

Running Head: Measuring Fire Prevention Effectiveness

Measuring the Effectiveness of Fire Code Inspections in Washington, DC

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Appendices Not Included. Please visit the Learning Resource Center on the Web at <http://www.lrc.dhs.gov/> to learn how to obtain this report in its entirety through Interlibrary Loan.

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Abstract

The problem was that the District of Columbia Fire & EMS Department had no fact data that its current model for conducting fire code inspections was effective, efficient, or meeting with industry best practices. By not having some definitive means to show effectiveness or efficiency in code enforcement, there was a perception of mismanagement and lack of accountability by those managers responsible for the program. The consequences of ineffective or misdirected prevention efforts could result in increased injuries, deaths, and property loss within the community. The purpose of this research was to identify and describe the current performance measures for fire code inspection program of the District of Columbia Fire Department in terms of true costs and measures of performance and compare these results to other comparable urban areas in an effort to determine performance and achieve efficiencies. Through the use of the descriptive research methodology, this research paper sought answers to the following questions; What best practices performance measures exist for evaluating fire code inspection programs? What performance measures are being utilized to evaluate fire code inspection programs in the District of Columbia? How are other comparable urban jurisdictions measuring fire code inspection performance? What opportunities exist for improving performance measurement and achieving efficiencies? Literature reviews, a survey, and time/task analysis were utilized to research the topics and develop an understanding of the many aspects of performance measures and management. The results of this research revealed increased efforts nationally to standardize performance measures in fire prevention. The District of Columbia performance measures, while relevant, were not used to turn data into useful information. While many numbers were collected and reported, programs did not benefit through evaluation. The recommendations included

improved performance management, risk analysis, better NFIRS reporting, and the use of technology to simplify measurement and analysis.

Table of Contents

Abstract.....3

Table of Contents.....5

Introduction.....7

Background and Significance.....8

Literature Review.....13

Procedures.....25

Results.....30

Table 1 (Performance Measures History by Year).....35

Table 2 (Summary of Survey Results).....36

Table 3 (Inspection Results).....39

Table 4 (Summary of Workload Analysis).....40

Discussion.....41

Recommendations.....44

Reference List.....46

Appendices

Appendix A: Vision 20/20 Model Performance Measures for Fire Prevention Programs....50

Appendix B: Eleven Core Measures (Hall et. al.).....63

Appendix C: Building Occupancy Counts in WDC.....67

Appendix D: NFPA 1201 Time/Task Analysis.....69

Appendix E: DCFEMS Annual Performance Plans FY 2009- 2012.....73

Appendix F: DCFEMS Annual Budget and Fiscal Plan FY 2011-2012.....140

Appendix G: DCFEMS Fire Inspection Salary Schedule FY 2012.....195

Appendix H: NFIRS Fire Response Data FY 2011-2012.....199

Appendix I: Sample Survey Form for Comparable Cities.....227

Appendix J: Comparable Cities Data.....230

Appendix K: DCFEMS Inspection Workload Analysis.....236

Appendix L: DCFEMS Performance Measurement Worksheets FY 2012.....240

Appendix M: Comparable Cities Survey Results.....258

Introduction

The problem was that the District of Columbia Fire & EMS Department had no fact data that its current model for conducting fire code inspections was effective, efficient, or meeting with industry best practices. By not having some definitive means to show effectiveness or efficiency in code enforcement, there was a perception of mismanagement and lack of accountability by those managers responsible for the program. The consequences of ineffective or misdirected prevention efforts could result in increased injuries, deaths, and property loss within the community. One of the performance measures used focused predominantly on the number of inspections completed annually. There seemed to be a significant amount of available data regarding fire inspections, however no analysis undertaken of that data to provide useful information for program evaluation. Lacking any correlation between historical fire data and resource allocation of the inspection program compounded the perception that program evaluation was lacking. The appearance was that the fire department did not manage the program based upon fact and evidence, but rather on assumptions and beliefs. This is not an acceptable methodology in today's society considering the economic climate, and without changes could adversely affect future fire department budgetary allotments. The purpose of this research was to identify and describe the current performance measures for fire code inspection program of the District of Columbia Fire Department in terms of true costs and measures of performance and compare these results to other comparable urban areas in an effort to determine performance and achieve efficiencies. Through the use of the descriptive research methodology, this research paper will seek answers to the following questions:

1. What best practices performance measures exist for evaluating fire code inspection programs?

2. What performance measures are being utilized to evaluate fire code inspection programs in the District of Columbia?
3. How are other comparable urban jurisdictions measuring fire code inspection performance?
4. What opportunities exist for improving performance measurement and achieving efficiencies?

Background and Significance

The District of Columbia Fire and Emergency Medical Services Department (DCFEMS) is an all-hazards emergency response agency within the District of Columbia, an urban city of 69.7 square miles. It is the seat of both the District of Columbia and Federal Governments. Within these boundaries the department provides comprehensive emergency services to many national treasures including the White House, United States Capitol, House and Senate office buildings, the Smithsonian Museums, and many national monuments. Additionally, the department is responsible for providing emergency services to foreign embassies and their resident facilities, the National Mall, and all federally-owned buildings within the District of Columbia. The department operates from 33 fire stations and annually responds to over 150,000 calls for assistance. (DCFEMS, 2012)

The department accomplishes this mission with an operating budget of more than \$200 million dollars and over 2000 uniformed and civilian workers. The uniform force consists of 432 fire officers and over 1100 firefighters, paramedics, and emergency medical technicians. The fire department allocates 63 positions (FTE's) to the Fire Prevention Division which performs public

fire safety education, fire code enforcement, and fire investigative services. This division is managed by a deputy fire chief who is designated as the Fire Marshal. The division is staffed with 14 armed fire investigators, 33 uniformed fire inspectors as well as supervisory and civilian support staff. Department statistics identify that the fire prevention inspectors conducted 11,120 inspections in fiscal year 2012. There were 6 fire fatalities, 60 fire related injuries, and 13.4 million dollars in direct property loss from investigated fires. (DCFEMS, 2012)

The DC Fire Code consists of the adopted International Code Council's, International Fire Code, 2006 Edition, as amended by the DC Municipal Regulations, Chapter 12H Fire Code (2008). Chapter 1 of this code specifically charges the Fire Chief with responsibility for the inspection of all structures and premises, except single family dwellings, and dwelling units of two-family and multi-family dwellings (DCMR, 2008). The fire chief delegates his authority to the Fire Marshal to manage the fire prevention division. Fire Inspections are primarily conducted by the 33 uniformed (sworn) fire inspectors, however the responsibility for inspections of the city's residential multi-family dwellings are designated to the operational fire companies as specified in fire department regulations. The local fire code limits these inspections to common areas of the building. Any violations identified by fire companies are communicated directly to the fire prevention division inspectors for follow-up inspections and enforcement actions. In addition to the follow up on these inspections, the fire prevention inspectors conduct commercial inspections, issue operational permits, review plans, and investigate code complaints. The 13 fire investigators have arrest powers and are responsible for investigating the origin and cause of all fires occurring within the District of Columbia, as well as handle code issues during non-traditional work hours.

Historically, the fire department has focused inspection efforts on inspections of schools, health care facilities, hazardous materials storage, and commercial buildings. This focus has continued since the late 1990's after new construction inspections were transferred to the building department. Existing building inspections comprise the lion's share of the current workload. There has never been a concerted effort to evaluate the inputs and outputs of the inspection activities, and the status quo has remained with some marked decrease in the number of inspections conducted over the last five years.

The City Administrator's staff has recently shown interest in the productivity levels of city agencies and a new performance management program was introduced several years ago. This system was initially called "CAPSTAT", and more recently "Track DC", and is akin to "STAT" systems used in many other municipalities. One similar example is Baltimore's CitiStat program. The Baltimore Office of CitiStat is a small performance-based management group responsible for continually improving the quality of services provided to the citizens of Baltimore City. (Endicott, 2012) Track DC allows users to click on a webpage, select a city agency, and view many datasets related to the performance of that particular city agency. The District of Columbia Fire & EMS Department page can be viewed at:
<http://track.dc.gov/Agency/FB0>

The increased scrutiny of public services has seen many city managers embrace public sector transparency. One avenue is through making real-time productivity and performance measures of government agencies readily available. This allows citizens to easily see where their tax dollars are going, and what they are getting in return for those dollars. From an organizational standpoint, the fire department cannot continue to operate in the blind, and believe they are providing the best service at a reasonable cost without being able to support this position

with fact data and statistics. Operating in the blind has been the primary mode of operation for the department for the last decade in relation to fire prevention activities. The ramifications of maintaining a status quo approach could result in a loss of funding, personnel, or even wholesale programmatic responsibility for inspections. There are very significant motivating factors to conduct this research, identify opportunities for efficiencies, and validate what level of public services the citizens are getting for their hard earned dollars.

This research is of great significance to the District of Columbia Fire Department's future in providing the best level of service to the citizens it serves. It is also significant in the need to ensure accountability of governmental funds and their efficient use through measurement, analysis, and evaluation. In summary, if the fire department isn't measuring performance, performance is not being managed and public confidence in the department can easily be eroded. This is expressed by Silva (2012), "Our customers- the citizens of our communities- have greater expectations of us and demand accountability for the funding they provide to us. They expect efficiency, and effectiveness in the programs and services we provide. As professionals in our chosen field, we must bring excellence to the workplace every day." (Silva, 2012, P. 1) In a recent performance audit of the fire prevention activities of the San Diego Fire Department, the author stated the intended purpose of the audit, "To determine the extent to which the City of San Diego fire prevention activities help to enhance public safety and whether the Bureau has the necessary internal controls to ensure that its fire prevention program is effectively implemented and that it properly recovers costs for its inspections...." (City of San Diego, 2010). This is very indicative of the modern environment fire service executives must operate within.

The fact that the fire prevention activities of the department have been neglected and not properly managed and evaluated for years is clearly identified in the 1997 Tri-Data Management

Reform Plan. The Tri-Data (1997) report made the following conclusions regarding fire prevention efforts within the department:

“There are serious shortcomings in the prevention and planning functions, which have aggravated the fire and EMS problems over the long term. There is little targeted activity to reduce the fire problem and little or no capacity or analysis undertaken for understanding its unique problems and their causes.” (p. ii)

“The District of Columbia has a fire death rate averaging about 60% higher than the national fire death rate per capita in the last four years (30 deaths per million versus 19 nationally). It has one of the highest per capita fire death rates among American cities.”(p. ii)

“The (fire prevention) unit is significantly understaffed, and has been trending downward on services provided, with no one raising alarm signals about this impact.”(p. ii)

This research project will describe the current fire prevention inspection efforts within the fire prevention bureau of the District of Columbia Fire and EMS Department, and determine its true costs and measures of performance. It will also examine and identify industry standard performance measures and benchmarks, used for evaluating fire prevention inspection practices. Finally, it will survey several comparable urban cities to determine how other prevention bureaus are measuring performance as related to fire prevention inspections.

The course goal of the National Fire Academy’s (NFA) Executive Leadership (EL) course is that an executive fire officer will develop the ability to conceptualize and employ key processes and interpersonal skills used by effective executive-level managers. (USFA-Executive Leadership, 2011, p.1-7). The research in this applied research project (ARP) will satisfy that

goal as well as the requirement to relate to and support one or more of the five United States Fire Administration strategic goals by improving the fire and emergency services' professional status. (USFA-EFOP, 2012, p. II-2). This ARP supports each of the five strategic goals.

Additionally, this ARP builds upon the primary goal of the National Fire Academy, Executive Analysis of Community Risk Reduction (EACRR) course to “empower the Executive Fire Officer with the ability to lead community risk reduction in a strategic manner” (DHS, 2009). This applied research project seeks to strategically evaluate the current inspection program as part of a larger community risk reduction plan, and to ensure the program is meeting defined goals and objectives through measurable outcomes.

Literature Review

An in-depth literature review was conducted to gain a more comprehensive understanding of fire service performance measures, specifically focused on fire prevention and those tools designed to measure inspection performance, effectiveness, and efficiency. Applied research projects from the on-line archives of the National Fire Academies Learning Resource Center, published reports, studies, periodicals, and textbooks related to fire service performance measures were identified and reviewed. Records of the fire department, and city, as well as monthly and annual reports for the fire prevention division were researched to understand the history and practices of the inspection program. Performance management reports from the city administrator's office were also obtained and reviewed. A survey was conducted of similarly sized jurisdictions to determine if other comparable departments utilize performance measures in

assessing their fire inspection programs, and if so, what measures are used and their opinions on whether the measures accurately depict performance.

The literature review occurred over a period of six months from July 2012 through December 2012. The search was multi-faceted and began with a web-based search utilizing the National Fire Academy, on-line Learning Resource Center, the internet using a Google search engine, and eventually extended to the local library, personal literature resources, web sites of the International City Management Association, and the Vision 20/20 program. As more in-depth information was sought, interviews were conducted with representatives of the ICMA, Center for Performance Management during a visit to the ICMA headquarters in Washington DC, and through telephone interviews with ICMA staff.

Performance management is based in collecting and analyzing all types of fire department data to assist in decision making. Good information is needed not only to help fire service managers make decisions, but also to back up those decisions with hard data that can stand the scrutiny of city managers, budget analysts, and others.

The first element in understanding performance management is to have a strong understanding of the key terminology used and to have an awareness of the definition of these terms. Endicott (2012) provides the following explanation of two key terms and how they relate to each other.

“Performance *measurement* captures data about programs, activities, and processes, and it displays the data in fairly standardized ways that are useful for managing programs to their peak performance. Performance *management* takes performance measurement to the next level. It identifies the causes of gaps in performance and explains the effects that changes in business practices, staff deployment and budgetary expenditures or reductions

will have on achieving performance goals and objectives. Performance management has been used to significantly improve how government agencies in general, and fire and emergency service departments in particular, set and refine goals and achieve results.”
(p.392)

Performance measurement relies on the evaluation of achieved outcomes, compared to desired outcomes. For the fire service, the desired outcomes- which are not easily measured- includes fires prevented or suppressed, and ultimately the human life and property preserved. (Hatry, 2006)

The Rand Study proposed any public service must be measured by its effectiveness, efficiency, and equity.

Effectiveness:

- Is the department fulfilling the basic reason for providing the service?
- These measures determine how well a service does what it is supposed to do.

Efficiency:

- How well are resources used in providing the service?
- These measures are most often associated with money.

Equity:

- How is the relationship between those who pay and those who benefit?
- These measures look at the fairness in levels of service provided and citizen expectations. (Chaiken & Ignall, 1979)

Cline (2008) includes a composition of “Meaningful measures” as related to fire prevention. She discusses measuring and benchmarking, “There is an abundance of things to measure and benchmark in a fire department. The key to providing information and not just numbers lies in the selection of what to count, and which yardstick to use to create a context that has meaning”.

Cline’s meaningful measures included:

- Inspections, Numbers conducted and turn-around times.
- Numbers of occupancies in the community by type
- Structure fires of the various occupancies
 - o Fires contained to the room of origin, unit of origin, and building of origin.
 - o Fires contained to the level of involvement on arrival of first fire unit.
- Number of false alarms
- Fire loss
- Civilian injury and death rates
- Fire investigations, numbers conducted
 - o Cause and origin determination rates
 - o Arson rates, conviction rates
- Complaints investigated
- Community Access rates, use of technology
- Built-in protection
 - o Number of residences with smoke alarms
 - o Number of residences with fire sprinkler systems (p.12-39)

Behn (2003) makes the point in relation to measuring performance, that neither the act of measuring performance nor the resulting data accomplishes anything itself; only when someone uses these measures in some way do they accomplish something. In essence, the collection of data, and the utilization of measures don't really accomplish anything in and of themselves. Performance improvement requires data analysis and action on the available information to translate into outcomes.

The literature review revealed several key organizations, and authors who have been instrumental in evaluating performance measures within the fire service. These efforts date back to the 1970's with the Urban Institute (UI), Government Accounting Standards Board (GASB) the National Fire Protection Association (NFPA), and extend to recent studies by the International City/County Management Association (ICMA), the Center for Public Safety Excellence Commission on Fire Accreditation (CPSE), the NFPA, and the International Fire Engineers (IFE) Vision 20/20 National Strategies for Loss Prevention. Several of the most comprehensive studies include the 2008 NFPA and Fire Protection Research Foundation final report, *Measuring Code Compliance Effectiveness for Fire-Related Portions of Codes*, the 2009 NFPA report *Fire Service Performance Measures*, and the Vision 20/20 National Strategies for Fire Loss Prevention, *Model Performance Measures for Fire Prevention Programs*. These three documents while only part of the literature review provided the most relevant and comprehensive information on the topic of fire prevention performance measurement. Authors Jennifer Flynn and John Hall, both NFPA researchers have conducted significant research on performance measures and provide a wealth of knowledge and understanding within their reports, as well as a significant literature review of many of the legacy documents concerning performance measures within the fire service. Harry Hatry of the Urban Institute and Philip S. Schaenman of Tri-Data

Corporation have also been significant authors and contributors to the research of performance measures and performance management in the fire service.

Vision 20/20 is a “grassroots effort to help define and implement strategies for effective fire prevention practices in the United States. It is a project of the Institution of Fire Engineers-USA Branch that is governed by a steering committee of National fire safety organizations and subject matter experts.” (Vision 20/20, 2012) The IFE Vision 20/20 group, as part of its work toward standardized performance measure for fire prevention programs, has extracted the essentials of performance measurement and reduced that down to a basic framework that is easily understandable. This work standardizes the terminology and processes of performance measurement to facilitate legitimate comparison among agencies. The Vision 20/20 (2009) document describes the purpose of the project as follows, “to outline potential model performance measures for local, state and national fire prevention program managers. The goal of that program is:

to begin reporting fire prevention efforts in a consistent enough fashion to allow for legitimate program comparison and the establishment of both baseline performance measures and benchmark standards. Following the models of the NFPA and the National Fire Academy, performance measures were categorized as process, impact, or outcome evaluation measures. These were defined as follows:

Outcome Evaluation: The mechanism of determining how well a program achieves its ultimate goals. (Like reduced losses)

Impact Evaluation: The mechanism of measuring changes in a target population that the program is intended to produce. These measures could be considered advanced indicators of successful outcomes. (Like reduced risk).

Process Evaluation: The mechanism of testing whether a program is reaching its goals (like reaching its target populations with quantifiable numbers expected). Process evaluation measures often include measures for workload (e.g. number of inspections done per inspector) and milestones in achievement of process objectives. (Vision20/20, 2009)

Measuring workload does not indicate success of a programs result. But it can be important to decision makers when deciding how many resources are required to perform certain prevention tasks, like inspections, plans reviews, investigations or public education activities. (P. 3)

This study describes the significance of utilizing each of the three measurement types, (outcome, impact and process) to enhance measurement at all levels. Appendix A identifies the sample measures for code compliance effectiveness from this document broken down by measure type. The list is only a sample and is not intended to be all inclusive.

Endicott (2012) describes that efficiency measures are often useful to managers to track changes in the cost of a process over time and to compare one organization to another. Endicott goes on to describe how efficiency measures can be expressed for fire and emergency medical services. “Efficiency measures can be expressed in two ways: as unit costs (input dollars divided by output, or input dollars divided by outcome) or as units of output per input (output or outcome divided by either costs or some other measure such as FTE’s) Efficiency measures for outputs

might include the operating cost per incident, per capita protected, per \$1 million of property value protected, or per inspection” (P.400-402).

This study describes the significance of utilizing each of the three measurement types, (outcome, impact and process) to enhance measurement at all levels. Appendix A identifies the sample measures for code compliance effectiveness from this document broken down by measure type. The list is only a sample and is not intended to be all inclusive.

Hall, Flynn, & Grant (2008) within the research report “Measuring Code Compliance Effectiveness for Fire-Related Portions of Codes” identify eleven core measures for measuring code compliance. These eleven core measures are suggested measures and methodologies for use by any fire department or community. This report sponsored by both the NFPA and the Fire Research Foundation, indicates that the “state of the art” performance measures for the fire service were once the 1976 NFPA/UI study, however they are now over 35 years old. . This report indicates its purpose as:

two-fold, (1) to refine the effectiveness measurement methods developed in the 1976 NFPA/UI study, and (2) enhance the detail and usefulness of the effectiveness measurement methodology”.

The project goals, as originally stated are:

- Develop tools to measure how fire prevention activities of fire safety enforcement organizations can reduce fire risk in communities.
- Develop a refined methodology to measure fire prevention effectiveness, to meet the needs of today’s state and local fire prevention personnel. (p.5)

Appendix B identifies these eleven core measurements discussed within this research and suggested as current “state of the art” performance measures.

The ICMA as well as the Governmental Accounting Standards Board (GASB) defined the following key terms in measuring performance. The only significant difference between the two was the addition of an “Intermediate Outcome” by the ICMA.

Input: A count of resources (money, people, FTE’s) devoted to the activity measured.

Output: The number of things produced as a result of the effort (eg., incidents responded to or inspections performed)

Output Efficiency: Inputs/Outputs (e.g., the cost per inspection or the number of inspections performed.

Outcome: The results of the effort (including quality) (e.g., reduction in the number of fires or fire dollar loss at inspected properties as a result of the inspection program). (e.g., emergency vehicle response time and the number of structural fires that reach flashover)

Intermediate Outcome:

Factors expected to directly result in a changed outcome. (e.g., emergency vehicle response time and the number of structure fires that reach flashover) (Compton, 2002, p.297)

(Granito1988) suggested measuring effectiveness using relative data points that may be compared with earlier and following years. These points suggested include:

1. Reported fire incident rates (annual)
 - a. Number of fires per 1,000 populations
 - b. Number of residential building fires per 1,000 dwelling units, by type of units
 - c. Number of commercial/industrial/institutional fires per 1,000 occupancies, by type of occupancy.
 - d. Incendiary and suspicious fires per 1,000 populations.
 - e. Number of fires in inspected properties per 1,000 occupancies, by type of occupancy.
2. Number of estimated unreported fires per 1,000 populations (annual)
3. Prevention Activities
 - a. Inspections
 - b. Plans review
 - c. Consultations
 - d. Code Administration Activities
 - e. Public Education activities (p. 107)

(Swisher, 2005) in his research asserts that program evaluation is the step most overlooked by fire departments when it comes to inspection programs. Farr and Sawyer (2003) point out that evaluation of outcomes of fire inspection programs are steps that are overlooked by most departments. Swisher carries this research further and seeks the measure of “Quality” of

these inspections. A common thread throughout the literature review relating to program quality was the need for effective program management, training, and continual program outcome evaluation. These studies highlighted the complexities of measuring outcomes, and the significant resource needs to perform program evaluation and management.

Lewis (2006) in his research of performance measures for the life safety division identified clear goals for moving his department forward in performance measurement. He summarized that there were four actions that needed to occur in improve measurement practices; Clear program objectives that flow from the departments mission and goals, a more complete but simplified set of measures that are clearly linked to the goals and objectives, more timely and reliable data collection, and increased acceptance and use of performance information by management for decision making.

A common theme among the literature was the apparent disconnect between inspection productivity levels (process evaluation) and outcome measures. Many departments seem focused on striving to achieve some pre-determined workload measure for inspections. The actual measuring or setting of outcome objectives for the inspection programs does not appear to be a priority. The focus is narrower, on meeting the inspection criteria regardless of an outcome objective. The outcome objective becomes less important if the productivity level cannot be met. Several case studies brought to light that fire departments are focusing on the process evaluation however disassociating it with the outcome measure, and ultimate mission and goals of the department.

The Tri Data (1997) report also addressed those areas requiring improvement and efficiencies within the District of Columbia Fire Department in relation to inspections and in their report wrote:

At least three-quarters of the buildings in DC are not inspected annually as they should be. The main impediment is too few fire inspectors for the workload, rather than inefficiencies of the inspectors. The busyness of the line companies makes it more difficult to get them to take on much of the burden.....

It is further recommended that after one year, the effectiveness of the new combined inspectional program be re-evaluated to determine if an acceptable number of occupancies are being inspected annually. If not, more inspectors may have to be added, or inspection frequency goals revised downward.(p. 3-11)

Benefits- The prime benefit is going from inspecting less than 20% of all occupancies to inspecting 35% (3000 annually and the rest at least once every three years). Inspections reduce property losses and increase life safety; no one can quantify the estimated reduction in a credible manner with the current state of the art” (p.3-12).

Within the Tri-Data report, there were calculations indicating the workload for inspectors at the time was approximately 500-600 inspections per year. They estimate that a full-time inspector can conduct at least four to six inspections on average per day using manual reporting systems. This is an average of between 800 to 1,000 inspections per year.

The work of Agers, (2011) is included as Appendix C, and provides an analysis of building occupancy counts within the District of Columbia, as developed using data provided by the DC Office of Tax and Revenue. It is a comprehensive categorization of the various building

occupancies in the District of Columbia. This data is critical in developing inspection programs and in performing a time/task analysis of fire code inspections.

(Hall et al. 2008) includes as an appendix to his work the worksheet for NFPA 1201, Standard for Providing Emergency Services to the Public. The worksheet is a time/task analysis that can provide some reasonable level of determination for the number of employees needed to perform a given task. This is a helpful tool and has many uses, including determining workload capacity of current staff. The worksheet is included as Appendix D.

Appendix E includes the DC Fire Department Performance Plans for FY 2009, 2010, 2011, and 2012. These documents identify all of the performance measurements, workload measures, and key performance indicators used by the department for these time periods. The DC Fire and EMS Department Proposed Budget and Fiscal Plans were utilized and instrumental in identifying the inputs for the fire inspection program as far as budget dollars, number of full time equivalents (FTE's), and the manner in which the budget is allocated by program.

Procedures

What best practices performance measures exist for evaluating fire code inspection programs?

The process to determine the best practices for fire code inspection programs began with an extensive literature review that spanned a six month period of time. The on-line Learning Resource Center of the National Fire Academy provided references to Executive Fire Officer, applied research projects using a search with keywords, inspections, performance management, performance measurement, effectiveness, and fire prevention. Additionally, ARP's from the "Executive Leadership" (EL) course were reviewed for relevance. Similar keywords were used

on the internet using a Google search engine to locate relevant literature, reports, websites, and textbooks. The author's personal library as well as the reference library within the DC Fire Marshal's office was used to consult common fire service text books, periodicals, and reference books for information related to performance management and useful measures. Once key organizations were identified, such as the NFPA, ICMA, IFE Vision 20/20, GASB, CFAI, it became easier to search using the internet for related information. The result identified those authors who were repeatedly publishing research on the topic, and allowed this author to identify key researchers in the field, as well as other organizations sponsoring related research. The literature review and analysis of the data was also organized from older historical data to the most up to date information so that a better understanding could be developed of the history of performance measures.

What performance measures are being utilized to evaluate fire code inspection programs in the District of Columbia?

This was a data collection and analysis effort that began with the website of the District of Columbia Office of the City Administrator, at www.track.dc.gov. Locating, and clicking on the "Fire and Emergency Medical Services Department", led to the performance management data and plans for the agency, as well as current data on key performance indicators, and other resources. Contact was made with Mr. Julius Agers, a Capitol City fellow working exclusively on performance management within the fire department for the city administrator. He was able to provide more in-depth and detailed information on the performance measures related to fire code inspections.

Many documents were made available to assist in this research. The chief fire marshal provided annual statistical reports from the fire marshal's office related to fire code inspection activity for fiscal years 2007, 2008, 2009, 2010, 2011, and 2012. Additionally, through the website of the Chief Financial Officer, Copies of the Proposed Budget and Financial Plan for the Fire Department were obtained for the last three fiscal years, 2011, 2012, &2013. These are included within Appendix F. A request of the fire department human resources office provided a current salary schedule for the fire prevention division, allowing a clear picture of inputs in terms of costs related to salary and benefits of employees assigned to code enforcement activities. The salary schedule and analysis is included as Appendix G.

Fire department statistical data was obtained through custom generated reports of the National Fire Incident Reporting System (NFIRS) utilizing the Zoll Fire/RMS system. Several reports were generated for fiscal years 2011 and FY 2012. The reports were labeled "Incident by type with detail FY 2011", "Incident by type with detail FY 2012"and "Incident distribution by occupancy 2011", "Incident distribution by occupancy FY 2012", "Building fire analysis by occupancy FY 2011" and "Building fire analysis by occupancy FY 2012" Due to a change in software, data prior to FY 2011 was not available. These reports help to identify fire risk, fire loss, casualties, fatalities, and building fires by occupancy. These reports are included as appendix H.

There was a need to obtain an updated building and structures inventory, for the purposes of identifying counts of residential properties, commercial properties, and inspection susceptible properties. Mr. Julius Agers of DCFEMS had previously requested and obtained the data from of the DC Office of Tax and Revenue. Mr. Agers provided a spreadsheet with a breakdown of properties within Washington DC for this research. This survey is included as appendix C.

How are other comparable urban jurisdictions measuring fire code inspection performance?

The procedures utilized for this research involved identifying case study examples and noting reference to other departments experience or measurement efforts during the literature review. Additionally, a survey was developed to solicit information from other comparable cities by population base, and having full time dedicated inspection personnel. The survey was created utilizing Microsoft word, and is attached as Appendix I. A contact list was developed through networking, department websites, and direct phone calls to obtain e-mail addresses for the fire marshals of each of the chosen cities. Twelve cities were chosen from the *Information Please Database of the Top 50 cities in the US by population and rank*, utilizing the 2010 Census population data. In choosing cities to sample relative to Washington, DC, cities were selected having populations between 579,000 and 750,000. There were 16 possible cities listed in this range to chose for comparison. The idea was to select as similar a population base as possible. The comparable cities data and the listing of selected cities are included in Appendix J. The fire marshals were sent an e-mail with the attached MS word survey to complete and returned via e-mail. A follow-up reminder was sent two weeks later if the response was not received, and then a phone call reminder to those not completing the survey after another two weeks. The purpose of this survey was to determine if similar fire departments were measuring the performance of fire code inspection programs, and if so to identify the methodology and measures utilized. Sample data was also requested. The survey also queried the status and number of inspectors to add validity to the comparison. Finally, the fire marshal was asked to provide an opinion on whether the measures used, accurately reflect the inspection activity and performance.

The limitations and assumptions of this research became evident during the literature review. The first limitation is that of time. The research was limited to the time available, and

those literary resources located and referenced within that specific time. In this case, the research was conducted periodically over approximately six months. Secondly, the research is limited to only those resources located and not those existing outside of the research both physically and in print. It does not assume to be all inclusive by any means. Any personal communication relies upon the assumptions that the source is valid and providing an accurate recollection and communication of the facts. There is also an assumption within the surveys that the respondents provide honest and candid responses. Additionally, the statistical data provided is assumed to be accurate and valid, and it is subject to verification. Historically, there have been issues with the validity of the data collected and submitted for performance evaluation purposes, particularly when that data is manually tabulated.

What opportunities exist for improving performance measurement and achieving efficiencies?

The procedure involved an analysis of the current (what exists) as compared to the industry best practices (what could be). Specifically, a comparison of the performance measures currently used with industry best practices with the goal to improve what is measured and how the measures are used. Areas where analysis showed gaps or shortfalls in measuring performance, or managing the performance measurement program, were identified as focused areas for improvement. Achieving efficiencies was primarily focused on maximizing outputs, while minimizing inputs. In short, reduced or steady costs and increased service. It also considered efficiencies in service that could reduce inspection times, time spent traveling, and time performing paperwork. This also considered effectiveness gained through risk analysis and focusing resources in the areas that are experiencing the greatest risks, versus expending resources to areas not indicating significant risks to the community.

Considerable analysis was put forth toward determining current efficiency levels of existing workload. Using the workload measures of “Number of inspections completed”, as well as the available data to measure inputs, the NFPA 1201 time/task analysis model provided some very useful data. The input data consisted of budget figures, FTE Positions, inspector salaries, training and education figures, and leave usage. The following parameters were much better defined as related to current levels achieved; average inspector salary, average number of inspections per day, per month per year, and capacity for workload. These figures and parameters are included in Appendix K. Utilizing this model; it was also possible to show the gap in workload that is not being achieved due to vacant positions that are not being filled. While the data collected may appear rather unrelated to the research, it is actually very relevant in evaluating the process measurement level to ensure that there is measurable work occurring at the process level that will hopefully contribute to achieving that end goal. The ultimate goal in this case is decreasing loss of life and property from the effects of fire.

The methodology for these calculations followed the model suggested by the GASB and described by Endicott (2012). Efficiency measures can be expressed as unit costs or as units of outputs. Input dollars divided by outputs, or outputs divided by the costs. The procedure used followed this general principle.

Results

What best practices performance measures exist for evaluating fire code inspection programs?

Hatry (2006) identifies two specific performance measures related to fire inspections. The first is designed for inspection effectiveness.

“Percentage of Fires in which the affected property was inspected within the 12 months prior to the fire, (a) for all occupancies, and (b) by property type.”

The second is designed for inspection violation clearances:

“Percentage of building violations resolved within a specified time period, (e.g., one week, one month, one year)”

The IFE Vision 20/20 (2009) recommended measures for code compliance effectiveness are:

Outcome Measures:

1. Total value of property lost in inspectable occupancies to fire in relation to assessed value.
2. Changes in the percentage of total fire losses occurring in inspectable occupancies.
3. Changes in fire deaths/ 100,000 residents in inspectable properties.
4. Changes in number of structural fires/1,000 residents in inspectable occupancies.

Impact Measures:

1. Percentage of code violations noted that were corrected/abated.
2. Percentage of fires that were preventable or could have been mitigated by inspection or by the educational or motivational elements of inspections.
3. Percentage of fires where there were pending, uncorrected violations present at the time of the fire.

Process Measures:

1. Percentage of fires in properties subject to inspection that were not listed in inspection files.
2. Percentage of inspections for which time since last inspection is greater than the department's target cycle time.
3. Number of building systems and features, from defined list, for which inspection and approval were not completed, per new construction project.

Hall, et. al. (2008) identifies the most updated eleven performance measures to be considered for code compliance effectiveness:

Outcome-type Measures:

1. Structure Fire Rate per 1,000 inspectable properties.

Use five-year averages to compensate for small numbers of fires per year. May exclude intentional fires. Designed for routine inspections.

2. List inspectable-property structure fires with at least \$25,000 in loss.
3. Estimated monetary value per additional inspection, by major property use group.

Calculate using the formula: Value of one annual inspection =

$(\text{Fire loss per year}) \times (\% \text{ loss preventable by inspection}) / (\# \text{ occupancies})$

Impact-type Measures:

4. Number of violations found per inspection, overall and separately for (a) sprinkler-related and (b) safe evacuation related.

5. Percentage of fires that were preventable or could have been mitigated by inspection or by the educational or motivational elements of inspection.
6. Percentage of fires where there were pending, uncorrected violations present at the time of the fire.

Process-type Measures:

7. Percentage of fires in properties subject to inspection that were not listed in inspection files.
8. Percentage of inspections for which time since last inspection is greater than the departments target cycle time. (For each major occupancy type)
9. Number of building systems or features, from a defined list, for which inspection and approval were not completed, per new construction project.
10. Percentage of inspections conducted by inspectors with all of the necessary certifications for their assignment.
11. Percentage of inspections conducted by full-time inspectors.

While these few lists are not all inclusive, they cover a wide range of possible measures a community may choose. It is interesting to note that there are several organizations that can be joined, via a monetary fee, to enable a community to participate in benchmarking among other municipal governments. The performance measures used are continually updated and built out to better capture the ability to measure performance. The measures are not readily shared; however, the author has learned they are very similar to those measures already listed within this results section.

What performance measures are being utilized to evaluate fire code inspection programs in the District of Columbia?

The District of Columbia government has utilized varying performance measures for quite some time; however the enclosed data only provides fact data back to FY 2009. The documents enclosed, both budget documents as well as the performance management plans included, show the individual measures that are used and have been used over the period FY 2010, 2011, 2012 and 2013. You will notice they have changed and been modified over this period of time. These measures are further elaborated upon in the worksheets for each measure, included within Appendix L. The worksheets are executed at the program level, and serve to provide guidance, direction, and understanding of each measure, and how the information is collected and calculated. The measures related to effectiveness of fire inspections that have been identified as being used or have been used are included in Table 1.

Table 1 Performance Measure History by Year					
Performance Measures:	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Number of Peak hour/high risk inspections	X				
Number of Fire Code Violations Observed		X	X	X	X
Number of Fire Code Complaints Investigated		X	X	X	X
End of Year Fee and Permit Revenue from Fire Marshal Office		X	X	X	X
Number of Structural Fires		X	X	X	X
Number of Other Fires (Other than Structural)		X	X	X	X
Number of Civilian Fatalities		X	X	X	X
Number of Occupancy Inspections		X	X	X	
Number of Residential Structure fires/per 1,000 residential Structures				X	X
Number of Residential Structure fires/per 1,000 population				X	X
Percent of Residential Structure fires Contained to the oject/room of origin				X	X
Percent of Residential Structure fires Contained to the floor/structure of origin				X	X
Total combined commercial/industrialstructure fire incidents per 1,000 C/I Structures				X	X
End of year % change in number of structural fires				X	X

How are other comparable urban jurisdictions measuring fire code inspection performance?

Surveys were solicited from 12 comparable jurisdictions to identify what measures were commonly used to measure effectiveness and efficiencies in fire code enforcement. The research is somewhat limited due only 6 of the 12 surveys being returned, hence a 50% return rate. This small sampling is probably not a significant enough sample to draw conclusions. The research is further limited by the returned surveys that lacked information, or indicated further information would follow, however that rarely occurred. The survey results and summary are included in

Appendix M. The constant from this survey identified only one common measure among all respondents. That common performance measure was the “total fire code inspections completed”. Table 2 is a summary of the results contained in Appendix M.

TABLE 2 Summary of Survey Results regarding Performance Measures						
City/State	Boston, MA	Louisville, KY	Las Vegas, NV	Baltimore, MD	El Paso, TX	Seattle, WA
# of Full Time Inspectors	N/A	16	17	27	24	12
# of Full Time Civilian Inspectors	N/A	0	0	0	13	0
# of Full Time Sworn Inspectors	N/A	16	17	25	11	14
Measure Inspection Productivity	Yes	Yes	Yes	Yes	Yes	yes
How do you measure Productivity?	See Below	Daily worksheet	Workload measures	Workload Measures	Workload Measures	Workload Measures
Do you measure # of Inspections?	Yes	Yes	Yes	Yes	Yes	Yes (figures in)
Do you measure Sq. Ft. Inspected?	No	No	Somewhat by Grids	No	No	No

TABLE 2 Summary of Survey Results regarding Performance Measures (Con't)

City/State	Boston, MA	Louisville KY	Las Vegas, NV	Baltimore, MD	El Paso, TX	Seattle, WA
What workload measures do you use?	# of Field Inspections	# of Field Inspections	# of Inspections	# of Inspections	# of inspections (by Inspector)	
	# of Code inspections		# of plans reviewed	# of fire drills conducted	# of inspections (totality)	
	# of Code violations issued		% completion of target goal	# of permits issued	# of inspections completed within specified timeframe.	# of inspections completed within a specified time frame.
	# of Plans reviewed		Waiting for more Measures	# of fire safety presentations		
	Number of Permits Issued			# of Systems tests completed		
	Number Masterbox Invoices Billed and Paid			# of plans examined		
	% of BFD Construction Permits issued in 5 days or less			% of violations abated >98%		
	# of Fire Deaths Reported			# of meaningful public contacts		

What opportunities exist for improving performance measurement and achieving efficiencies?

Clearly, opportunities exist for improving the performance measures utilized by the DC Fire and EMS Department. The results show that historically the quantity and quality of the

measures used have significantly improved. The measures vary from a low in FY 2009 of one measure, to a high in FY 2013 of 12 measures. Results also show that the measures are coming more into line with nationally recognized and suggested performance measures, however they still are somewhat different, and often lack an element that adds meaning to the measures. Those missing elements are often the critical elements that connect the entire measure to the fire code inspection. Without this element, the measure may be irrelevant to the fire code inspection effectiveness measure. An additional opportunity for improvement lies with an analysis of whether each of the measures has true and definable impact through inspections within the community. This is at the heart of the issue, and the question that remains to be answered here is, “Are we measuring the right things”.

The results show that the department focuses most of its inspection efforts (90.6%) on inspecting commercial occupancies. If you look at the historical fire data of the District of Columbia, the majority of the fire deaths, injuries and property losses are occurring in residential buildings, one and two family, and multifamily dwellings. In the last 6 years, only one fire fatality occurred in a commercial building. In order to have some impact on the reduction of these deaths, injuries and loss, the inspection efforts need to be directed at those properties where the losses are occurring. This is an area for additional consideration and improvement. It speaks to the overarching mission of the agency and its strategies, and how that translates into goals and objectives. The community would benefit from a comprehensive risk and hazard analysis to ensure the focus of its programs will positively impact the risk or hazard.

Assuming the inspections are properly directed for maximum impact, the analysis of the basic workload measures identified some concerning statistics. The number of inspections conducted from FY 2005 – FY 2012 is included in Table 3.

Table 3 Inspection Data 2005 - 2012							
Inspection Year	Total inspections	Initial Inspections	Reinspections	% of Re-inspect	Breakdown of Focus		
					Residential	Commercial	
FY 2005	29,072	20,613	8,459	29.00%	9,738	19,334	
FY 2006	28,636	19,930	8,706	30.40%	9,378	19,258	
FY 2007	25,151	17,180	7,971	31.60%	10,406	14,745	
FY 2008	13,175	8,100	5,075	38.50%	3,936	9,239	
FY 2009	24,862	16,526	8,336	33.50%	4,566	20,296	
FY 2010	15,193	9,800	5,393	35.40%	3,657	11,536	
FY 2011	14,231	10,354	5,367	37.70%	2,468	11,763	
FY 2012	11,120	7,282	3,838	34.50%	1,045	10,075	

The number of inspections has trended downward at a significant pace and for FY 2011 is at 38% as compared to FY 2005. This equates to a 62% decrease in workload. The anomaly here is the marked decrease from FY 2007 to FY 2008. The author can attest to this occurrence.

Inspectors within the District of Columbia worked in pairs, meaning two inspectors went to conduct a single inspection of a property. In doing so, the inspection was counted for each inspector (2). This effectively doubled the count of true inspections. This adaptive change has been a challenge for the division, and finally by 2010, it appears to have stabilized to a more realistic number of inspections. Other factors impacting in the number of inspections can be attributed to not filling inspector vacancies that have occurred since FY 2010, and the current inspector staffing rate at 73.2% with 10 vacancies. According to the research, the loss of 10

inspectors could equate to over 8,000 less inspections being performed each year. Additionally, during FY2011 the inspection personnel transitioned from hard-copy forms to mobile computers and inspection software utilizing the city’s wireless network with real time connectivity.

Mangers anticipated a short term decrease in productivity, however a long term increase in both productivity and efficiency.

Efficiencies:

The time task/analysis (Appendix K) shows the current workload of the fire inspectors with a significant amount of detail. The use of the principles in NFPA 120 facilitated performing some basic yet informative analysis of the workload in relation to efficiencies. The methodology was the classic GASB efficiency measure utilizing input dollars divided by outputs and to express this as a unit cost. Summary details are below in Table 4:

Table 4 Summary of Workload Analysis	
Inspector Days per calendar year	206
Inspector Hours per Day	5.5
Total Inspector hours per year/per inspector	1133
Total Inspectors working FY 2012	25
Capacity of work hours of 25 inspectors	28,325
Inspectable days per month	17.33
Monthly average of total inspections completed (FY 2012)	926
Monthly average number of inspections per inspector	37.04
Yearly average number of inspections per inspector	448.48
Average number of inspections per day/per inspector	2.13
Average time spent on an inspection	2.58 hours
Average Inspector Salary *	\$78,209.00
Average cost per inspection, based on salary	\$175.75
*(Salary does not include 39% Benefits and fringe)	

To summarize the facts detailed in Table 4, DCFEMS inspectors are compensated (Input) on average \$78,209.00 per year, in addition to an estimated 39% benefits and fringe (\$30,501) for an output of 2.13 inspections per day, and the ability of the department to utilize the inspectors in an operational capacity when and as needed. Records indicate full mobilization of department resources last occurred on September 11th, 2001. There are efficiencies that may be achieved in this area and it requires further thought and evaluation.

Discussion

This research is critical to the ongoing success and longevity of the District of Columbia Fire and EMS Department's fire prevention inspection program, and the fire marshal's office. There needs to be positive indicators of the contributions the prevention programs are providing to achieve strategic goals and the overall mission of the agency. Within this body of research, there are both positive indicators as well as concerning issues. While there are an abundance of things to measure within the fire service, and many tools to help us perform that function, there are severe and concerning issues in meeting the challenge. The first obvious challenge is the lack of resources to perform meaningful measurement, analysis, and basic data collection. This study identifies a current staffing level at 74% of available FTE's , and 10 vacant positions, which includes two inspections supervisors. Based upon survey results, and comments, fire prevention managers are the primary target of budget reductions and cutbacks, forcing many into the streets to fill gaps and keep inspections moving. This does not allow time for program management, evaluation, and improvement. This challenge does not appear to be going away any time soon. Another issue that needs to be considered is the need to standardize and maintain defined

measures for consistency and in order to build a history. If the target (measure were trying to achieve) changes every year, the target becomes difficult to hit. There needs to be consistency and longevity with the measures. It appears there is movement in that direction; however, with a local political election less than two years away, the measures may once again change as political priorities change. This has been and will continue to be a challenge.

The results of the research are a bit surprising to this author, whose thinking was that our agency lagged behind most other comparable jurisdictions in terms of performance measurement and management. Based upon the research, it appears the District Government is utilizing appropriate performance measures for many programs; however there appears to be room for improvement and consideration of new measures to achieve “state of the art” as described by (Hall et. al. 2008) The research shows that the District utilizes more measures than the surveyed comparable cities, and you could opine that some of the measures appear more precise or comprehensive regarding inspections effectiveness.

There is also evidence that the utilized measures are reflective of the meaningful measures proposed by Cline (2008). Those shared measures consist of; Inspections, occupancies by type, structure fires, fires contained to the object, room, building of origin, fire dollar loss, and civilian injury /death rates. The results also support the use of the measures suggested by Granito (1988). The measures he identified and are currently used by the department include; fire incident rates, residential building fires per 1,000 residential units, number of commercial/industrial fires per 1,000 commercial/Industrial occupancies, and number of inspections.

The most impressionable information from the literature review was that of Behn (2003), who makes the point in relation to measuring performance, “neither the act of measuring performance

nor the resulting data accomplishes anything itself; only when someone uses these measures in some way do they accomplish something". It seems there is evidence to suggest that while numbers are being collected, and measures are selected and used, the data is not being translated into useful information that can drive decision making. Look no further than the trending of inspection numbers. These numbers have spiraled downward for several years without concern, or any alarm being raised. The Tri Data (1997) report recognized that there were shortfalls in the funding and attention given to prevention efforts, and there was a lack of capability to analyze data. The significance of understanding the fire problem is also evident in the lax and haphazard reporting of national statistics (NFIRS) to the National Fire Data Center at the National Fire Academy. The submissions from the District of Columbia are dismal over the last 10 years. Swisher (2005) and, Farr & Sawyer (2003) recognized how the most overlooked part of program management is outcome measurement, and evaluation. This research confirms that program measurement and evaluation is a relatively new concept to the department, and while it has collected loads of data over many years, very little has ever been done to analyze and evaluate the data and turn it into useable information.

The organizational implications of this research point to a clear need to have a well defined organizational mission, with goals and objectives that will fully support achieving the mission. The programs, activities, and processes that seek to achieve the goals and missions need to be evaluated for their effectiveness toward achieving the outcomes. The key is to tie all of these pieces together, and effectively communicate this from the top to the bottom of the organization. There has been some breakdown in this process and efforts should be to revisit and re-structure the performance management plan so it is all working together to achieve outcomes and goals. Overall to the organization, the relevance is that there is work to be done, and areas for

improvement, but the benefits of doing so are to work more effectively and efficiently toward common goals.

Recommendations

There are numerous recommendations to be made in order to move the department toward being able to readily articulate to both internal and external stakeholders the effectiveness of its programs it provides. There should be no guesswork, feelings, or hopes that our programs achieve desired outcomes. Managers need to be able to readily identify the successes and failures of programs in a continuous process to provide better service at lower costs. The following list is not in any specific rank order; however, they are items that have been identified as requiring attention within the body of this research:

1. A team of fire prevention managers should re-evaluate the performance measures and ensure they measure the right thing, while evaluating the use of the 11 new benchmarks.
2. Fire Prevention managers need to closely monitor the workload of fire inspectors to determine the cause of falling inspection numbers, and seek ways to improve performance.
3. A study should be undertaken to evaluate the efficiencies that could be gained through utilizing civilian inspection staff.
4. Fire department managers need to place significant importance on NFIRS reporting and sanctions for not reporting into the NFIRS system. Data not reported is critical to the mission of the agency.

5. Once performance measures are implemented, they need to remain unchanged for some defined period of time to allow for meaningful apples to apples measurement and benchmarking.
6. Program evaluation and management must take place for all program areas.
7. The performance measures need to be built into the inspection software as a pre-defined output or report to ease the burden of performance measurement on managers.
8. Performance measurement/management training needs to be provided to all managers.
9. The use of technology needs to be explored in an effort to simplify performance measurement for the manager.
10. Executive staff should meet monthly to review and present performance data and discuss trends and identify gaps.
11. The department should engage in a comprehensive risk reduction program and/or seek accreditation to ensure it is expending resources in the most effective manner to effect positive change.
12. Fire Inspector vacancies should be filled as soon as possible.
13. Consideration should be given to trading an inspector position for a data analyst position for the fire prevention division, in an effort to better understand and utilize data.

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