Collaborative Radiological Response Planning" (master's thesis, Naval Postgraduate School, 2013), 3, <http://calhoun.nps.edu/handle/10945/39002>.

²⁵ Roman, 29.

1. Convene a working group
2. Determine capability requirements
3. Assess current capability levels
4. Identify, analyze, and choose options
5. Update plans and strategies
6. Allocate funds
7. Update and execute program plans
8. Assess and report

According to Roman, the plan is not effective if the steps are taken out of order. Once the planners have completed all eight steps, they should never need to repeat steps 1 and 2 for a single pre-incident plan unless the planning environment (or the emergency being planned for) has changed significantly. The model further requires a diverse planning-process group. Roman's recommendations are not specific to any single jurisdiction or region, but were tailored to a generalized planning process for radiological response events. She advises that when planning for emergency response, planners must first consider the risk associated with the hazard and then determine the assets necessary to respond to the event. Roman acknowledges that "long-term culture, system, and habits" can make change difficult, but enhanced coordination and information sharing among involved response agencies can overcome these challenges.²⁶ Her recommendations directly support the DOE Order 1066 requirement to have both emergency responders and non-responders as a significant part of the pre-incident plan development process.

C. EMERGENCY PLANNING IN THE UNITED KINGDOM

Emergency responders in the United Kingdom have a comprehensive emergency planning process required by the Civil Contingencies Act. This act defines an "emergency" and pre-planning requirements.²⁷ The act gives the Minister of the Crown or Scottish ministers authority to order planning information, as well as to order

²⁶ Roman, 42.

²⁷ Civil Contingencies Act 2004, c. 36, Parliament of the United Kingdom (November 18, 2004), 4, http://www.legislation.gov.uk/ukpga/2004/36/pdfs/ukpga_20040036_en.pdf.

collaboration or cooperation in the development of a pre-planning document.²⁸ The act also requires agencies to disclose pre-planning information upon request; agencies that do not comply with the request “may [face] proceedings in the High Court.”²⁹ The terms of the Civil Contingencies Act are further defined by the Civil Contingencies Act Enhancement Programme. The UK Programme guidance resembles NFPA standards. Their “Chapter 2 Co-operation” document specifies that agencies with emergency response responsibilities must create emergency plans cooperatively with other agencies that may respond to the same incident, through the formation of a Local Resilience Forum.³⁰ An offshoot of this forum is a sub-group called the Strategic Co-ordinating Group (SCG). The response agency’s top management must participate in the forum, while operations-level management must participate in the SCG.

The Programme’s “Chapter 5” guidance document provides even more specific direction for emergency planning. UK emergency plans are classified as generic, specific, or site specific, as well as by agency involvement levels—there are single agency, multi-agency, and multi-level plans.³¹ Generic plans are primarily single-agency plans that resemble U.S.-style standard operating procedures and are not specific to a location. One example might be a plan for a single-family residential structure fire. The plan provides a somewhat standard set of operating rules for responses of the defined nature, regardless of the incident location. Specific plans are more detailed and are designed for a specific incident. A standard operating procedure for fighting a pyrophoric metal fire in a glove box containment system at LANL, for instance, would be a specific plan. Site-specific plans are another form of specific plans. They are used in the United Kingdom for major industrial hazard sites, such as gas and oil pipelines and nuclear power stations. UK

²⁸ Civil Contingencies Act 2004, 8.

²⁹ Civil Contingencies Act 2004, 10.

³⁰ Cabinet Office, “Chapter 2 Co-operation: Revision to *Emergency Preparedness*,” Contingencies Act Enhancement Programme, March 2012, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/61025/Chapter-2-Co-operation-revised-March-2012.pdf.

³¹ Cabinet Office, “Chapter 5 (Emergency Planning): Revision to *Emergency Preparedness*,” Civil Contingencies Act Enhancement Programme, October 2011, 11, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/61028/Emergency_Preparedness_chapter5_amends_21112011.pdf.

nuclear power stations are subject to Defense Major Accident Control Regulations.³² These regulations are similar to DOE/NNSA regulations in the United States.

If a UK-style regulatory system were implemented for LANL, it would place more emphasis on pre-incident planning. Having high-level management involved in the planning process might help ensure that pre-incident planning is a priority within the organization. The UK requirement to collaborate and share information would further ensure that when multiple agencies—like LAFD, LANL emergency management teams, and LANL facility representatives—respond, they would do so in a coordinated manner, and with knowledge of the other responders’ responsibilities. The UK information disclosure requirement would ensure LAFD pre-plans contain adequate information to support an emergency response. Although a pre-planning legislative act similar to the United Kingdom’s may not be possible in the United States, LANL could create a policy document that illustrates and requires, by internal rules, the provision of information and collaborator efforts in the pre-incident planning process.

D. REPORTS ON PRE-INCIDENT PLANNING IMPROVEMENT EFFORTS

This section examines pre-incident planning reviews written by students from the National Fire Academy’s Executive Fire Officer Program between 2002 and 2010, as well as other similar documents; one report details the tragic outcome of an ineffective pre-incident planning process.

(1) Greensboro, North Carolina

One National Fire Academy research project studied pre-incident planning in Greensboro, North Carolina. This study revealed recommended linking pre-incident planning software with a mapping program.³³ The Greensboro study also noted that a pre-incident plan should provide information to the incident commander that cannot be viewed from a command post. The study further suggested that pre-incident plans should be simple, and emphasized that too much information is just as damaging as too little

³² Cabinet Office, 34.

³³ David Bullins, “Pre-incident Planning in the 21st Century” (research project, National Fire Academy, 2002), 13, <https://www.hsdl.org/?view&did=8887>.

information. The Greensboro study noted the importance of standardized drawings and a formal guideline or general operating procedure to guide plans' development and maintenance. The project author suggests using NFPA 170, *Standard for Fire Safety Symbols*, as a guideline for standardizing symbols used in pre-incident plan drawings.

(2) Fayetteville, North Carolina

Another report, studying the Fayetteville, North Carolina, pre-incident planning process, also recommended that responders incorporate technology into pre-incident plans. The author suggested connecting GPS technology and a computer-aided dispatching system to the pre-plan.³⁴

(3) Savannah, Georgia

A study on Savannah, Georgia, focused on expanding the pre-incident planning process for special hazards. Many LANL facilities would be considered special hazards. This research noted, "The plan should not attempt to specify detailed, explicit actions to be taken during an actual incident. Rather, the plan should provide the information necessary to allow emergency responder to make informed decision based on actual scene conditions."³⁵ Other recommendations were to utilize a data worksheet to collect information about special hazards and to identify resources available from other response agencies.

(4) Henrico County, Virginia

Like the other studies, the study that examined Henrico County, Virginia, called for standardizing the pre-incident planning process.³⁶ The researcher noted significant variations between departmental pre-plans' quality and scope and attributed this variance to a lack of uniform direction. Like the Savannah study, this study also pointed out that

³⁴ Bullins, 55.

³⁵ Anthony Faust, "Model to Expand the Special Hazards/Processes Criteria of Savannah Fire & Emergency Services' Pre-incident Planning Guidelines" (research paper, National Fire Academy, 2009), 16, <https://www.hSDL.org/?view&did=692131>.

³⁶ Anthony E. McDowell, "Requirements for Implementing a Pre-incident Planning Software System in the Henrico County (Va) Division of Fire" (research paper, National Fire Academy, 2008), 37, <https://www.hSDL.org/?view&did=683014>.

too much information within the pre-plan can prevent the user from surmising or locating the most critical information. Like others, this study recommended integrating pre-incident planning with mapping programs, and further suggested including plume modeling and evacuation routes. As in the Greensboro study, the Henrico study mentioned using standardized symbols for drawings in pre-incident plans. Finally, the researcher recommended that evaluators consider the speed of data access when reviewing the planning processes.³⁷

(5) Baltimore, Maryland

Due to the sheer size of the department (1,800 members) and its budget (\$129 million), one might expect the Baltimore City Fire Department to have more advanced pre-incident planning processes when compared to other departments.³⁸ A study of the department's planning process, however, made strong recommendations for needed improvement.³⁹ The department has mobile data terminals installed in its response units, but they are primarily only used to obtain the address of the dispatched location. The study author suggested incorporating the pre-incident planning program into the mobile data terminals. The study noted the importance of reviewing pre-incident plans annually, and suggested that data collection and entry should happen the company level; if the responders who depend on the information are responsible for inputting the data, the author suggested, the data quality may improve. The study also recommended that the fire department share planning information with other response agencies, referencing the Canby, Oregon, Fire Department, which shares its information with law enforcement agencies and other stakeholders.⁴⁰

³⁷ McDowell, 39.

³⁸ Staff and budget numbers reflect 2010 data; Jeffery R. Segal, "Pre-incident Surveys in the Baltimore City Fire Department" (research paper, National Fire Academy, 2010), 7.

³⁹ Seal, 43.

⁴⁰ Segal, 41.

(6) Charleston, South Carolina

On June 18, 2007, nine Charleston, South Carolina, Fire Department responders lost their lives in a large furniture store fire. After this tragic loss, the city of Charleston commissioned a special investigative report to determine the cause of the catastrophe and prevent a similar event from happening in the future.⁴¹ The report cited pre-incident planning failures on the part of the Charleston Fire Department as a contributing factor to the lives lost. Specifically, the report cited an incomplete pre-fire plan that was furthermore unavailable to on-scene commanders. Although the pre-plan included drawings of the building, the drawings did not show all portions of the building and did not indicate fire walls and fire separations. The most recent pre-fire plan for the building at the time had been completed on April 26, 2006—just over one year prior to the fire—but the plan did not specify that the building was constructed using lightweight metal trusses, which collapsed during the fire, trapping and killing several firefighters.⁴² The incident report made several specific recommendations for pre-fire planning within the Charleston Fire Department. The report recommended a more “systematic pre-fire planning process” that would familiarize responders with the hazards in pre-planned buildings.⁴³ The report also stressed making the pre-plan information readily available to on-scene commanders.

E. DECISION MAKING UNDER PRESSURE

A pre-incident plan is essentially a collection of information. To establish how much information should be included in a pre-incident plan, and in what format, this subsection briefly examines how information is used to make decisions during an emergency.

⁴¹ J. Gordon Routley et al., “Firefighter Fatality Investigative Report—Sofa Super Store, 1807 Savannah Highway, Charleston, South Carolina, June 18, 2007,” Iowa Department of Public Safety, 2008, <http://www.dps.state.ia.us/fm/fstb/NewWebStuff2012/TrainingResources/PDFs/PhaseIIReport.pdf>.

⁴² Routley et al., 106.

⁴³ Routley et al., 143.

In 1985, Gary Klein et al. conducted a study to explore fire commanders' decision-making processes.⁴⁴ The study examined experienced decision makers who make life-and-death decisions under extreme time pressure. During this study, Klein et al. worked with twenty-six experienced fire ground commanders, each of whom had, on average, twenty-three years of experience. The authors looked at 156 critical decision points and found that, 80 percent of the time, these commanders used their experience to identify the situation as a standard prototype and then applied a typical or standard solution.⁴⁵ The data collected during the study was used to construct the “recognition-primed decision-making model.”

The Klein et al. study found that in time-pressure situations like those a fire ground commander faces, “concurrent evaluation is probably impossible.”⁴⁶ Having examined experienced fire ground commanders, the study then looked to perceptual learning. Due to a person's experiences over time, perceptual learning results in a long-term perception change. For example, a fire officer who uses a computer-simulated model to practice various response strategies for a building fire will experience various outcomes after each simulation; over time the fire officer learns to select strategies that produce the desired outcomes. Prototype development is like conditioning; experience, over time, will condition a person to react automatically when faced with familiar stimuli. Klein et al. found that prototype development was primarily based upon experience and could not be augmented easily through written text, such as pre-incident plans. When the fire ground commanders faced unfamiliar situations with no clear prototype, they resorted to imagery: the commanders tried to predict the outcome of a particular strategy to decide if that option would work, or if they should select another. The study found that 78 percent of the decisions studied were made in less than one minute.⁴⁷ Klein describes the recognition-primed decision-making model as “a blend of intuition (the prototype

⁴⁴ 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 21, 2010): 186–209, <https://doi.org/10.1518/155534310X12844000801203>.

⁴⁵ Klein, Calderwood, and Clinton-Cirocco, 7.

⁴⁶ Klein, Calderwood, and Clinton-Cirocco, 199.

⁴⁷ Klein, Calderwood, and Clinton-Cirocco, 192.

matches, which today would be described as pattern-matching) and analysis (the mental stimulation).”⁴⁸

Other studies have also found that when critical decisions must be made under extreme time constraints, the decision makers tend to rely on intuition or gut reactions. A study by the Leeds University Business School also noted that a coping strategy for time pressure decisions is to “Do what you did previously in similar situations.”⁴⁹ This coping strategy aligns with Klein et al.’s findings about prototypes or pattern matching for time-pressure decision making. The Leeds study indicated that these time-pressure decisions can be “outside the normal operating range” and can lead to “extreme states such as panic.”⁵⁰

F. CONCLUSION

This literature review of pre-incident planning practices has examined existing gaps in standards and orders, including a lack of specific direction regarding planning for a national nuclear laboratory complex. The reports related to common practices showed that readily available research on pre-incident planning generally responds to failing systems that need to be enhanced. Research regarding rapid decision making for the fire service is limited, but does clearly indicate that most critical fire ground operational decisions are made in less than sixty seconds, which means that critical information in the pre-incident plan must be easily and quickly attained.

⁴⁸ Klein, Calderwood, and Clinton-Cirocco, 207.

⁴⁹ A. J. Maule and I. Andrade, “The Effects of Time Pressure on Decision Making: How Harassed Managers Cope,” in *IEE Colloquium on Decision Making and Problem Solving*, 1997, 4/4, <https://doi.org/10.1049/ic:19971220>.

⁵⁰ Maule and Andrade, 4/3.

III. PREVIOUS EVALUATIONS OF LAFD PRE-INCIDENT PLANNING

LAFD records document several previous evaluations of the LAFD pre-incident plan program. This chapter reviews those past evaluations in aggregate to identify common themes or continuing trends.

A. 1995: BEATTY, HARVEY AND ASSOCIATES

The oldest evaluation on file was a 1995 DOE/NNSA-contracted study of LAFD services and resources conducted by Beatty, Harvey & Associates.⁵¹ This study examined emergency services provided to LANL and made four specific pre-incident planning recommendations:

- Pre-fire planning and training should be site specific.
- LAFD should conduct realistic drills to test pre-fire plans.
- LAFD pre-fire plans should contain additional site-specific information.
- Pre-fire planning for all significant LANL facilities should be complete and should include more information.⁵²

Within this same report, the authors noted that pre-fire planning had “advanced.”⁵³ In spite of this noted improvement, they criticized the pre-fire plans for lack of depth and understanding about site-specific hazards, indicating that emergency drills were not realistic and failed to test pre-fire planning concepts.

B. 2004: HUGHES ASSOCIATES, INC.

In June 2004, DOE/NNSA contracted with Hughes Associates, Inc., which authored a report titled *Needs Assessment Fire Prevention and Suppression Services and*

⁵¹ Beatty, Harvey & Associates, *Needs Assessment for Fire Department Services and Resources*, LANL Contract No. B 000720015-35 (Los Alamos, NM: LANL, 1995).

⁵² Beatty, Harvey & Associates, 43.

⁵³ Beatty, Harvey & Associates, 43.

Resources.⁵⁴ This report was also critical of the LAFD's pre-fire plans. The report specifically noted that "pre-fire plans did not accurately reflect the sum of known hazards to the responders."⁵⁵ The authors recommended that facility management be more involved in the development of pre-fire plans to ensure that hazards are clearly identified for responders.⁵⁶ This report also recommended that LAFD be provided facility tours at least once every two years and suggested that pre-fire plans could be updated as needed following the tours.⁵⁷

C. 2009: LOS ALAMOS SITE OFFICE

In 2009, multiple reports evaluated LAFD's pre-fire planning. A DOE/NNSA Los Alamos Site Office report indicated that LAFD pre-fire planning procedures were "established and well-founded," but also improvements for responder safety.⁵⁸ The report specifically noted a shortage of special firefighting techniques related to LANL facilities' unique materials. The report authors expected "more evidence of improved pre-incident plans in 2010."⁵⁹

D. 2009: DEPARTMENT OF ENERGY INSPECTOR GENERAL

In a September 2009 report titled *Fire Suppression and Related Services at Los Alamos National Laboratory*, the DOE Office of Inspector General suggested substantial improvements for the LAFD pre-incident plans.⁶⁰ Inspector Friedman expressed that the plans should contain more information and must be revised to consider:

⁵⁴ Hughes Associates, *Needs Assessment Fire Prevention and Suppression Services and Resources* (Los Alamos, NM: LANL, 2004).

⁵⁵ Hughes Associates, 158.

⁵⁶ Beatty, Harvey & Associates, *Needs Assessment*, 158.

⁵⁷ Beatty, Harvey & Associates, 158.

⁵⁸ William Gentile and Dennis Urban, "Fiscal Year 2009, Los Alamos Site Office Assessment of the Los Alamos Fire Department, Incident Command System, Pre-incident Plans, Response Procedures," (Review, DOE/NNSA, 2009).

⁵⁹ Gentile and Urban, 24.

⁶⁰ Friedman, "Fire Suppression."

- Scenarios: Information used to anticipate likely scenarios;
- Extinguishment: Any unusual material or methods required for extinguishing fires;
- Exposures: A list of any buildings and/or other features that might be affected in an emergency situation;
- Equipment response: The equipment that would normally be used for response to each facility, as well as any special equipment that might be needed, including backup equipment for second-alarm responses;
- Plan of attack: The positioning of each fire engine and any special information necessary for attacking fire in the buildings; and
- Entry: A list of all entrances to the building.⁶¹

Inspector Friedman also indicated deficiencies related to radioactive materials. He stated the pre-plans failed to identify

- Radioactive materials as a fire hazard,
- The exact locations of the radioactive materials, or
- Guidelines for extinguishing specific radioactive materials.⁶²

Friedman found that LAFD pre-incident plans did not incorporate criticality safety controls for firefighting in areas within or adjacent to moderator-controlled areas.⁶³ Friedman also noted the DOE/NNSA site office's poor attention to the pre-incident planning process. He also referenced NFPA 1620, indicating that the head of the DOE/NNSA Los Alamos site office should be considered the "authority having jurisdiction" and should therefore be responsible for "[determining] the level of planning appropriate for the jurisdiction and the property being pre-planned." The report found no evidence over an eleven-year period that DOE/NNSA had provided any developmental guidance to LAFD for pre-incident plans.

⁶¹ Friedman, 6.

⁶² Friedman, 6.

⁶³ Friedman, 6.

E. 2009: BASELINE NEEDS ASSESSMENT

Later in 2009, a report titled *Baseline Needs Assessment, Fire Prevention and Suppression Services and Resources* evaluated LAFD pre-incident plans at nine different high-hazard LANL facilities.⁶⁴ The evaluation first applauded several elements of the reviewed pre-incident plans; all the plans

- contained a significant level of information regarding the facility's fire-protection systems,
- informed the user of general hazards,
- provided essential contact information, and
- included basic information regarding vehicle approaches, as well as summary descriptions of building geometry.⁶⁵

This report also noted, however, issues the plans did not address, including:

- nuclear facility hazard category,
- radiation contamination potential,
- criticality concerns/potential,
- water use restrictions (moderator-controlled areas),
- approximate building population,
- personnel assembly areas,
- presence of gloveboxes and laboratory hoods,
- appropriate use of specialized firefighting agents,
- confinement ventilation considerations,
- presence of HEPA filters,
- firefighting techniques for HEPA filter/plenum fires,
- techniques and expectations for containing firefighting water runoff,

⁶⁴ Robert J. Farris and Stephan D. Thorne, "Baseline Needs Assessment, Fire Prevention and Suppression Services and Resources" (review, LANL, 2009).

⁶⁵ Farris and Thorne, 117–18.

- strategies for manual firefighting, including hose lays, use of hydrants and standpipes, and access limitations, or
- compensatory plans for responding to a facility with an impaired or degraded water supply.⁶⁶

The authors stressed the importance of “extensive facility review and support from nuclear facility management” to ensure the effectiveness of LAFD pre-incident plans. They also suggested that pre-incident plans include defensive firefighting tactics for deactivated facilities. The report closed its commentary on LAFD pre-incident plans by noting the importance of LANL facility tours, by which specific hazard mitigation can be incorporated into the LAFD pre-incident plans.

In reviewing reports from 2009 and earlier, several clear patterns. One is that plans contained insufficient information, primarily related to special hazards or operations within the facility. A second and even more critical pattern is the need for LANL facility subject-matter experts to be more involved in pre-incident plan development. The call for greater involvement from LANL staff echoes Roman’s recommendations regarding the capabilities-based planning model, and aligns with the statutory requirements for collaborative planning in the United Kingdom.

F. 2011: LOS ALAMOS SITE OFFICE

In September 2011, the Los Alamos DOE/NNSA site office reviewed LAFD pre-incident plans.⁶⁷ In total the DOE/NNSA reviewed seven plans, all of which were approved. The report author listed only one deficiency with LAFD pre-incident plans; however, the report indicates, “This issue was effectively closed by LAFD, and as such, is consistent with the expectations of the evaluation criterion.”⁶⁸

⁶⁶ Farris and Thorne.

⁶⁷ William Gentile, “Fiscal Year 2011, Los Alamos Site Office Assessment of the Los Alamos Fire Department, Incident Command System, Pre-incident Plans, Response Procedures” (review, DOE/NNSA, 2011).

⁶⁸ Gentile, 16.

G. 2013: DOE OFFICE OF ENTERPRISE ASSESSMENTS

In October 2013, DOE's Office of Enterprise Assessments reviewed the fire protection program at LANL, including LAFD's pre-incident plans. The report was critical of LAFD for failing to provide sufficient information. Notably, the pre-incident plans did not include floor plans, the locations of fire walls, fire alarm panels, fire detection systems, or the location of flammable liquid storage cabinets.⁶⁹

H. 2014: DEPARTMENT OF ENERGY

In April 2014, the DOE/NNSA issued an evaluative report titled, *Report for the LANL Fire Protection Program Triennial Independent Assessment*.⁷⁰ One of the report's findings mentioned LAFD pre-incident plans: "Contrary to DOE O 420.1B and NFPA 1620, Pre-Incident Plans for LANL do not provide necessary information to support timely and effective response to the Laboratory."⁷¹ Although the report did not provide clarification, it mentioned this observation when discussing emergency vehicle access to facilities with security gates during power outages.

I. 2014: BASELINE NEEDS ASSESSMENT

Again in 2014, an October report about LANL fire protection needs identified several LAFD pre-incident planning deficiencies.⁷² For instance, the report indicated that the LAFD fire chief's directive regarding pre-incident plans conflicted with DOE orders, and was furthermore not being implemented. The fire chief's directive called for specific requirements in pre-incident plans, such as the inclusion of floor plans, that were missing from LAFD's pre-incident plans.⁷³ The report was also critical of LAFD for failing to update plans as recommended by LANL staff.

⁶⁹ Office of Enterprise Assessments, "Office of Enterprise Assessments Review of the Fire Protection Program at the Los Alamos National Laboratory" (review, DOE, 2014), 7.

⁷⁰ John A. Krepps, "Report for the LANL Fire Protection Program Triennial Independent Assessment" (review, DOE/NNSA, 2014).

⁷¹ Krepps, 26.

⁷² Farris and Thorne, "Baseline Needs Assessment," 105.

⁷³ Robert J. Farris, "Revision 1 Baseline Needs Assessment Fire Protection and Suppression Services and Resources" (review, LANL, 2014), 105.

The report expressed further concern about pre-incident plans related to a May 2014 fire in LANL Technical Area 53. Even though the report specifically notes that the authority having jurisdiction (AHJ) had not approved the LAFD pre-incident planning process, it states, “LANL has not been delegated any AHJ responsibilities associated with the approval of the content, format, breadth or inclusion of strategies with LAFD pre-incident plans through the Cooperative Agreement or associated document.”⁷⁴ This report criticizes the LAFD pre-incident plan for LANL Technical Area 53, citing insufficient information related to hazards, contamination potential, criticality, and other operations within the facility.⁷⁵ Like past evaluations, this report states, “To be effective, these pre-incident plan elements require extensive facility review and support from nuclear facility management.”⁷⁶

Consistent with other evaluations, this report cited insufficient information and called for input from LANL facility subject-matter experts. LAFD staff cannot improve their pre-incident plans alone; LAFD members gathering data at LANL facilities do not have the necessary expertise or access to information to update the plans, and must depend on LANL staff to provide the information.

J. 2016: LOS ALAMOS SITE OFFICE

The most recent recorded evaluation was in a letter sent from the Los Alamos DOE/NNSA site office to LAFD on November 21, 2016.⁷⁷ This letter was sent from Site Office Manager Kimberly Davis Lebak and addressed to LAFD Fire Chief Troy Hughes and LANL Deputy Director Richard Kacich. The letter cited four different reviews of LAFD pre-incident plans, indicating, “Numerous concerns have been identified about the content and validity of these documents.”⁷⁸ Lebak noted that the site office had reviewed

⁷⁴ Farris, 105.

⁷⁵ Farris, 105.

⁷⁶ Farris, 106.

⁷⁷ Kimberly Davis Lebak, “Los Alamos Field Office Review of Los Alamos Fire Department Pre-incident Plan Content for Los Alamos National Laboratory Buildings,” personal communication, November 21, 2016.

⁷⁸ Lebak, 2.

LAFD pre-incident plans in August, and found “several disconnects” between the planning process and NFPA 1620 requirements, including deficiencies in NFPA 1620 or similar tactical criteria.⁷⁹ Of the thirty-seven criteria evaluated, nineteen met expectations and eighteen failed to meet expectations.

The letter stated that the Los Alamos site office recognizes some improvement in the LAFD pre-incident planning process, yet “the results of the review indicate that significant facility information and pre-planned strategies remain unavailable to responding firefighters.”⁸⁰ Lebak specifically requested LAFD undertake the following actions:

- Assemble a knowledgeable team (to potentially include external support with NFPA 1620 expertise) to evaluate and reinvigorate the LANL pre-incident plan approach and process.
- Strive for more timely and comprehensive pre-incident plan reviews and updates for LANL hazardous materials and complex facilities.
- Receive close support from Los Alamos National Security, LLC.⁸¹

Lebak stressed that the positive outcomes from this effort could include:

- advanced effectiveness of LAFD response effort,
- a better chance of saving lives and preserving critical government property, and
- the ability to protect the safety and health of responding firefighters.⁸²

Lebak’s remarks are consistent with other evaluations. Her request to assemble a “knowledgeable team” to work toward improving the pre-incident planning process aligns with previously recommended improvement measures.

⁷⁹ Standard criteria came from both NFPA 1620 and a textbook titled “*Structural Firefighting: Strategy and Tactics*. Lebak, 2; NFPA, *NFPA 1620*; Bernard Klaene, *Structural Firefighting Strategy and Tactics*, 3rd ed. (Burlington, MA: Jones and Bartlett Learning, 2016).

⁸⁰ Lebak, “Los Alamos Field Office Review,” 2.

⁸¹ Lebak, 2.

⁸² Lebak, 2.

K. 2013 AND 2016: INSURANCE SERVICES OFFICE

The Insurance Services Office (ISO) conducts a Public Protection Classification survey that evaluates fire department operations. Based on the survey data, fire departments are ranked between 1 and 10, with 1 being the highest ranking.⁸³ LAFD has consistently been ranked a 2, which is the second highest ranking. To determine their rank, fire departments receive ranking scores in several categories; within the “credit for training” category is a subcategory called “pre-fire planning process.” LAFD received 14.10 of 15 points in this subcategory during the 2013 ISO evaluation, and 8.04 of 12 possible points in 2016.⁸⁴ The evaluations only show the point totals, and do not explain how the points are calculated. The ISO report offers the following explanation:

For maximum credit, pre-fire planning inspections of each commercial, industrial, institutional, and other similar type building (all buildings except 1–4 family dwellings) should be made annually by company members. Records of inspections should include up-to-day notes and sketches.⁸⁵

By reviewing the ISO evaluations, it is difficult for LAFD to determine specific improvements to make. Additionally, because the scoring matrix for pre-incident planning changed between the 2013 and 2016 evaluations without a specific understanding of how the points were achieved, LAFD cannot directly discern or address its shortcoming. What is clear from both evaluations is that LAFD has room to improve in future evaluations.

L. CONCLUSION

One common criticism of the LAFD pre-incident planning documents between 1995 and 2016 is a general lack of site-specific information. The 2009 and 2014 baseline needs assessments provide specific lists of needed information; in both documents, the

⁸³ “Fire Suppression Rating Schedule Overview,” Insurance Services, Office, accessed November 12, 2017, <https://www.isomitigation.com/fdrs/fire-suppression-rating-schedule-fdrs-overview.html>.

⁸⁴ Insurance Services Office (ISO), “Public Protection Classification Summary Report, Los Alamos CO and Los Alamos OPA, New Mexico, March 4, 2013” (review, ISO, 2013); ISO, “Public Protection Classification Summary Report, Los Alamos FPSA, New Mexico, August 2016” (review, ISO, 2016).

⁸⁵ ISO, “Public Protection Classification 2016.”

lists are identical, indicating that recommendations from the 2009 report were never implemented. While most recommendations were general, two of the recommendations mentioned a specific location or pre-incident plan.⁸⁶

On December 9, 2016, the LAFD database contained 1,365 pre-incident plans, each developed independently of one another. However, the documents are all developed in accordance with an LAFD fire chief directive called *Pre-Incident Plan (PIP) Program*, division 300, article 1.⁸⁷ The directive was first written in 1991 and was updated in 1995, 2006, twice in 2010, and again in October 2014. The updates appear to correlate with the outside evaluations.

Both DOE Inspectors General Friedman and Farris mentioned the authority having jurisdiction (AHJ) in their reports. Friedman contended that the head of the DOE/NNSA Los Alamos site office should be considered the AHJ.⁸⁸ Farris noted that the AHJ has not approved the LAFD pre-incident planning process, but also submits that LANL has not been delegated any AHJ responsibilities.⁸⁹ The AHJ designation is important because of recommendations in NFPA 1620, which gives the AHJ the following responsibilities:

- 1.31 The authority having jurisdiction (AHJ) shall determine the locations (s) to be pre-incident planned, data to be collected, and extent of documentation and training appropriate for the jurisdiction.
- 1.3.2 The authority having jurisdiction shall apply the requirements in this standard to the development of a pre-incident plan.⁹⁰
- 4.3.1* The level of detail of the data collected shall be determined by the authority having jurisdiction for the pre-incident plan development.
- 4.4* Pre-Incident Plan Preparation. The authority having jurisdiction shall determine the complexity of the pre-incident plan to maintain ease of use.

⁸⁶ Farris, "Revision 1 Baseline Needs Assessment."

⁸⁷ Los Alamos County Fire Department, "301 Pre-incident Plan Program" (directive, Los Alamos County Fire Department, 2014), division 300, article 1.

⁸⁸ Friedman, "Fire Suppression."

⁸⁹ Farris, "Revision 1 Baseline Needs Assessment."

⁹⁰ NFPA, *NFPA 1620*, 5.

- 4.41 The AHJ shall consider if it is necessary to modify operational procedures to reflect unique site conditions found during pre-planning data collection and include those procedures in the pre-incident plan.
- 4.5.1 The AHJ shall decide how to present the details of the plan in the most concise format for the user.
- 4.7 Pre-Incident Plan Distribution. Copies of the pre-incident plan shall be distributed to responsible personnel as determine by the AHJ.⁹¹

NFPA 1620 discusses selection of the appropriate AHJ regarding the pre-incident planning process:

A.1.3.3 The specific determination of the authority having jurisdiction depends on the mechanism under which this standard is adopted and enforced. Where the standard is adopted voluntarily by a particular emergency services organization (ESO) for its own use, the ESO is the authority having jurisdiction. Where the standard is legally adopted and enforced by a body having regulatory authority over an ESO, such as the federal, state, or local government or political subdivision, the body is responsible for making those determinations as the authority having jurisdiction. The pre-incident plan development should take into account the ESO services, the financial resources available, the availability of personnel, the availability of trainers, and such other factors as will affect the ESO's ability to achieve compliance.⁹²

LAFD provides services to LANL through a cooperative agreement with DOE/NNSA. A cooperative agreement can be defined as

a form of assistance. It reflects a relationship between the U.S. Government and a recipient. Cooperative agreements are used when the government's purpose is to assist the intermediary in providing goods or services to the authorized recipient, rather than to acquire an intermediary's services, which may ultimately be delivered to an authorized recipient. [Trauma Serv. Group v. United States, 33 Fed. Cl. 426 (Fed. Cl. 1995).]⁹³

It does not appear that a cooperative agreement provides any regulatory authority.

⁹¹ NFPA, 8-9.

⁹² NFPA, 13.

⁹³ US Legal, s.v. "Cooperative Agreement Law and Legal Definition," accessed December 10, 2016, <https://definitions.uslegal.com/c/cooperative-agreement/>.

Several of the LAFD pre-incident plan reviews call for increased support from facility staff. The LANL complex comprises 1,000 buildings (including thirteen nuclear facilities), approximately 8.2 million square feet of covered space, and chemical, biological, radiological, nuclear, and explosive hazards.⁹⁴ The complex challenges LAFD faces at LANL go beyond typical fire department experiences. Support from LANL facility personnel who deeply understand these hazards is essential to the successful development of pre-incident plans.

Several evaluation authors identified deficiencies in specific operational strategies or pre-defining apparatus staging areas with LAFD pre-incident plans. NFPA 1620 specifically addresses this issue:

A.4.3.1.2 For this effort, it is critical that the pre-incident plan developer and user (s) interact. An overabundance of information can be a detrimental to a pre-incident plan user as a lack of information if the user cannot easily distinguish critical information. Additionally, the specifics of any particular incident cannot be exhaustively anticipated. Therefore, the pre-incident plan should not attempt to perform incident command or management functions (e.g., placing apparatus, specifying attack strategies), although this could be desirable in certain instances.⁹⁵

The evaluators' suggestion for more comprehensive information conflicts with NFPA 1620, section A.4.6, which stresses the critical nature of information being "relevant, clear, concise, and complete."⁹⁶ This section goes on to say, "It is unlikely that emergency responders will have the time to read extensive text. Information should be presented graphically (sketches and pictures) wherever possible."⁹⁷ This suggestion appears to agree with a study Klein et al.'s 1985 study.⁹⁸

Almost every evaluation—in addition to NFPA 1620—stressed the need for cooperation between responders and facility representatives. NFPA 1620 suggests that

⁹⁴ "Facts, Figures," LANL, accessed November 28, 2017, <http://www.lanl.gov/about/facts-figures/index.php>.

⁹⁵ NFPA, *NFPA 1620*, 17.

⁹⁶ NFPA, 17.

⁹⁷ NFPA, 17.

⁹⁸ Klein, Calderwood, and Clinton-Cirocco, "Rapid Decision Making."

pre-incident plans should address how responders can consult with site representatives “until an on-site liaison can be established.”⁹⁹ With a large number of LANL facilities and their extraordinary scope of work, LAFD requires a great deal of assistance from facility subject-matter experts to create comprehensive and complete pre-incident plans.

The most common deficiency found in LAFD pre-incident plans was incomplete or insufficient information, which is directly correlated to poor collaboration between LAFD and LANL facility subject-matter experts. The call for more involvement from LANL staff appears to have fallen on deaf ears. Many years have passed without any significant increase in collaboration. Although these critical evaluations are widely distributed to LAFD and LANL, they do not appear to affect how planning documents are developed or maintained. It certainly appears that a more influential method, possibly resembling the mandate in the UK, might be necessary to effect substantial change in the pre-incident planning process.

⁹⁹ NFPA, *NFPA 1620*, 23.

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IV. LAFD PRE-INCIDENT PLANNING 2017

This chapter describes the LAFD pre-incident planning process to facilitate its comparison to literature review findings and best practices. This description of the LAFD program also validates the findings from pre-incident plan evaluations discussed in the previous chapter.

A. OVERSIGHT AND STAFFING

The LAFD LANL Training Division chief oversees pre-incident plan development and maintenance. The chief is supported by one technical specialist. Both the chief and specialist have heavy workloads outside of their pre-incident planning duties.

B. FIRE CHIEF'S DIRECTIVE

The LAFD Fire Chief's Directive (FCD) provides formal guidance for pre-incident planning.¹⁰⁰ This FCD was first written in March 1995 and has been revised four times since; the most recent revision was released on October 21, 2014. The only outside source the FCD cites is the 2010 version of NFPA 1620.¹⁰¹ The research in this chapter stems predominantly from the FCD, as well as from interviews the author conducted with the LANL training chief and technical specialists who support LAFD's pre-incident planning program. The FCD categorizes LANL facilities into four classes: high, important, moderate, and low. The directive requires yearly site visits for "high" facilities and some "important" facilities; site visits for "important" and some "moderate" facilities must occur every two years, and every three years for "moderate" and "low" facilities.¹⁰² The directive further requires that assignments are sent by January 31 and completed and submitted to the LAFD LANL training coordinator by December 31 of the same year.

¹⁰⁰ LAFD, "301 Pre-incident Plan Program," division 300, article 1.

¹⁰¹ The most recent version of NFPA 1620 was released in 2015.

¹⁰² Los Alamos County Fire Department, "Pre-incident Plan Program," 4.

After every major incident, the directive calls for LAFD to review the facility's pre-incident plan. While post-incident reviews do occur, the post-incident plans are frequently not analyzed as part of the review process.¹⁰³

The directive also calls for pre-incident plan training and validation. The LAFD training division is responsible for developing exercises to test pre-incident plans' effectiveness. LAFD Training Division Chief Gill conducted a review of LAFD training records contained within the FIREHOUSE records management system and found no training records that specifically mentioned pre-incident planning training had occurred in the last year.¹⁰⁴

LAFD LANL Training Division Chief Grano provided training to all LAFD captains in March 2017. During the training, Chief Grano showed responders how to enter pre-incident plan updates into the FIREHOUSE records management system. However, this training did not show up in a record search; this is likely because the training rosters were not completed or entered into the records management system.

C. TECHNOLOGY

LAFD currently uses a pre-incident planning program that is part of a FIREHOUSE records management software package.¹⁰⁵ Though it can be altered to some degree, the FIREHOUSE Mobile Preplans software presents a standard format—compliant with NFPA 1620—that is utilized by many fire departments nationwide. The associated pre-plans are contained in a Panasonic Toughbook laptop mounted inside all front-line fire response apparatus, including the shift battalion chief's unit. This laptop serves only as an electronic look-up device for pre-plans and does not serve as a mobile dispatch terminal. LAFD units do not currently contain mobile dispatch terminals, but the department plans to purchase and install terminals in all response apparatus, with funding

¹⁰³ Kelly Sterna, "LAFD Safety Division Records Review of Post Incident Analysis Reports" (review, LAFD, 2017).

¹⁰⁴ Michael Gill, "FIREHOUSE Records Management System Report on Pre-incident Planning Training" (report, LAFD, 2017).

¹⁰⁵ Homepage, FIREHOUSE Software, accessed August 29, 2017, <http://www.firehousesoftware.com/>.

from a federal grant, prior to July 1, 2018. The Toughbook laptops are not connected to the internet, unless the trucks are parked in the station and the laptop is connected to the wireless network, or if the laptop is plugged directly into the Los Alamos County network via a hard cable. Pre-plans can only be updated when the laptop is connected to the internet, the FIREHOUSE software is running, and the update command is selected. This update, or synchronization, is generally done by the driver of each LAFD apparatus at the start of his or her forty-eight-hour tour of duty during the first morning truck check.

On August 31, 2017, the author conducted unannounced observations of the LAFD Panasonic Toughbooks that contain LAFD pre-incident plans. The observations were designed to determine the effectiveness of the hardware and software associated with LAFD pre-incident planning. The LAFD member operating the device was logged on before the observation began. The observation was timed, starting when each Toughbook was turned on and displayed the home screen. The LAFD operators were asked to access the pre-incident plan for LANL Technical Area 48, Building 29. Observations were conducted throughout the day at all five LAFD fire stations.

LAFD pre-plan Toughbooks are located on Engine 1, Truck 1, and Battalion 1 within LAFD Fire Station 1. The Toughbook on Battalion 1 successfully recalled the specified pre-incident plan in approximately 1 minute and 15 seconds. The Toughbooks on both Truck 1 and Engine 1 could not successfully retrieve the pre-incident plan after eight minutes. LAFD Fire Station 3 contained two pre-plan Toughbooks, one on Truck 3 and one on Engine 3. The unit on Truck 3 was out of service and not available to test. The unit on Engine 3 was able to access the specified pre-plan in 1 minute and 45 seconds. Station 4 contained one Toughbook, on Engine 40. This unit was not able to access the pre-plan; it went into a synchronizing mode and then failed completely or locked up six minutes into the test. The inoperable unit was taken out of service and sent for repair. Station 5 contained one Toughbook, on Engine 5. This unit failed to access the pre-plan and went into synchronizing mode; the test was stopped after eight minutes. The one Toughbook in Station 6, on Engine 6, failed to connect and went into synchronizing mode; the test was again stopped after eight minutes. Of the ten unit observations two

units passed, five units failed, and one unit was out of service; only 25 percent of the LAFD pre-plan Toughbooks could access LAFD pre-plans.

D. NEW FACILITY PRE-INCIDENT PLAN DEVELOPMENT

When a new facility is constructed, the LAFD LANL Training Division chief directly oversees the initial pre-plan development. This chief may use field crews to gather information about the site, but will be directly involved in inputting critical information and finalizing the plan before it is published and available in the FIREHOUSE software database. Once the chief has a draft plan, he or she sends the draft to the LANL Fire Protection Division, where a subject-matter expert reviews the document and sends comments back to LANL Fire Protection staff; the Fire Protection staff adds these comments to any existing comments on the document. Once all comments are incorporated, the LANL Fire Protection Division sends their comments back to the LAFD LANL Training Division chief, who incorporates them into the draft plan; the chief may ask for clarification if comments are unclear or conflicting. The chief then finalizes the document and publishes it in FIREHOUSE, where it is available to responders. A copy of the finalized plan is also sent to the LANL Fire Protection Division and the DOE/NNSA field office.

E. UPDATING AND MAINTAINING EXISTING PRE-INCIDENT PLANS

The division chief periodically assigns field crews to update LAFD pre-incident plans. Crews are spread out over three shifts that work in five different locations. Two of these locations have two captains in the station. The pre-incident planning update assignments are given to twenty-one LAFD captains each year. Each captain is typically given twenty-five to thirty plans to update. Although the FCD requires pre-incident plan update assignments to be issued by January 31, assignments typically do not go out until later in the year, but generally by May. Updates must be completed by December 31, and captains are responsible for developing their own schedules to facilitate completion. While some captains complete all their updates on time, others do not. If an update is not completed, it is reassigned to the same captain the following year, in addition to the captain's new assignments; if a captain has been lax with assignment completion, his or

her number of update assignments could double. To collect information for pre-incident plan updates, the crew uses a paper template on a clipboard, which they bring back to the fire station. The captain then uses a LAC computer terminal to enter the updates in the FIREHOUSE database system. As mentioned, timely completion of updates is sporadic; Table 1 shows the number of plans assigned each year between 2010 and 2017 against the number completed within the allotted timeframe.

Table 1. Pre-incident Plan Update Completion Rates, 2010–2017¹⁰⁶

Year	Plan Updates Assigned	Updates Completed	% Completed
2010	338	276	82%
2011	446	375	84%
2012	388	314	81%
2013	357	271	76%
2014	663	340	51%
2015	514	367	71%
2016	564	504	89%
2017 (5 months)	563	370	66%

As of June 2017, some captains had updated 100 percent of their plans, and others had not completed any updates. A captain at LAFD Station 6 was assigned sixty plan updates and had only completed six (10 percent), although this was the largest number of assignments among LAFD captains. The large number of assignments indicates that this particular captain did not complete his assigned updates the previous year and they were carried over to 2017.

¹⁰⁶ Louisa Martinez, “Pre-incident Planning Statistics from FIREHOUSE Records Management System” (report, LAFD, 2017).

F. PRE-INCIDENT PLAN DATA

Even when Toughbooks can successfully open the FIREHOUSE Mobile Preplan software, the product has limited usefulness.¹⁰⁷ The software does not contain mapping assistance to help guide the LAFD response unit to the incident location. As an example, this section discusses the pre-incident plan for LANL Technical Area 53, Building 945.

The written section of this plan contains limited information. Although the plan does indicate locations of hazards and the alarm panel, it does not contain a map or floor plan, which means the responder must make an educated guess based only on the written descriptions. Although the plan describes the facility as a single-story building, it later indicates a specific hazard in the basement. The firefighting strategy for a true one-story building can be drastically different than the plan for a building with a basement.

The LAFD pre-incident plan and attached LANL building run sheet both contain facility contacts. LAFD has recently worked with LANL to transfer updated contact information electronically each month. This same contact list is updated daily at the 24/7 LANL operations center. Although having the contact list in the pre-incident plan might be convenient, it is not necessary; up-to-date contact information is readily available through a telephone call to the LANL operations center.

The plan for Technical Area 53, Building 945 contains four attachments, but they are not labeled; this means the operator must open each attached file to determine the information it contains. The attachments contain a copy of a building run sheet used by LANL emergency management staff, a list of smoke/heat detector numbers and locations in the building, one aerial “Google Earth”-style view of the building, and four pages from a LANL map book. The aerial view and other maps in the electronic file were incorrectly included for LANL Technical Area 48 rather than Area 53.

¹⁰⁷ “FH Mobile Preplans,” FIREHOUSE Software, accessed September 5, 2017, www.firehousesoftware.com/products/fh-mobile/preplans.php.

G. COLLABORATION WITH LANL STAFF

As of May 19, 2017, LAFD had submitted fifty-two pre-incident plan updates to the LANL Fire Protection Division for subject-matter expert review. The LANL Fire Protection Division sends the LAFD plan updates to the facility staff and requests review and suggestions for improvement. LAFD received comments back for ten of the updated plans and incorporated all comments except one, which lacked specificity—it recommended more strategy, but did not specify to which strategy it referred. LAFD asked for clarification, but did not receive a response. Less than 20 percent of the submitted plan updates received additional recommendations for improvement. LAFD responders and LANL emergency managers both use a pre plan-type document to guide them during a response. Neither LAFD responders nor LANL emergency managers are included in the development of the plan documents. LANL emergency managers share part of their plan with LAFD (the building run sheet), but not other parts, such as the chemical and hazardous materials inventories.

When a significant emergency event occurs on LANL property, both LAFD and LANL emergency managers respond. On Monday through Friday, from 0800–1700, both agencies arrive on the scene simultaneously, or within a minute or two of each other. Outside of these typical business hours, LANL emergency managers respond from home. They take a response vehicle home after hours and are given twenty minutes to arrive on LANL property once requested to respond to an emergency. This means that if LAFD responders are on scene at a serious event, they may wait for 20 minutes or more to obtain valuable information that is only held by LANL emergency managers.

H. CONCLUSION

Current LAFD pre-incident planning processes directly align with common findings in previous evaluations. The plans lack information, and LAFD and LANL do not effectively collaborate to maintain and improve the plans. There should not be multiple plans for responders going to the same event; LAFD and LANL emergency managers should be looking at a common response plan. Without immediate access to

critical information contained in LANL-only plans during after-hour response, LAFD responders can be in danger, and the effectiveness of their response may be limited.

Technology failures that affect plan accessibility are problematic. Without reliable access to the plans, LAFD captains may not see the value of completing their plan updates on schedule. Although plan access should be improved, even the most reliable technology can fail. LAFD should have a backup plan for technological failures.

The fire chief's directive does not have up-to-date references and does not reference DOE orders. This guidance document needs to be updated and should reference applicable DOE orders. The staff assigned to oversee LAFD pre-incident plans are busy supporting other mission-critical functions, and do not have the necessary time to focus effort on improving the planning processes. It may be more effective to specifically assign an individual or group a special project focused only on improving the LAFD pre-incident planning process.

V. BEST PRACTICES IN PRE-INCIDENT PLANNING

Rather than conducting a ground-up evaluation of the planning process, this thesis reviews other agencies that conduct pre-incident planning to identify best practices. Following the advice of Bardach and Patashnik, the “tangible and visible behavior” associated with pre-incident planning was examined in the selected “best practice” agencies.¹⁰⁸ The participating agencies were selected for their similarities with LAFD. Fire departments from other national laboratories plan for similar hazards with DOE oversight. Internationally accredited fire departments have completed the same rigorous evaluation as LAFD and plan within a similar operational improvement atmosphere. From what we know thus far, being accredited does not necessarily mean a department will have a successful pre-incident planning program, but it does mean the department maintains core values of continuous evaluation and improvement. Accredited fire departments that have proactively improved their pre-incident planning processes have likely documented the improvements, and are likely to share them.

A. NATIONAL LABORATORY FIRE DEPARTMENTS

1. Idaho National Laboratory (INL)

The Idaho National Laboratory (INL) is very similar to LANL; it is a large national laboratory that, like LANL, conducts national security research overseen by the DOE. Accordingly, the lab’s hazards are much like LANL’s, so the pre-incident planning process serves a similar environment. INL utilizes three guidance documents related to pre-incident planning: an incident planning process SOP, a pre-incident planning process SOP, and a “Quick Access Plans” document.

INL’s “SOP-2.1.3 Incident Planning Process” primarily lists the duties of the incident planning program manager, company officers, and shift battalion chiefs.¹⁰⁹ “SOP-2.1.3.1 Pre-incident Planning” provides additional details on what to include in a

¹⁰⁸ Bardach and Patashnik, *A Practical Guide for Policy Analysis*, 126.

¹⁰⁹ Idaho National Laboratory (INL), “SOP 2.1.3 Incident Planning Process” (standard operating procedure, INL, 2017).

pre-incident plan, and lists specific duties of company officers, shift battalion chiefs, and the responsible staff officer.¹¹⁰ The third document, “SOP 2.1.3.2 Quick Access Plans,” describes how to properly complete a quick access plan, which is created for each building to which the INL Fire Department responds.¹¹¹ The quick access plan is designed to clearly and concisely provide critical information; the document contains only one page of written information, broken down into five sections:

- Section 1—Hazards: utilizes the NFPA 704 hazard system to identify criticality controlled areas and any other special or physical hazards.
- Section 2—Facility and Building: includes a photo of the building and an explanation of any hazards identified in Section 1.
- Section 3—Building Description: describes the building construction type, its contents hazard class, physical dimensions, and fire suppression systems.
- Section 4—Utility Locations and Shut Offs
- Section 5—briefly describes special considerations like access issues, exposure concerns, contents, or ventilation considerations.¹¹²

The Quick Access Plan also includes a map for each floor and a building overview map. Including maps and floor plans, the documents are typically only two to six pages long. They are stored on electronic devices and are also available as paper copies.

INL classifies a “significant facility” as “a nuclear facility, a high hazard occupancy, an occupancy with a replacement value in excess of \$10 million, or an occupancy presenting unique firefighting challenges as determined by the INL Fire Chief.”¹¹³ Buildings classified as significant facilities require a detailed pre-incident plan in addition to the quick access plan. The INL detailed pre-incident plan contains eighteen specific information sections:

¹¹⁰ INL, “SOP-2.1.3.1 Pre-incident Planning” (standard operating procedure, INL, 2017).

¹¹¹ INL, “SOP 2.1.3.2 Quick Access Plans” (standard operating procedure, INL, 2017).

¹¹² INL, 2–3.

¹¹³ INL, “SOP 2.1.3 Incident Planning Process,” 1.

1. Address
2. Building Description
3. Occupancy Hazard Category
4. Building Construction
5. Fire Suppression Systems
6. Fire Detection Systems
7. Water Supply
8. Unique Building Processes
9. Search and Rescue
10. Exposures
11. Ventilation
12. Salvage
13. Overhaul
14. Special Considerations
15. Fire Attack
16. Hazardous Materials
17. Confined Space/High Angle
18. Utilities¹¹⁴

The detailed pre-incident plan may also contain relevant attachments, such as copies of an internal fire procedure plan. The pre-incident plan also includes detailed maps that show fire walls, room names or numbers, sprinkler zones, and alarm zones.¹¹⁵

Detailed pre-incident plans for significant facilities must be reviewed annually, and quick access plans for support facilities must be reviewed every three years. Plans for INL facilities that contain a criticality controlled area must be reviewed by a criticality safety point of contact. If a facility contains a security area, its plan must be reviewed by

¹¹⁴ INL, “CPP 1696 Pre-incident Plan” (planning document, INL, 2016), 1–13.

¹¹⁵ INL.

the area physical security officer before it is published. Pre-incident plans for qualifying new facilities must be documented prior to personnel occupancy.

2. Oak Ridge National Laboratory (ORNL)

Oak Ridge National Laboratory (ORNL) is also very similar to LANL, but focuses its research on clean energy and security solutions.¹¹⁶ ORNL utilizes a detailed pre-incident plan and a pre-incident information sheet. The ORNL “Pre-fire Plans” SOP lists specific responsibilities related to pre-incident plans, criteria to determine which facilities require a plan, requirements for plan content, review and distribution requirements, and documentation handling requirements.¹¹⁷ This pre-plan SOP requires ORNL facilities to conduct pre-planning reviews annually, biennially, or triennially:

- Annual pre-fire plans
 - Category 1 and 2 nuclear facilities
 - Facilities in excess of \$100 million
 - Facilities considered high hazard by the contractor
 - Facilities considered high importance to the contractor in the completion of their contracted scope of work
- Biennial pre-fire plans
 - Category 3 nuclear facilities
 - Radiological facilities
 - Facilities valued in excess of \$10 million up to \$100 million
- Triennial pre-fire plans
 - Facilities with a fire protection system
 - Facilities with special hazards
 - Facilities with special or significant operational importance
 - Facilities where unique firefighting activities may be executed¹¹⁸

¹¹⁶ Oak Ridge National Laboratory (ORNL), “Solving the Big Problems,” accessed October 9, 2017, <https://www.ornl.gov/content/solving-big-problems>.

¹¹⁷ ORNL, “LPD-FD-ADM-020104 Rev 8 Pre-fire Plans” (planning document, ORNL, 2014).

¹¹⁸ ORNL, 2.

ORNL facilities that do not meet any of these qualifiers do not require a pre-incident plan. If major changes have occurred to the configuration of the building or facility operations, ORNL does require the pre-incident plan to be updated immediately.

Planners generate drawings within the plans using Microsoft Visio, under the guidance of a specific set of drawing specifications reflected in the SOP.¹¹⁹ In the sample plan ORNL provided, drawings are very detailed and provide relevant information related to an emergency response. Written information within the plan is robust, listed in twenty-two specific categories:

1. Building number
2. Building name
3. Normal Occupancy
4. Street Location
5. Important information—not listed in another specific category
6. Exposures
7. Power main
8. Gas
9. Potable water
10. Wall construction
11. Roof construction
12. Floor construction
13. Door construction
14. Fire alarm signal
15. Fire protection systems at property
16. Hydrant 1 and 2—closest and next closest hydrants
17. Hazardous conditions/situation
18. Tactical considerations

¹¹⁹ ORNL, 3.

19. Required fire flow—25 percent involvement, 50 percent involvement, and 100 percent involvement
20. Date of last full review
21. Date of last update
22. Full reviewer author¹²⁰

ORNL fire officers are responsible for updating pre-incident plans. They are given the update assignment at the beginning of the month and must have the update completed prior to their last working day of the month. During the month following any update, fire officers must review the updated document and potentially tour the facility; the company officer decides if a tour is necessary based on the crew's familiarity with the facility.¹²¹ Training rosters must be completed to reflect any reviews and/or tours related to the updated pre-incident plan.¹²² ORNL responders utilize printed copies of pre-incident plans in response units and electronic versions in their emergency operations center.

ORNL also utilizes a pre-incident information sheet. The pre-incident information sheet is “a condensed version of a pre-fire plan for project/events/experiment that pose unique or special hazards.”¹²³ The sheet is used for special projects or events that are temporary in nature and have a clear beginning and ending point. They could be added to a detailed pre-incident plan for an experiment that is occurring at a planned facility, but will not become part of the regular operations at the facility.

3. Brookhaven National Laboratory (BNL)

Brookhaven National Laboratory (BNL), though like LANL, occupies a much smaller geographic area (on New York's Long Island) and conducts more diverse

¹²⁰ ORNL, 4.

¹²¹ ORNL, 1.

¹²² “Public Safety Training Management System,” Target Solutions, accessed September 7, 2017, <http://www.targetsolutions.com/>.

¹²³ ORNL, “LPD-FD-ADM-020105 Rev 5 Pre-incident Plans” (planning document, ORNL, 2017), 1.

research. They call their pre-incident plans “run cards.”¹²⁴ Run cards are required for buildings that have a Facility Use Agreement, or for specialty operations that could pose a significant hazard.¹²⁵ BNL run cards comprise three parts: a main section, utilities section, and contacts section. The main section includes hazards, special notes, fire department connections, fire protection systems, fire panel locations, key box locations, construction type, and occupancy.¹²⁶ The utilities section includes shutoff locations for HVAC, gas, electric, water, chilled water, and compressed air.¹²⁷ The contacts section lists the primary local emergency coordinator, secondary local emergency coordinator, telephone numbers, division manager, and key personnel.¹²⁸

BNL also documents how they develop a local emergency plan.¹²⁹ Local emergency plans are created for individual buildings and provided to the building occupants and fire department. This local emergency plan explains “what to do” in the event of an emergency, and can contain contact information, personnel accountability, shelter-in-place procedures, automated external defibrillator locations, and HVAC shutdown procedures.¹³⁰ This document lets responders know how the building occupants were instructed to react during an emergency.

BNL staffs local emergency coordinators to enhance response. The coordinators are building residents, not emergency responders, who create and maintain the local emergency plan for their buildings.¹³¹ They are also responsible for ensuring that building fire/evacuation drills are conducted, emergency equipment in the building is

¹²⁴ While responders in many parts of the United States use “pre-incident plan” as the predominant terminology, some geographic areas use “run card”—much how the terms “soda” and “pop” are preferred in different areas of the country.

¹²⁵ Brookhaven National Laboratory (BNL), “Completing and Editing Emergency Pre-plan Response Cards” (planning document, BNL, 2013), 1.

¹²⁶ BNL, 2.

¹²⁷ BNL, 2.

¹²⁸ BNL, 2.

¹²⁹ BNL, “Developing Local Emergency Plans” (planning document, BNL, 2014).

¹³⁰ BNL, “Local Emergency Plan Template” (planning document, BNL, 2016).

¹³¹ BNL, “Emergency Preparation—Local Emergency Coordinators” (planning document, BNL, 2016).

maintained, and notification systems are in working order, as well as leading personnel accountability efforts during an exercise or actual emergency event.

BNL's pre-incident planning process does not provide specific details for building a pre-incident plan; rather, the facility uses a capability planning process as described by Roman.¹³² BNL involves multiple impacted groups in the process, which appears to be a good method for building a common operating picture during an actual emergency event.

4. SLAC National Accelerator Laboratory

In May 2017, a SLAC National Accelerator Laboratory representative—Assistant Fire Marshal Lance Lougee—delivered a presentation at the DOE Emergency Management Issues Special Interest Group Annual Meeting that described some aspects of SLAC's pre-incident planning program.¹³³ SLAC's technologically advanced program is cloud based and provides state-of-the-art graphical guidance to emergency responders, showing aerial views, floor plans, interior and exterior images, and clear symbols to indicate essential elements like fire hydrants, sprinkler hookups, and fire alarm panel locations. Additionally, responders can view images from security cameras to check for smoke or fire inside the building that may not be visible from the exterior, which helps them plan resource deployment and prioritize response tasks—this also allows responders to determine if a fire alarm activation was a false alarm, or a true activation that requires immediate dispatch. The pre-incident plans also call for automatic updates of facility contacts and chemical or hazardous materials inventories. The pre-incident plan program is configured to mine for this information in the records management software, which means a human being does not need to retrieve or input the information into the program manually. Marshal Lougee, who manages the pre-incident plan program, indicated during his presentation that it took about five years, from concept to implementation, to develop the program.¹³⁴

¹³² Roman, "Collaborative Radiological Response Planning."

¹³³ Lougee, "Pre-incident Planning."

¹³⁴ Lougee.

B. INTERNATIONALLY ACCREDITED FIRE DEPARTMENTS

Because there is no list that ranks successful fire department pre-incident planning programs, the author narrowed research to internationally accredited departments to examine “best practices” data. While none of the departments that provide pre-incident planning information also provide emergency response to a national laboratory, and none provide samples of actual pre-incident plans, they all do have standard operating procedures document that describe how their pre-incident planning programs operate. Since these departments operate in a somewhat different environment than LAFD, the author’s review of their programs was not as detailed as it was for fire departments that respond to other national laboratories. This review focuses on highlights from their standard operating procedures that might be applicable, or that differ from LANL and other national laboratory procedures.

The Statesville, North Carolina, Fire Department classifies pre-incident plans as either “standard” plans or “process-level” plans.¹³⁵ Process-level plans are more detailed than standard plans, and are developed for facilities that conduct hazardous processes. Statesville also identifies three hydrants in priority order, uses pre-established symbols on drawings, and utilizes First Look Pro software to manage its pre-incident plan program.¹³⁶ The Cedar Park, Texas, Fire Department requires crews that are completing a pre-incident plan to ladder the building and look for hazards on the roof.¹³⁷ Their SOP also provides specific guidelines for drawings of the site and facility. Both Cedar Park and the North Liberty, Iowa, Fire Departments use FIREHOUSE software to manage their programs.¹³⁸ Savannah, Georgia’s, Fire & Emergency Services has a hazardous materials response team that supports pre-incident planning at facilities that contain

¹³⁵ Statesville Fire Department, “1.10.6 Pre-incident Planning” (planning document, Statesville Fire Department, 2008).

¹³⁶ “First Look Pro,” The CAD Zone, accessed September 7, 2017, <http://www.cadzone.com/first-look-pro>.

¹³⁷ City of Cedar Park Fire Department, “Pre-incident Planning Program,” (planning document, City of Cedar Park Fire Department, 2016), 1.

¹³⁸ North Liberty Fire Department, “Pre-incident Plans—Administrative Policy No. 016” (planning document, North Liberty Fire Department, 2017), 2.

significant hazardous materials.¹³⁹ Ottawa Fire Services in Canada does not conduct code enforcement action during pre-planning visits to facilities, but if responders notice potential violations, they will forward the information to the fire marshal’s office for code enforcement follow-up.¹⁴⁰

The Bowling Green, Kentucky, Fire Department aggressively updates its pre-incident plans; general plans are updated annually, and “special-risk” plans are updated biennially.¹⁴¹ They also pre-plan for a wide range of facilities, including:

- all commercial occupancies,
- all properties located within the city boundaries, or owned or leased by the city of Bowling Green,
- all multi-family residential units having four or more living units,
- all properties owned or leased by Bowling Green University,
- any occupancy equipped with a sprinkler system and/or a standpipe system, and
- any occupancy with a Knox Box.¹⁴²

Bowling Green’s pre-incident plan lists all fire hydrants within 800 feet of the facility. The department uses the Ohio Fire Code as a guide for uniformly determining construction class. The North Charleston, South Carolina, Fire Department’s standard operating procedure document clearly defines how pre-incident plans should be stored: they must be placed in alphabetical order by street name and numerical order by address.¹⁴³ Charleston also uses NFPA Standard 220—*Standard on Types of Building*

¹³⁹ Jeffrey Alberts, “OPS 58 Pre-fire Plans Savannah Fire and Emergency Services” (planning document, Savannah Fire & Emergency Services, 2017), 2.

¹⁴⁰ Ottawa Fire Services, “GO 1 FI 01.11-2011—Pre-fire Building Planning—Revised,” (planning document, Ottawa Fire Services, 2011), 2.

¹⁴¹ Bowling Green Fire Division, “Policy 408: Pre-plan Development and Review” in *Bowling Green Fire Division Policy Manual* (Frisco, TX: Lexipol, 2017), 1.

¹⁴² Bowling Green Fire Division, 1.

¹⁴³ North Charleston Fire Department, “SOG-200.20—Pre-incident Surveys” (planning document, North Charleston Fire Department, 2017), 2.

Construction and the International Fire Code Fire Flow Table—to uniformly determine building construction type and necessary fire flow.¹⁴⁴

The Miami-Dade, Florida, Fire Rescue Department classifies its pre-incident plan facilities in three different priority levels¹⁴⁵:

- Priority 1—Industrial occupancy structures,
- Priority 2—High Occupancy structures,
- Priority 3—Commercial occupancy structures.

Like others, Miami-Dade lists specific requirements for drawings and photos within the plan.¹⁴⁶ The department also provides instructions for developing plans for complex sites that contain multiple buildings. For these properties, the department utilizes a master plan and a dependent plan concept. The department’s pre-incident plan training manual provides additional guidance for conducting pre-incident planning at complex. Miami-Dade, like some other reviewed departments, also assigns pre-incident plans monthly and accesses plans electronically on a mobile computing unit.

C. CONCLUSION

This review of best practices has revealed several practical solutions to deficiencies identified in the LAFD pre-incident planning process. One commonality, specific to fire departments serving national laboratories, was collaboration between the fire department, facility staff, and technical experts. Most of these departments utilized a multi-level pre-incident planning system, in which facilities that are considered more dangerous or valuable receive a more detailed pre-incident plan that is reviewed annually. Plans for facilities with fewer hazards are less detailed and reviewed less frequently. Other best practices include specifications for maps, incorporation of pre-incident plans into training and exercises, and referencing current standards and orders in pre-incident planning guidance documents.

¹⁴⁴ North Charleston Fire Department, 3.

¹⁴⁵ Arthur Holmes, “Standard Operating Procedure—Pre-incident Planning Procedure Miami-Dade” (planning document, Miami-Dade Fire Rescue Department, 2014), 2.

¹⁴⁶ Holmes, 6.

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VI. ANALYSIS AND RECOMMENDATIONS

The review of best practices and deficiencies from past evaluations has identified some key aspects of acceptable pre-incident planning programs. While many aspects could be applied to any pre-incident planning program for any fire department, others are applicable only to fire departments that serve a national laboratory with hazards similar to LANL's. This final chapter identifies each best practice or key aspect, explains why it should be considered a best practice, compares it to the current LAFD pre-incident planning processes, and discusses how it should be incorporated into LAFD's planning process if needed.

A. RELIABLE ACCESS

(1) Discussion

NFPA 1620 allows responders to use electronic devices to access pre-incident plans, but only if the devices meet certain criteria. The authority having jurisdiction must consider the device reliable, secure from unauthorized use, secure from unauthorized changes, and transportable to the incident scene.¹⁴⁷ Oak Ridge utilizes an electronic device to store their pre-incident plans, but also has backup paper copies in case of a technological failure. In 2007, the Charleston, South Carolina, Fire Department tragically lost nine responders during a fire in a large furniture store. Investigators found that on-scene fire commanders did not have access to the pre-incident plan.¹⁴⁸

Currently, LAFD responders do not have reliable electronic access to pre-incident plans on station Toughbooks. When tested, only two of the eight units could access pre-incident plan data; responders indicated that the Toughbook failures are a common occurrence. When electronic access fails, LAFD responders do not have backup or paper-copy plans.

¹⁴⁷ NFPA, *NFPA 1620*, 9.

¹⁴⁸ Routley et al., "Firefighter Fatality Investigative Report," 143.

(2) Recommendation

LAFD should work with IT professionals to find a reliable electronic device for pre-incident plan access. Responders should also have access to a paper copy of the most significant plans, which should be stored according to Oak Ridge National Laboratory's method: one copy on the operational battalion chief's response unit, and a second backup copy in the emergency operations center.

B. QUICK ACCESS TO CRITICAL DATA

(1) Discussion

As Klein et al. state, fire ground commanders must make decisions quickly; INL's quick access plans facilitate quick decision making. With just one page of critical information, supported by facility maps and floorplans, the quick access plans allow first-in-fire officers to quickly access the most critical information and make tactical decisions within one minute.¹⁴⁹ Klein et al.'s study reported that, of the 156 critical decisions made by fire ground commanders, 137 of them occurred in less than two minutes.¹⁵⁰

The current LAFD pre-incident plans do not facilitate quick access to critical information. The current system failed to access any information 75 percent of the time when tested. LAFD's current plans are all in one format that does not allow for the most critical information to be accessed quickly.

(2) Recommendation

LAFD should develop a quick access pre-incident plan using the INL plan as a template. Quick access plans for the most critical facilities should be accessible both electronically and as a hard copy on all response apparatus.

¹⁴⁹ Klein, Calderwood, and Clinton-Cirocco, "Rapid Decision Making on the Fire Ground," 192.

¹⁵⁰ Klein, Calderwood, and Clinton-Cirocco, 192.

C. DATA

(1) Discussion

When compared to INL's significant facility pre-incident plan program, the LANL program and plans lack detail. Past evaluation of the LAFD pre-incident program specifically note insufficient information as a significant issue. This thesis research may be the first existing comparison between LAFD plans and plans from other DOE sites. This comparison shows that LAFD pre-incident plans lack significant detail and must be improved, or criticism from outside evaluators will continue. Although too much information in a pre-incident plan can make it difficult for responders to find the most important details, the INL process of coupling a detailed plan with a quick access plan can assuage this concern. The quick access plan provides the most important details to facilitate initial response actions, and the detailed plan allows responders to look more deeply at the facility for potential long-term problems. The INL pre-incident plan template requires eighteen specific areas of data and the ORNL pre-incident plan calls for twenty-two specific data entries. The LAFD fire chief's directive (FCD) lists thirty different suggested data inputs for the pre-incident plan, but the FIREHOUSE software used to capture and store plan data does not align with the FCD.¹⁵¹ The software was not developed specifically for fire departments that respond to national laboratories.

(2) Recommendation

LAFD should use pre-incident plans from INL and ORNL as models to develop a specific set of data categories for the detailed pre-incident plan. LAFD should also use software that allows data collection fields to be customized so that the FCD and data collection categories align.

¹⁵¹ LAFD, "301 Pre-incident Plan Program," 6-7.

D. STANDARDS AND ORDERS, AND ENFORCEABLE POLICIES

(1) Discussion

The current LAFD pre-incident planning FCD does not reference the current NFPA 1620 standard or any associated DOE standards or orders, which likely contributed to past evaluations that showed a failure to evaluate the plans for criticality issues in moderator-controlled areas. The LAFD FCD does not give clear specifications regarding maps, floor plans, symbols, or other supporting graphical data. NFPA 1620 requires the use of standardized symbols from NFPA 170.¹⁵² This requirement should be incorporated into the LAFD FCD.

LAFD members are not capable of generating many supporting visual graphics, such as LANL maps and floor plans, and requesting this data from LANL staff has been a challenge. LANL support has been inconsistent. Without direct support from LANL, maps, floor plans, and other significant operational hazard data will continue to be absent from LAFD pre-incident plans.

The LAFD pre-incident plan program is guided by the FCD, but LANL staff, who must actively contribute, have no guiding document related to pre-incident plans. LANL must establish a guidance document to ensure that staff understand how they must contribute to a successful pre-incident plans, and the FCD should be updated in conjunction with this LANL guidance. Only an enforceable LANL policy that requires LANL facilities staff to develop and supply specific supporting information will ensure critical data is included in LAFD pre-incident plans.

(2) Recommendation

LAFD should update its pre-incident planning to include the current editions of NFPA standards and DOE orders. LANL should develop a policy in coordination with LAFD's pre-incident planning FCD that requires LANL facility staff to develop and deliver critical data for use in LAFD pre-incident plans.

¹⁵² NFPA, *NFPA 1620*, 9.

E. COLLABORATION

(1) Discussion

The most notable finding from this research related to pre-incident planning is how that planning is conducted. LAFD pre-incident plans are developed almost entirely by LAFD. LANL staff infrequently respond to requests for adequate contributing information. The quality of pre-incident planning information cannot drastically improve without LANL's increased involvement in the planning process.

When an emergency response is needed at a LANL facility, LAFD emergency responders, LANL emergency management staff, and LANL facility staff from the affected facility are involved. One unique challenge to LAFD is that—unlike BNL, ORNL, and INL fire departments—LAFD is not directly associated with the prime contractors that operate the national laboratory. LAFD is a county agency, whereas these other national laboratory fire departments are departments or divisions within the laboratory contractor's structure. Requests for pre-incident plan information, such as chemical inventories or maps, are therefore made within the same organization, which likely improves responsiveness.

Pre-incident plans for LANL facilities are currently held within LAFD and are owned by LAFD. If these pre-incident plans were owned by LANL, there would be added emphasis for LANL staff to provide needed data. The process of developing and maintaining pre-incident plans for responses to LANL will need to apply concepts from the capabilities-based planning model. For instance, LANL and LAFD should form a working group consisting of members from both staffs, with some oversight from the DOE field office. LANL representatives should include members from emergency management, fire protection, facilities, security, and IT. The initial objective for this group should be to develop a LANL procedure document related to pre-incident plans at LANL facilities. Once formally adopted, this document would guide LANL and LAFD staff in the formation and maintenance of LANL pre-incident plans. It would also serve as a mandate for LANL staff to actively participate in the planning process and ensure that maps, floor plans, and other currently missing information is included in future plans

for LANL facilities. Los Alamos DOE/NNSA field office Manager Kim Davis-Lebak specifically called for the assembly of a “knowledgeable team” and “close support” from the contractor that operates LANL to improve LAFD pre-incident plans.¹⁵³

In 2009, INL assembled a similar working group that generated a pre-incident planning benchmarking report.¹⁵⁴ This report was utilized to improve the pre-incident planning process at INL and is referenced in the current INL Fire Department pre-incident planning standard operating procedure.¹⁵⁵ BNL’s pre-incident planning process includes active involvement from the planned facility. BNL creates a pre-incident plan for emergency responders and is directly involved in the development of the facility emergency response plan. BNL’s plans appear to be following the capabilities-based planning model described by Roman.¹⁵⁶

The United Kingdom’s multiple-level plans correlate to the capabilities-based planning model. The UK planning process involves many parties and directly ties training and exercises to the plan to test its effectiveness. This thesis has shown several examples of effective emergency planning that can be used to model an improved emergency planning process for LANL and LAFD. Although it is possible to change the LANL pre-incident planning process, Roman noted that “long-term culture, system, and habits” can make change difficult.¹⁵⁷ However, enhanced coordination and information sharing, according to Roman, can help overcome obstacles to change. Problems with LAFD’s pre-incident planning process date back to at least 1995; this long-standing problem can only be overcome with strong collaboration between LAFD and LANL.

¹⁵³ Lebak, personal communication, November 21, 2016, 2.

¹⁵⁴ Idaho National Laboratory and Battelle Energy Alliance, LLC, “Idaho National Laboratory Fire Department Pre-incident Planning Benchmarking Report” (report, Idaho National Laboratory, 2009).

¹⁵⁵ INL, “SOP-2.1.3.1 Pre-incident Planning,” 4.

¹⁵⁶ Roman, “Collaborative Radiological Response Planning,” 25.

¹⁵⁷ Roman, 42.

(2) Recommendation

The LAFD pre-incident plan improvement effort should follow the capabilities-based planning model and first establish a working group to improve collaboration. The working group should have a clear vision for improving the planning process, and should use recommendations from this thesis—specifically the pre-incident planning process from INL—to guide improvement for all LANL pre-incident plans. The quick access plans and detailed pre-incident plans from INL have proven to be an industry best practice and should be used as a benchmark for the working group. The working group should use the findings from this thesis as a starting point, but should conduct site visits to INL and SLAC for more details about their successful pre-incident plan programs.

F. MULTI-LEVEL PRE-INCIDENT PLANNING

(1) Discussion

The sheer number of LAFD pre-incident plans (more than 1,300) presents a logistical challenge for regular updating. The LAFD pre-incident planning FCD establishes four categories of planned facilities (high priority, important, moderate, low), but does not indicate which LANL facilities should receive a pre-incident plan.¹⁵⁸ More importantly, the directive does not eliminate any LANL buildings from receiving a pre-incident plan.

INL's process, however, identifies two categories of facilities related to pre-incident plans: the significant facilities receive a detailed plan and a quick access plan, while support facilities receive only a quick access plan. The significant designation requires annual updates and the support designation requires updates once every three years. ORNL also clearly specifies pre-incident planning facilities that must have plans, and the frequency with which those plans must be updated. Within each facility category is specific facility requirements; any facility that does not meet a requirement within one of the listed categories does not receive a pre-incident plan. LAFD currently creates a pre-incident plan for nearly all buildings on LANL property. Some of these buildings

¹⁵⁸ LAFD, "301 Pre-incident Plan Program," 2–3.

contain less than 1,000 square feet and contain no hazards. They are essentially storage sheds, similar to those in residential backyards, but without flammable liquids or other chemical hazards that might be in a typical residential storage shed.

The concept of one master and several dependent pre-incident plans, as utilized by Miami-Dade Fire Rescue, may be worth considering for LANL facilities. With this type of plan structure, the high-hazard main buildings at LANL could facilitate master plans, and the smaller support buildings would have dependent plans.

(2) Recommendation

LAFD should establish a clear set of guidelines for categorizing pre-planned facilities. These guidelines should indicate a clear qualifying specification for a high-hazard facility that requires a detailed plan (updated yearly), and a qualifying specification for facilities that should receive only a quick access (updated once every three years). The minimum requirements for completing a pre-incident plan should be clear so that minor or low-hazard facilities are not planned.

G. TECHNOLOGY

(1) Discussion

The current LAFD process of collecting information for pre-incident plans is problematic. LAFD members use a paper form to collect information when updating or authorizing a new plan; other national laboratory sites, however, integrate technology into this process. SLAC employs a digital stitching camera—often used by real estate agents to display the interior of property for sale—to capture interior views of planned facilities.¹⁵⁹ This camera produces a set of images that gives viewers a virtual reality-type experience in which they feel as if they are walking around inside the structure. This would be helpful for LAFD responders, who are not likely to be extremely familiar with LANL buildings' interior layouts. SLAC also includes digital images in pre-incident plans to display important features of the building like sprinkler hookups and utility shut-offs. Further, SLAC's ability to display security camera footage to incoming responders

¹⁵⁹ Lougee, "Pre-incident Planning for SLAC National Accelerator Laboratory."

helps them quickly determine the extent of the emergency. The latest technology available to enhance LAFD pre-incident plans should be incorporated into the program.

LANL security is careful not to allow controlled articles within restricted facilities. LANL Procedure P217 lists the following items as examples of controlled articles:

- cameras,
- cell phones and smart phones (including iPhones),
- personal digital assistants (PDAs),
- digital audio players,
- laptop computers,
- Tablet computers (such as iPads, Android tablets, and Windows Surface devices),
- video and audio recording equipment,
- medical devices and ankle monitor bracelets,
- copiers and/or scanners with a hard drive,
- portable scanners,
- two-way pagers,
- two-way radios,
- CD and DVD write drives,
- external hard drives,
- flash memory, and
- USB memory devices (e.g., thumb drives, memory sticks, jump drives).¹⁶⁰

LAFD has had a few issues with carrying two-way radios (owned by Los Alamos County) into security areas, but these radios are generally accepted. LANL Procedure P217 section 3.3.4 has an exemption that allows LAFD responders to utilize a controlled

¹⁶⁰ Los Alamos National Laboratory (LANL), "Procedure No. P217, Controlled Articles," (procedural document, Los Alamos National Laboratory, 2013), 2.

article, like a digital camera or tablet computer.¹⁶¹ This section gives firefighters an exemption to the restriction of controlled articles “while carrying out their official duties, unless a safety reason exists to prohibit controlled articles (e.g., cellular telephones, transceiver radios, and other electronic radiating/emitting devices).”¹⁶² In April 2015, the Los Alamos field office sent a letter to LAFD that specifically noted the controlled article exemption for LAFD firefighters.¹⁶³ The letter goes on to say that “the NA-LA Officially Designated Federal Security Authority (ODFSA) and Cyber Security Authorizing Official support the following position of LANL P217.”¹⁶⁴ The letter indicates that the firefighter exemption is valid “during emergencies and exercises/drills.”

To collect pre-incident plan data electronically, LAFD would need to utilize LAFD-owned electronic devices. While the LANL P217 rule allows this, it might be difficult for site-area security personnel to accept the use of LAFD-owned electronic devices due to their focus on security and their unfamiliarity with the P217 exception. However, if LAFD staff use LANL-issued devices to collect data, local facility security would be more likely to accept the use of the electronic devices. According to P217, a LANL-issued device must meet five requirements it must be:

1. purchased through the Laboratory procurement or Electronic Software Distribution (ESD),
2. marked as Laboratory property,
3. approved by the Laboratory information system security manager after concurrence from the Network and Infrastructure Engineering (NIE) Division that the device can be managed, if it is to be connected to any Laboratory network,
4. configured to ensure that microphone, camera, voice record, and wireless capabilities are disabled in Laboratory work areas unless authorized by Form 1897PA, *Photographic Equipment and Activity Authorization*, or other prior approvals, and

¹⁶¹ LANL, 6.

¹⁶² LANL, 6.

¹⁶³ Albert R. Roybal and Pamela J. Valdez, “Approval of Los Alamos Fire Department Use of Controlled Articles Consistent with Standing Los Alamos National Laboratory Policy” (procedural document, Los Alamos National Laboratory, 2015).

¹⁶⁴ Roybal and Valdez.

5. configured to Laboratory Information Architecture and Configuration Management standards¹⁶⁵

Because facility staff are more familiar with LANL-issued electronic devices, it would be easier for LAFD to utilize these devices during data collection rather than relying on Los Alamos County's devices.

- (2) Recommendation

LAFD should incorporate proven technology into the pre-incident planning process. Site visits to INL and SLAC should be conducted to observe firsthand the application of modern technology into successful pre-incident planning processes.

H. STANDARDS FOR MAPS, DRAWINGS, AND SYMBOLS

- (1) Discussion

The sample pre-incident plans provided by INL and ORNL are starkly different from LAFD plans. The aerial view maps, floor plans, and sprinkler zone maps in INL and ORNL plans are far superior to those within, or missing from, the reviewed LAFD plan for LANL Technical Area 53 (in which the attached maps were for LANL Technical Area 48). Further, the reviewed LAFD pre-incident plans did not contain maps that showed aerial views of the building, sprinkler zones, or exterior connections for fire protection systems. INL and ORNL have specifications within their pre-incident planning program guidance that clarify the type of maps, floor plans, and other supporting graphical images that must be provided.

The LAFD pre-incident planning FCD does not specify the types of drawings that need to be included in the plan. When asked how maps are attained for include in the plan, the chief who oversees the program and LAFD captains who collect data indicated that not all LAFD pre-incident plans have maps, floor plans, or aerial views of the building. LAFD captains indicated they sometimes make a copy of the planned facility's evacuation map, and have been denied requests to obtain maps or floor plans from LANL facility staff, who claim the data is restricted from release outside of the facility. Without

¹⁶⁵ LANL, "Procedure No. P217, Controlled Articles," 2.

a LANL policy requiring staff to provide graphical support for pre-incident plans, LAFD staff will remain unable to attain critical supporting graphical data.

(2) Recommendation

LAFD will need to update its pre-incident planning procedures to include specifications related to maps, floor plans, and other supporting graphical images. The provision of floor plans, maps, and other related data should be specific and consistent, and provision of the data should be mandatory.

I. SECURITY OF INFORMATION

(1) Discussion

Some information in LAFD pre-incident plans is considered unclassified controlled unclassified information (UCNI).¹⁶⁶ Printed UCNI documents must be protected by the authorized user, who maintains physical control of or access to the documents. If LAFD pre-incident plans were printed and contained UCNI or other official use only (OUO) information, then these documents would need to be locked in a secure location on the LAFD apparatus; LAFD apparatus do not currently contain provisions to secure sensitive documents.

Electronically stored UCNI and OUO documents must also be protected from unauthorized access. Currently, LAFD pre-incident planning documents are stored on a Los Alamos County electronic device that cannot store sensitive data. Storing UCNI or OUO documents on a LANL-issued electronic device, however, would comply with UCNI security requirements.¹⁶⁷

(2) Recommendation

LAFD should utilize LANL-issued electronic devices to collect and store sensitive data. These devices are more easily accepted by security forces and have been designed to protect sensitive information. To ensure a secondary source is available for

¹⁶⁶ LANL, "Procedure No. P204-1: Controlled Unclassified Information" (procedural document, LANL, 2012), 7.

¹⁶⁷ LANL, 10.

pre-incident planning information, LAFD should install an approved locking container to safely store pre-incident plans that contain sensitive information.

J. TRAINING, EXERCISES, AND AFTER-ACTION REPORTS

(1) Discussion

Klein et al.'s findings show that there is value in exposure to facility data. They found that exposure helps the fire ground command build familiarity with the potential response problems. Having fire ground commanders collect pre-incident plan information reinforces Klein et al.'s concept of prototype building to enhance familiarity with the planned facility.¹⁶⁸ ORNL's requirement that updated pre-incident plans be reviewed by fire department staff following any updates also supports Klein et al.'s prototype development.

The United Kingdom requires responders to utilize pre-incident plans when developing training and exercises.¹⁶⁹ The United Kingdom also requires pre-incident plans to be updated when lessons are learned from actual emergency response events.¹⁷⁰ To comply with this requirement, responders must review the pre-incident plan during an after-action review following an emergency event.

The current LAFD FCD requires the use of pre-incident plans in training and exercises, but it does not appear this requirement is being implemented. Miami-Dade Fire Rescue, on the other hand, has a pre-incident planning process training manual.

(2) Recommendation

The end users of LAFD pre-incident plans will need to be involved in the collection of plan data and should review pre-incident plans on a regular basis to ensure the pre-incident planning program is enhancing facility familiarity. Training on pre-incident plans will need to be included in the yearly training plan and a pre-incident plan training manual similar, to the one used by Miami-Dade, should be developed. The

¹⁶⁸ Klein, Calderwood, and Clinton-Cirocco, "Rapid Decision Making on the Fire Ground."

¹⁶⁹ Cabinet Office, "Chapter 5 (Emergency Planning)," 15.

¹⁷⁰ Cabinet Office, 64.

LAFD FCD must require pre-incident plans to be reviewed in conjunction with the after-action process. Pre-incident plans should be used in the development of exercise plans.

K. CONCLUSION

To improve a pre-incident planning program, one might think that the forty-four pages of guidance within NFPA 1620 is the only necessary source of guidance.¹⁷¹ While NFPA 1620 does provide extensive guidance, the best-practice research in this thesis—conducted with the help of INL, ORNL, and BNL—provided the “tangible and visible behavior” data necessary to apply NFPA recommendations to a national laboratory fire department.¹⁷²

Several visible indicators qualify the pre-incident plan programs at INL, ORNL, and BNL as best-practice programs. For instance, these organizations have received positive DOE evaluations, while LAFD’s program has received multiple criticisms over the last twenty years. While LAFD has been criticized for poor collaboration and insufficient detail, other national laboratory sites require participation from a wide variety of people when developing and maintaining plans, and have specific requirements for data categories and supporting graphics.

This research has clearly shown significant issues related to the LAFD pre-incident planning process. Los Alamos Field Office Manager Kim Davis Lebak predicted that improving the LAFD pre-incident planning process could result in an improved emergency response, greater likelihood of saving lives, and a safer working environment for LAFD responders.¹⁷³ If LAFD, LANL, and DOE/NNSA collectively work together and all are strongly committed to improving the pre-incident plans for LANL facilities, then Lebak’s predicted outcomes are possible.

The greatest challenge to improvement will not be hardware, software, or physical changes; it will be a lack of commitment to change. Roman specifically noted the

¹⁷¹ NFPA, *NFPA 1620*.

¹⁷² Bardach and Patashnik, *A Practical Guide for Policy Analysis*, 126

¹⁷³ Lebak, personal communication, November 21, 2016.

difficulties associated with changing culture.¹⁷⁴ Evaluations from DOE are not taken lightly; yet, despite these strong recommendations for change, the LAFD pre-incident planning program has not significantly changed and lags far behind planning programs for other national laboratory sites.

The change effort will require the formation of a working group staffed by representatives from LAFD and LANL facilities, LANL emergency managers, and other subject-matter experts. The membership will need to believe in the process and must have authority to make decisions without the need for approval from superiors. It might be wise to involve LANL and LAFD department directors to establish goals and outcomes for this working group. The importance of this change cannot be overstated; without proper knowledge of the issue, however, the importance of change might not be recognized. The findings in this thesis will provide the background knowledge necessary to ensure that long-overdue changes will come to the LAFD pre-incident planning program.

¹⁷⁴ Roman, "Collaborative Radiological Response Planning."

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