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Executive Development

Analyzing The Effectiveness Of The Oklahoma City Fire Department In Determining The Cause

of Fires.

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Officer Program

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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.

CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is

set forth, quotation marks so indicate, and that appropriate credit is given where I have used the

language, ideas, expressions, or writings of another.

Signed: _____

ABSTRACT

The effectiveness of the Oklahoma City Fire Department's fire cause determinations had not been verified. This research purpose was to examine the effectiveness of the department in fire cause determination. A descriptive methodology was utilized to identify effectiveness in determining fire cause. Surveys, data analysis, and interviews answered the following questions: What training is provided by the Oklahoma City Fire Department in cause determination? How do similar size cities determine the cause of fire in their departments? How effective is the Oklahoma City Fire Department in cause determination? Results showed that determining fire cause was consistent across jurisdictions, but to insure effectiveness changes were needed. Implementing Standard Operating Procedures, standardized training, developing performance goals and improving data bases was recommended.

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INTRODUCTION

The Oklahoma City Fire Department (OCFD) is a full time paid fire department with approximately 1000 uniformed and non-uniformed employees. The OCFD assumes responsibility for a variety of services provided through 35 fire stations, a centrally located Fire Prevention Office, and various specific purpose facilities. The fire department disseminates its' services both internally and externally through the divisions of Prevention, Operations, and Support Services all working under the OCFD Fire Chief. These services are provided for 523,303 citizens living within the 621.15 square miles that constitute the city of Oklahoma City.

The OCFD assumed internal responsibility for the investigation and pursuit of arson fires in the mid-1970's (J. Soos, OCFD Fire Marshal Retired, personal communication, July 13, 2004), and remains the investigative agency responsible for criminal arson fires today. The OCFD determines the cause of fires with a staff of over 160 Company Officers and District Chiefs who work in cooperation with twelve full-time fire investigators, forming an integral fire cause investigation team. This investigative team must determine the cause of fires within a city that varies from a metropolitan downtown high-rise district, to a large agricultural and wildland urban interface. It is this diversity of Oklahoma City and its' industries that creates an environment where complicated fires requiring accurate cause determinations are common.

The fact that OCFD has evolved from six employees with dual fire inspection and investigation responsibilities in the mid-seventies, into a dedicated fire investigation office with a thirteen member staff is alone evidence of a commitment to identify arson fires. However, the success of these efforts in determining the cause of all fires had not been evaluated. The OCFD performance measurements of fire investigation clearance rates were insufficient to insure the

quality of fire cause determinations for all fires. Therefore, the availability of accurate statistical fire cause data was in question.

The problem was that the effectiveness of the OCFD in determining the cause of fires had not been verified, which leaves in question the success of the program. The purpose of this research paper was to examine the effectiveness of the OCFD's fire investigation program in determining the cause of fires. In order to accomplish this task, a descriptive research methodology was utilized and answered the following relevant questions:

1.   What training is provided by the Oklahoma City Fire Department in cause determination?

2.   How do similar size cities determine the cause of fire in their departments?

3.   How effective is the Oklahoma City Fire Department in cause determination?

In order to substantiate the research, the undetermined fire percentages for both the Fire Investigation Office and Operations Division were evaluated. The researcher sought to analyze quantifiable fire reporting and survey data to produce qualitative assessment. In order for any fire cause determination program to be effective it must provide the jurisdictional authority with accurate useable information that identifies the causation of fires within the community.

BACKGROUND AND SIGNIFICANCE

The process of determining the cause of fires under the OCFD format involves a systematic investigation that intensifies in investigative personnel and technical skill levels in direct relation to the initial fire cause assessment. The initial cause determination of a fire and/or assessment to determine need for additional technically trained fire investigators is the responsibility of the Operations Division. It is the Company Officers and District Chiefs who initiate the investigative process, and they may or may not generate a formal fire investigation by

requesting fire investigators from the Prevention division. Nowhere else within the OCFD was the interdependence of two divisions more relevant than in the determination of fire causes, where collaboration between the officers in Operations and Investigations was imperative to successfully determine fire cause.

The OCFD Prevention Division relies on statistical data to determine performance success and establish prevention programs and goals. Specifically the fire investigation office has historically relied on its reported clearance rates as a measurement of investigative performance. However, case clearance rates as a performance measurement only identifies the successful criminal investigation of confirmed arson fires and fails to analyze the departmental team effectiveness in actually determining all fire causes. Therefore, measuring the performance of the OCFD in determining the cause of fires had never been analyzed.

The statistical fact the majority of formal fire investigations were, or were not, initiated by company officers and district chiefs brought into question the skills and training provided to those officers in fire cause determination. This caused the author to question the potential for failure of the fire cause determination program at the initiation point if sufficient controls and training were not in place.

In the years of 2001 to 2003 Oklahoma City reported 42 fire fatalities, and 102 fire related injuries. During the same time period 6 juveniles died as a result of fire and 18 juveniles were injured. There was a defined need to insure that accurate fire cause determinations were being made and that fire cause trends were being identified to reduce the loss of life in both children and elderly citizens, a stated United States Fire Administration objective. The future ability of the OCFD to prevent fires and ultimately reduce preventable fires, as well as fire

fatalities and injuries, may well rest in its ability to accurately determine the cause of fires occurring today.

The Executive Development course discussed both the technical and adaptive challenges that occur with organizational change. This applied research project was expected to identify potential changes needed to insure effective fire investigations. This would likely involve both technical and adaptive challenges as they related to the OCFD providing effective fire cause determinations. In order to conduct the research the author utilized a descriptive methodology to explain the current effectiveness of the OCFD in determining the cause of fires and establish a baseline of performance issues. The subsequent information and data gathered from this research would be provided to the OCFD Fire Marshal to be used for recommendations to enhance or improve the OCFD's ability to determine causes of fires in the future.

LITERATURE REVIEW

As with any research involving aspects of the investigation of fires, the statutory requirements were reviewed. The Oklahoma State Fire Marshal is a statutory position established to, among other things administer, if not perform "fire and arson investigations" (Okla. Stat. 74 § 11-324.4) throughout the state of Oklahoma. The state law further mandates extending the legal obligation to determine fire cause statewide to local jurisdictions in Okla. Stat. 74§ 11-314, 2001, which says in part, that the fire chief of every department is legally obligated to conduct origin and cause fire investigations anytime damage to property occurs.

The Oklahoma City Municipal Code in Chapter 20 Fire Prevention and Protection further provides ordinances that enable the OCFD to meet the state mandated fire cause determination requirements. Specifically, municipal ordinance requires the OCFD to be staffed with a Fire Marshal (Oklahoma City, Okla. Municipal Code § 20-1, 2002). The duties of the

Fire Marshal and fire investigators are defined in city ordinance as the enforcement of fire prevention codes, determination of fire causes, and the identification of arson fires (Oklahoma City Municipal Code § 20-26 (f). 2002; Oklahoma City, Okla. Municipal Code § 20-5, 2002). These duties are then extended to Company Officers and District Chiefs by the language, "Each chief officer and each station officer shall be Ex Officio Fire Marshal of the districts they are assigned to" (Oklahoma City Municipal Code § 20-7, 2002).

The National Fire Protection Association (NFPA) in its annual fire loss report stated "In 2003 1,584,500 fires were attended by public fire departments" (NPFA, 2004, p. i) in the United States identifying the need for fire cause determinations. Of the fires reported by the NFPA, the majority occurred in residential structures. The same report found statistically that there was a fire related injury every 29 minutes and a fire death every 134 minutes in the United States (NFPA, 2004). Similar information was reported by the Federal Emergency Management Agency (FEMA) who reported statistically a fire related injury occurs every 28 minutes and a fire death every 156 minutes (Federal Emergency Management Agency, 2004). Despite minor discrepancies between the reports, both clearly articulate fire related injuries and fatalities remain a significant issue for the fire service, with NFPA reporting a total of 3,925 civilian fire related deaths nationally in 2003 (NFPA, 2004).

During the same 2003 time period NFPA (2004) reported intentionally set fires accounted for 37,500 of the reported total fires, and resulted in 305 reported civilian fire deaths. From the data, one can logically conclude that there is a definitive need for the OCFD to insure effective fire cause determinations are being conducted. Further, some authors such as Dehaan (2002) have said regarding the statistical arson data:

These [fire cause] estimates are almost certainly on the conservative side, since many

fires are never properly investigated due to lack of time, or are misidentified

inadvertently as accidental fires due to lack of experience or intentionally to avoid the

complications that arise from identifying a fire as a criminal act…. It is the opinion of

this author that as many as 40 percent of all urban structure fires in the United States

today are incendiary in origin, that is, intentionally started. (p. 3)

There is a universal agreement within the literature that the effective determination of fire

causes is critical in minimizing the losses, both in human lives and property damage, from fires

in the United States (Dehaan, 2002; NFPA, 2004; NFPA, 2001).

Traditional fire service literature was implicit on the reasons why skilled proficiency is

needed for conducting an investigation into fire cause. The NFPA has published three standards

that are applicable directly or indirectly to the investigation of fire and the determination of fire

cause. NFPA 1021 the Standard for Fire Officer Professional Qualifications addresses specific

Job Performance Requirements (JPR) in regards to determining the cause of fires as a fire

officer. The standard has graduated officer performance requirements into two skill levels. A

Level I Fire Officer by standard should be able to minimally determine a preliminary fire cause,

secure a fire scene and preserve evidence (NFPA, 1997). Additionally, the NFPA 1021 Standard

adds determination of the point of origin and determining Arson as additional Level II officer

minimum skills (NFPA, 1997). However, the training required to enable officers to meet the

standard are left to "The local or state provincial training program…" (NFPA, 1997, p. 5).

NFPA 1033 Standard for Professional Qualifications for Fire Investigator, is written in

similar format as NFPA 1021, and identifies minimum JPR's for a fire investigator. While being

relatively comprehensive the standard is limited in that it only defines "… the performance

required for a specific job" (NFPA, 1998, p. 5) in each identified skill.

Notably the most comprehensive document reviewed in regard to determining the cause

of fires was NFPA 921 Guide for Fire and Explosion Investigations, which is an exhaustive 229

page how-to manual for fire investigations. NFPA 921 draws conclusions regarding fire

investigations such as, "Generally, if the origin of a fire cannot be determined, the cause of the

fire cannot be determined" (NFPA, 2001, p. 116). The NFPA 921 (2001) Standard establishes

the determinations necessary to establish fire cause as:

> The determination of the cause of a fire requires the identification of those circumstances
>
> and factors that were necessary for the fire to have occurred. Those circumstances and
>
> factors include, but are not limited to, the device or equipment involved in the ignition,
>
> the presence of a competent ignition source, the type and form of the material first
>
> ignited, and the circumstances or human actions that allowed the factors to come together
>
> to allow the fire to occur (p. 121).

Further as it relates to the purpose of this research NFPA 921 states, "The cause of a fire

may be classified as accidental, natural, incendiary (arson), or undetermined" (NFPA, 2001, p.

121). The undetermined classification is clarified to be the only acceptable fire cause

determination if none of the other causes can be established based on factual evidence.

Additionally, the importance of gathering data is consistent with other literature in that "Pertinent

information should be reported in a proper form and forum to help prevent recurrence [of fires]"

(NFPA, 2001, p. 11). The major contribution offered from the available NFPA literature

reviewed was its use in development of training standards, as references in setting performance

goals, and establishing performance measurements relating to the determination of fire causes.

To the determination of fire causes, Dehaan (2002) has said, "No other investigation is as daunting as a fire scene", and concludes, "… a fire scene has to be investigated before it can be established whether or not the crime of arson has been committed, every fire scene must be considered a possible crime scene until clear proof is found that the fire was accidental" (p.3). With this thought in mind the investigation for the determination of fire cause may quite well be the most daunting team task in existence. Law enforcement literature suggests all parties responsible for the determination of fire cause must always be cognizant of their contribution to the investigative team. Criminalist and forensic expert, Dr. Henry Lee has said:

> The crime scene investigators must work as a team. In order to conduct a thorough coordinated and successful investigation all participants must know their responsibilities, importance, and limitations. Each individual – from the first responder [company officers and chief officers] to the investigating detective [fire investigators], from the laboratory analyst to the prosecuting attorney – must work with each other to do their respective parts in solving the case (Lee et al., 1994, p.17).

To analyze the effectiveness of the OCFD in determining the cause of fires, literature was reviewed regarding team performance and performance measurement. Marti Eicholz defines teams as, "… a group of people who are committed to a common purpose, performance goals, and an approach for which they hold themselves mutually accountable" (Eicholz, 1997, p.17). Barner (2001) extends the idea of a team beyond the customary image of people directly interacting, into what he calls "virtual teams" (p. 75), being a team where the members of the team are not necessarily positioned at one location doing one group task. While still again Katzenbach and Smith (2003) say, teams will develop informally when individuals are collectively challenged to perform difficult common tasks. They continue further proposing a

team is formed when it has a common purpose, common performance goals, and a mutually

agreeable working approach has formed. The literature consistently suggests to have successful

team performance each member must internalize accountability for the performance outcomes

(Barner, 2001; Eicholz, 1997; Lee et al., 1994; Katzenbach & Smith, 2003).

  For the purpose of analyzing effectiveness, Barner (2001) proposes, "What gets measured

gets attended to" (p.177). Barner describes this process as asking, "What are the major business

drivers that shape and influence the performance of our work team" (p.136), and concludes, "A

solid and explicit performance scorecard is essential to the success of any team" (p.175). One

could reasonably assume that Eicholz (1997) agrees as she states, "A team works best when

everyone understands its' purpose and goals" (p. 178). In fact most authors of the text reviewed

stressed the importance of measurement and clear performance goals when assessing team

performances (Barner, 2001; Katzenbach & Smith, 2003; Ogata & Goodkey, 2002).

  In order to determine what needs to be measured and set valid performance goals data

must be collected. An example of the failure of fire service personnel to understand the

importance of data is stated by the International Fire Service Training Association (IFSTA)

Chief Officer manual as personnel "regard[ing] record keeping and reports as busywork"(IFSTA,

1984, p.91). The philosophy proposed by Barner (2001) says, in order to use data it must be

comprehensive and recommends data be converted to percentages or similar formats for ease of

analysis.

  Therefore, the reviewed literature tends to agree that evaluating performance as well as a

data analysis are interdependent factors for successfully determining the effectiveness in

achieving performance goals. In the 2003 NFPA Fire Loss in the United States report there were

five recommendations put forward to address the fire problem in the United States. Of the

suggested major strategies two require fire cause determinations to be accurately performed, the first being collection of information on common causes of fatality fires, and the second determining additional ways to improve products in the home (NFPA, 2004). The reoccurring theme identified in literature, was the necessity to collect data for analysis, set performance goals based on analysis, and conduct ongoing performance measurements to evaluate effectiveness (Barner, 2001; Dehaan, 2002; Eicholz, 1997).

Key literature points of significance were identified as it relates to this research. To validate effectiveness one must measure performance through the analysis of data. Also, to perform a fire cause investigation is a complicated team task requiring specific skills and requisite knowledge. Further, the value in determining the cause of fires to prevent fire deaths and injuries is not unique to the OCFD. Therefore, this research will attempt to analyze current available data to evaluate performance, identify the current training proficiency levels to assess skills, and survey similar size cities to identify similarities and differences in methodologies for determining the cause of fires.

PROCEDURES

A descriptive research methodology was utilized to identify the information and data necessary to analyze the effectiveness of the OCFD in determining the cause of fires. This was conducted with the use of an inter-departmental officer/investigator survey, personal telephone interviews of comparable fire departments, and data analysis. A literature review was initiated at the Learning Resource Center (LRC) on the campus of the National Fire Academy (NFA) during instruction of the Executive Fire Officer Program (EFO) Executive Development course in May 2004. The literature review process was continued throughout the project utilizing such additional sources as the Oklahoma City Metropolitan Library System, Oklahoma City

University Law Library, the internet, and various internal produced documents from the libraries

and data systems of the City of Oklahoma City and the OCFD.

In order to obtain information regarding the training provided by the OCFD in fire cause

determination multiple methods were employed. The first method was a review of internal

training documents that failed to produce useable information. This prompted a personal

interview with the OCFD Training Officer, Major Danny Hague which also failed to produce

useable data. This required the researcher to develop and conduct an internal survey of OCFD

personnel. The survey data was collected from both the Investigators of the Fire Investigation

Office as well as Company Officers and District Chiefs in the Operations Division.

Procedure for Inter-departmental Officer Survey

In order to develop the survey, a review of applicable literature was conducted. The

system being utilized to report data by personnel had been formatted from coding established in

NFPA 901 Standard Classifications for Incident Reporting and Fire Protection Data (personal

communication, John Williams OCFD-FMIS, June 2004). This standard and the correlated data

necessary to establish the cause of a fire were utilized to formulate survey questions along with

critical areas of training as it applied to determining the causes of fires.

The Survey Questionnaire was placed into a draft format and written for peer review.

The survey was given to two current EFO students and one EFO graduate for review prior to

distribution. The peer review process was performed on two drafts prior to finalizing the survey

for distribution with recommended modifications. The final survey was submitted to the Fire

Marshal and the Deputy Chief of Operations for approval prior to inter-departmental distribution.

The survey was distributed internally in September 2004 utilizing the district chief

officers as the distribution method to the 171 Operations Company Officers and District Chiefs.

This format was chosen because it was the general distribution methodology utilized by the

OCFD for internal documents and insured a reasonable amount of reliability. A timeline was

established that allowed all respondents multiple working days to respond to the survey. The

survey was also distributed to OCFD Fire Investigators utilizing standard internal document

distribution methods.

The survey was composed of nine closed ended yes/no questions and one open-ended

free text response question for a total of ten survey questions. A copy of the survey is provided

in Appendix A. All the survey questions were directly related to training levels and requisite

knowledge competencies of the surveyed personnel in determining the cause of fires.

Questions one through four were taken directly from the OCFD incident reporting

system; as well as literature review. Numerous reviewed literature sources established that in

order to determine the cause of a fire one must identify the origin, the heat source, the material

ignited, and the sequence of events, also known as the ignition factor, to determine the cause of a

fire.

Question five was established to identify whether surveyed personnel had utilized NFPA

921, a nationally recognized standard, while conducting their fire cause investigations. NFPA

921 was selected as a measurement criterion due to its universal acceptance in both the judicial

environment, as well as the field of fire investigation training.

Questions six through eight were designed to gather information about personnel's

requisite knowledge and training competencies as it related to statutory regulation and crime

scene procedures. This criterion was deemed relevant due to the amount of statutory literature

located regarding the determination of fire cause.

Question nine was formulated to gather data on the standardization of formal investigation requests within the OCFD. Again the relevant literature review failed to identify specific documents of standardization in the program, therefore this was added to the survey for analysis.

Question ten was designed to gather data on the overall training competencies currently possessed by personnel of the OCFD in determining the cause of fires. The goal of this question was to identify the specific training levels held by individuals in the field of fire cause determination.

The surveys results were sorted, according to training levels, utilizing data provided in the answer given to question ten. Three classes of respondents were identified, with those classifications being no training, internal OCFD training only, and formal fire investigation training. For the purpose of this research the classification determination was made by the following criteria.

1.   If respondent indicated specific origin and cause training by a recognized agency/organization such as NFA course, any collegiate course in fire investigation, or other institutional organization generally recognized in the fire service, field of fire investigation, or law enforcement he/she was classified as having formal training.

2.   If the respondent indicated internal OCFD officer academies or inter-departmental training with investigators at fires he/she was classified as having internal training.

3.   Finally, if the respondent indicated no training or failed to respond leaving the question blank he/she was classified as having had no training.

The data was then analyzed for each classification group by determining respondent percentages for each individual question. Finally, the overall aggregate of all respondents' answers, in each group classification, was formatted into overall percentages for an internal assessment of the training levels for the OCFD. The analysis of the internal survey data was then utilized to answer the question of what training is provided by the OCFD in cause determination. A copy of the survey and the analyzed results are provided in Appendix A.

Procedure for Personal Telephone Interviews of Similar Fire Departments

An informal telephone interview of similar size cities fire departments was utilized to gather comparison data for this research. The departments polled were identified from an established list containing ten cities mutually and contractually agreed to by the City of Oklahoma City and the International Association of Firefighters Local 157(IAFF 157), the OCFD bargaining agent. The standing ten city survey list was utilized for its relative reliability and acceptance as containing comparable fire departments in comparable size cities. The interviews were conducted in an unstructured format with generalized adherence to topics relative to this research. The information requested from the interviewed departments was related to fire cause determination training, methods of initiating fire investigator responses, and internal policies or laws regarding fire cause determination investigations. The data gained from these interviews was then compared to the OCFD and utilized to answer the question of how similar size cities determine the cause of fires.

Procedure for Incident Report Data Analysis

The final procedure employed in this research to address the question of how effective the OCFD is in cause determination was a data analysis. The OCFD utilized a computer based information data system to compile incident reporting information. The system was based on

NFPA 901 and allowed a query of coded identifiers in the categories of area of origin, material

first ignited as both form and type, equipment involved in fire ignition and the ignition factor for

all fire reports. The assistance of the OCFD FMIS Officer, Major John Williams, was utilized to

run code specific queries of the incident reports for all OCFD 2003 fire related dispatched calls.

The data was provided by Major Williams in Microsoft Excel Pivot Table format and analyzed

to identify undetermined fire reports. For the purpose of this research three categories of fire

reports were identified for analysis. These categories were established as structure fires, car fires

and grass/brush fires. The analyzed data is available as provided to the author in Appendix B.

Any fire report that failed to identify, or identified as undetermined, the data entry for an

ignition factor, the area of origin, and/or either the form or type of material involved in the fire

was classified as an undetermined fire for the purposes of this research. If the reporting author

identified either a form of material and or a type of material on any specific incident report, this

was accepted for this research as a determination for that category. Since there are acceptable

instances where a fire cause can be accurately determined with no equipment involved, this

criterion was not utilized to identify an undetermined fire.

Once the incident reporting data was analyzed, percentages of undetermined fires were

tabulated to provide for additional comparisons. Fire Investigator cause determination reporting

data is kept in a separate database; therefore, the Uniformed Crime Report (UCR) forms filed by

the OCFD Investigation Office were utilized to identify undetermined fire causes for this group.

A copy of the UCR is provided in Appendix C. This data was analyzed in the same percentage

format as the fire report data allowing a comparison of fire causes determined by fire

investigators and fire causes determined by operations personnel. The aggregate total of

gathered reporting data was utilized to answer the question of how effective the OCFD is in

determining the cause of fires.

Limitations and Assumptions

Access to materials was greatly impeded by local sources. Both the Oklahoma City

Metropolitan Library System and the Pioneer Library System refused to acquire requested

materials through the LRC utilizing the inter-library loan program. No explanation was obtained

from local libraries for their refusal to participate in inter-library loans, and the LRC was not

found to be at fault; however resources were limited by this local action.

It was assumed incorrectly that standardized departmental training in the area of fire

cause determinations was being provided to Company Officers and District Chiefs with the

OCFD. Since that was not found to be the practice, documents and standards that had been

anticipated were not available for analysis. That led the researcher to develop and depend on an

internal survey to evaluate training competencies of OCFD employees. Therefore, the validity of

the data is directly dependent on the accuracy of answers provided by the respondents. Further

an instructional error was identified after the survey had been conducted as the instructions

related to question ten. However, the data provided by respondents for this question tends to

indicate the error had minimal impact on the survey reliability.

The incident reporting data critical to this project was not readily available for analysis by

the researcher. The method of obtaining reporting data was an internal request of the FMIS staff

and the timeline for receiving requested data was very long. This extended delay inhibited the

available time for analysis and impacted the overall quality of this research. It was further found

that reporting data being entered into multiple databases utilizing different data formats and

storage methodologies complicated comparison and analysis.

Respondents to the officer survey among the fire investigators sample group was minimal, at less than 61% of the group returning the survey. Therefore this data does not meet the criteria necessary to assure a 95 percent confidence level.

RESULTS

Answer to research question: What training is provided by the Oklahoma City Fire Department in cause determination?

An internal search of the OCFD documents failed to identify relevant data to the question. Therefore, the researcher interviewed the OCFD Training Supervisor, Major Danny Hague by phone on June 23, 2003 regarding officer training in fire cause determination provided by the OCFD. The result of the interview established that the OCFD had no written training standards, and did not follow any established standards for fire cause determination training of its officers. The interview revealed that generally, company officers receive one hour of unstructured instruction in fire investigation during internal promotional officer academies as a block of training prior to completion. This training was not always conducted in all officer academies and was not standardized by format or delivery. Further, the instructional materials and information provided during this training block was not known to the training officer, nor was it available for analysis.

The Line Officer cause determination survey was analyzed for Operations respondents and produced the following results based on 160 returned samples of the 171 distributed surveys: this data being well within the necessary sample size to establish a 95% confidence level. Officers reporting formal training in fire cause determination constituted 32% of Operations division, while officers with only internal training represented 15% of the division, and the largest respondent group was Operations officers with no training in fire cause determination at

53% of the division. Subsequently the same analysis of the survey distributed among the fire

investigators produced the following results based on 8 returned samples of 13 distributed

surveys. As previously noted this sample is not sufficient to produce a 95% confidence level.

Investigators reporting formal training in fire cause determinations represented 75% of

respondents.

For questions one through four which related to training in the key elements necessary to

determine the cause of fires, the origin, the heat source, the material ignited, and the ignition

factor, Operations respondents consistently reported above 50% of the officers were inadequately

trained. Even among the Operations officer group classified as having had formal training in

determining the cause of fires, respondents reported that 30% to 49% (dependent on the specific

question) were inadequately trained in these critical areas. For the same series of questions, fire

investigators reported adequate training in all responses representing 100% of respondents.

Question five of the survey asked if respondents generally followed the NFPA 921 Guide

for Fire and Explosion Investigation for determining the cause of fire. 88% of Operations

respondents reported no. This response was consistent even among Operations officers reporting

formal training in fire cause determination with 86% reporting they did not follow NFPA 921

guidelines when determining fire cause. For fire investigators surveyed 87% of respondents

reported they did follow NFPA 921 guidelines when determining fire cause.

For questions six through eight which related to officers requisite knowledge and training

in the statutes and crime scene procedures, respondents again consistently reported above 55% of

the sample were inadequately trained. While these responses were substantially higher among

officers classified as having no training, formally trained officers still reported inadequate

training in crime scene procedures and state and local laws by above 45% of the respondent

group. However, officers with formal training reported only 33% were inadequately trained in

recognition of fire evidence. Fire investigators again reported adequate training to all related

questions representing 100% of respondents.

To question nine regarding if the OCFD had clear guidelines for calling a fire investigator

to the incident scene, Operations respondents reported yes the department did by 73%. An

analysis of all group classifications for this question did indicate that consistently 68% or more

of each class group responded positively to this question saying, the OCFD had clear guidelines.

Fire Investigation respondents to the same question; however reported the OCFD did not have

clear guidelines for calling a fire investigator by 87%. This question created an unexpected

variance in the research data and will be covered further in the discussion section of this

research.

Overall the answer to the research question regarding what training is provided by the

OCFD in cause determination is directly related to where you are working within the fire cause

investigation team. The overall result of all the methods employed to answer this question was

that the OCFD is not providing training in fire cause determination to Operations officers except

in a very limited capacity. The current level of training held by Operations officers required to

make critical decisions regarding fire cause determinations and assessments for additional

investigations is tenuous at best. Additionally, the OCFD officers with the training required to

make such determinations, generally the fire investigators, are not in an operational position to

render assistance.

Answer to research question: How do similar size cities determine the cause of fire in

their departments?

Of the fire departments interviewed it was found all the surveyed cities utilize the same format as Oklahoma City in determining the cause of fires. The surveyed cities of Austin, TX. Fire Department (AFD), Fort Worth, TX. Fire Department (FWFD), Tulsa, OK. Fire Department (TFD), and the Tucson, AZ. Fire Department (Tucson FD), provided internal commissioned fire investigators to determine the cause of fires and pursue the crime of arson. Of the departments surveyed, all but the FWFD who responds by policy to all fire alarms, relied on their Company Officers and Incident Commanders to provide over 90% of their request for formal fire investigations. Chief F. Gonzales (personal communication, October 11, 2004) said, the FWFD has a Standard Operating Policy to send fire investigators to generally all fires that constitute a fire alarm response. This made his department unique in the survey; however he further said this policy had possibly been the reason fire officer training was not being provided although he had requested it.

Except for the FWFD, the other surveyed departments were mandating and providing standardized fire officer training. This training was generally incorporated in regular promotional academies or schools and was developed from recognized standards.   The fire officer training was also predominately being taught by the fire investigation offices from the respective fire departments.

Captain A. Wolverton (personal communication, October 7, 2004) of the AFD said training begins with drivers who receive four hours, and then when employees are promoted to Captain an additional eight hours of training is required. As training related to fire investigators, all departments reported training was given. This training was generally obtained by investigators from external agencies such as the NFA. Chief S. Mason (personal communication, October 11, 2004) of the TFD even reported an internal requirement for new

investigators to become Certified Fire Investigators within five years; however he said this was

not being enforced due to limited training budgets prohibiting compliance.

The reported undetermined fire statistics from the surveyed departments provided fire

investigation undetermined ratios consistently in the range of 14% to 16% of the investigated

fires. There was generally not a consistent trend to track undetermined fires occurring outside

the investigation offices. The exception to this was FWFD where Chief F. Gonzales (personal

communication, October 11, 2004) said he unofficially tracked this data, and he believes this

data may be the most telling statistic for evaluating performance. Additionally, Captain A.

Wolverton (personal communication, October 7, 2004) said when he was tracking non-

investigated fire data, the combined Operations and Investigations undetermined fire percentage

was approximately 30% up from the investigation undetermined fire percentage of 16%.

Possibly the most compelling statistic revealed during this survey was the relative

consistency of the number of structure fires being investigated in each jurisdiction. Despite the

geographical separations, and similarities or differences among the surveyed fire departments,

respondents consistently reported above 800 fire investigations were being conducted annually

by their investigation offices.

Answer to research question: How effective is the Oklahoma City Fire Department in

cause determination?

Structure Fires

The analysis of Operations fire incident reporting data and fire investigation reporting

showed deficiencies in the OCFD effectively determining the cause of fires. Of 826 Operations

structure fire reports provided to this author, a sample size of 585 was analyzed to produce the

following results. The sample size represents 71% of the structure fires reported and exceeds the

265 reports required to assure 95% accuracy. Of the analyzed reports 185 fire reports were

identified representing 32% of the fire causes as undetermined by the criteria described in the

procedures section of this research. Additionally 47 of the 585 reports sampled or 8% were

identified as incendiary intentionally set (arson) fires. However, of the 47 arson fire reports

identified, 15 of these failed to identify the criteria necessary to determine an arson fire cause

representing a 31% reporting error rate when fires were determined to be arson fires.

During this same time period the OCFD fire investigation office responded to 281

investigations of structure fires representing 34% of the total 826 fires. Of these investigator

responses, 45% of the structure fires were found not to be arson fires. However, 152

investigations representing 54% of investigator responses were determined to be arson fires. Of

the identified arson fires, 46 were cleared by arrests. Also identified was that 29 of the 46 arrest

clearances were below the age of 18 representing 63% involved juvenile arson fires.

Car Fires

For vehicle fires within Oklahoma City in 2003, 555 fire reports were analyzed. Of these

reports, 309 fire reports were found to be undetermined fire causes, representing 55% of the car

fires. Of the car fire reports, 25 were identified as arson fire cause representing only 4% of the

total car fires. However, again of the 25 arson fire reports, 13 or 52% failed to identify the

criteria necessary to establish an accurate fire cause determination.

During this same time the OCFD Fire Investigation Office responded to 27 incidents

representing only 4% of all car fires for 2003. Of these fires 27 responses, 22 or 81% were

determined to be arson fires. Additionally, three arrests were made representing 13% of the

arson car fires investigated by fire investigators resulted in arrests.

Fires in Trees, Brush, and Grass

For the category of tree, brush, or grass fires in 2003, 933 fire reports were analyzed. Of these reports 535 reports were undetermined fire causes by the criteria of this research representing 57% of the fires for the year 2003. Additionally, 99 fires or 10% were determined to be arson fires. However, again 27 of the 99 identified arson fires or 27% failed to properly identify the criteria necessary to establish an accurate fire cause determination.

During this same time period the OCFD Investigation Office responded to 15 calls for investigation of tree, brush or grass fires, representing only 1% of all these type fires. Of these 15 responses to investigate fire cause, 12 responses or 80% of the fires were determined to be arson fires. The 12 arson fires investigated by fire investigators resulted in 5 arrests with 4 of these arrests or 80% representing juvenile(s) who set fires.

<div align="center">DISCUSSION</div>

The purpose of this research project was to analyze the effectiveness of the OCFD in determining the cause of fires. In order to accomplish this assessment the following questions were applied. What training is provided by the OCFD in cause determination? How do similar size cities determine the cause of fire in their departments? Then ultimately, how effective is the OCFD in determining fire cause? Answering the question of what training is provided by the OCFD in fire cause determinations was vital in the ultimate analysis of the departments' overall ability to determine the cause of fires. The interview conducted with the OCFD Training Officer as well as the internal survey provided a general common answer. The OCFD is providing very little, if any, formal training for Company Officers and District Chiefs in determining the cause of fires, as well as the legal standards associated with this function. However, the training of fire investigators is meeting at least a sufficient level to create competency and proficiency in determining the cause of fires.

The interview of Major Danny Hague, supervisor of the OCFD training staff provided only one specific instance where external training, a regional course in fire cause determination from the NFA, had been brought to the OCFD in 2003. Additionally, the results of an internal survey of Company Officers and District Chiefs showed 53% of the personnel had no training at all in fire cause determination. Even when officers who reported training either internally or formal, above 50% still reported they felt their training was inadequate in the critical areas of determining an area of origin, the equipment involved in ignition, the materials involved in ignition, and the ignition factors of fires. It is these very officers who are responsible for an initial assessment of the fire. "The purpose of this initial examination is to determine the scope of the investigation, such as the equipment and manpower needed, to determine the safety of the fire scene, and to determine the areas that warrant further study" (NFPA, 2001, p. 117). Additionally, these officers should be able to "perform a fire investigation to determine a preliminary cause, securing the incident scene, and preserving evidence …." (NFPA, 1997, p. 7). The lack of training competency being provided by the OCFD creates the potential for failure of the entire fire cause determination investigation process, since it is the company officers and district chiefs who initiate requests for formal fire investigations.

The general consensus in the literature review was significant regarding the implicit goal of any fire cause determination investigation. "The purposes of the investigation are as follows: 1. To determine the origin of the fire. Where did it start? 2. To determine the cause - the nature of the initial fuel and means of ignition. What was ignited? How did first fuel and ignition source come together? 3. Was it an accidental fire or an intentionally set fire?" (Dehaan, 2002, p. 160). Other authors were less specific in detail but agreed in concept that "The major objective in the search of a fire scene is to determine the point of origin" (Lee et al., 1994, p. 18).

While yet again recognized text as NFPA 921 (2001) state, "Generally, if the origin of a fire cannot be determined, the cause cannot be determined" (p. 116), but the broader focus of any fire investigation is "… to come to a correct conclusion about the significant features of a particular fire or explosion incident" (p. 121).

The necessity to provide formal training to Operations personnel responsible for determining fire cause cannot be understated. This is due in part to the fact, "A fire or explosion investigation is a complex endeavor involving skill, technology, knowledge, and science" (NFPA, 2001, p.10). Additionally, the scientific knowledge base related to fire investigation techniques and the understanding of fire development and progression has grown exponentially in the last few years due in a large part to civil litigation and subrogation cases. John Dehaan, who has been directly involved with several aspects of the progression in knowledge regarding fire cause determinations has said:

> The integration of the information, knowledge, and experience of fire engineers and those scientists involved in the chemistry and physics of fire development into fire investigation has proceeded along many paths - personal, educational, and professional - and on an international basis. Fire engineers are now involved directly in investigations and also teach investigators how to apply engineering principals. (Dehaan, 2002, p.xv)

Failure to train OCFD fire officers to standardized minimum competencies in fire cause determination inhibits the departments' ability to protect its citizens. There is generally universal agreement that, "If the fire department does not determine the cause of fires, whether accidental or incendiary, it cannot effectively work to decrease the frequency and severity of fires" (IFSTA, 2000, p.5). This fact is further stressed when taken in consideration of the assertions of scientific experts like Dehaan (2002) who openly says he believes that up to 40% of all structure fires in

America are intentionally set incendiary fires. In perspective this assertion by Dehaan would

constitute approximately 328 arson structure fires occurred in Oklahoma City in 2003, based on

over 800 structure fires data was provided for. This estimated figure represents a number of fires

nearly as much as the total number of fire investigations conducted by the OCFD Fire

Investigation Office in 2003.

The comparison of fire departments in similar size cities as it relates to determining the

cause of fires shows the need to train Operations officers, have standard operating procedures,

and conduct performance measurements. These issues are not unique to the OCFD. The

surveyed fire departments are tasked with the same challenges as OCFD in determining the cause

of fires and predominately the departments are approaching this obligation with similar staffing

and fire cause determination formats. The most significant result of the surveyed departments in

contrast to the OCFD is establishment of departmental policies and formalized training being

provided internally. Of the departments providing the fire cause training, most are utilizing

internal fire investigators to instruct fire cause determination material.

The relevance of analyzing the effectiveness in determining the cause of fires is the

persistent loss of life and injuries due to fires in the United States. NFPA (2004) reports, "3,925

fire deaths occurred in 2003, an increase of 16.1% from a year ago [and of these] about 80% of

all fire deaths occurred in the home" (p.ii). This statistical increase is further reported to be at or

equal to the 2000 and 2001 levels of occurrence and is consistent among multiple reporting

agencies (NFPA 2004; FEMA, 2004).

In the instance of this research, the success of the fire cause determination program itself

will ultimately depend on the abilities of Operations personnel to make initial determinations.

While undetermined fire cause is a recognized result of a fire cause investigation in literature

(Dehaan, 2002; IFSTA, 2000; NFPA, 2001), this determination provides little benefit to the

department or Oklahoma City except possible adherence to the statutory mandate to "… the chief

of the fire department … [who] shall investigate the cause, origin, and circumstances of every

fire occurring in [Oklahoma] city, … by which property has been destroyed or damaged…"

(Okla. Stat. § 11-314 (2001). Although, the implied purpose of the statute could be reasonably

determined to mandate substantially more than a mere reporting requirement as it also states, "…

[the fire chief]… shall especially make investigation as to whether such fire was the result of

carelessness or design" (Okla. Stat. § 11-314 (2001).

      The personnel of the OCFD have historically shown the ability to adapt and the desire to

provide professional service under any circumstances. Unfortunately, the research shows OCFD

personnel are not being provided the knowledge and training to meet their responsibilities of

determining the cause of fires. The minimal or lack of training as well as the failure to have

standardized departmental procedures for the investigation of fires can logically be correlated to

the undetermined fire ratios identified from the fire reporting run data and the UCR data

generated by fire investigators.

      The analysis showed that approximately one-third of all structure fires are undetermined

and yet no formal investigations were initiated on these fires. The ratios increased substantially

when applied to car fires where 55% were undetermined fires. Additionally, the error rate for

those car fires determined to be intentionally set was 52% when the fire reporting data is required

to identify "…. the device or equipment involved in the ignition, the presence of a competent

ignition source, the type and form of the material first ignited, and the circumstances or human

actions that allowed the factors to come together to allow the fire to occur" (NFPA, 2001, p.

122). Again, of the total number of car fires, formal investigations were initiated only 4% of the

time. Grass fires were nearly the same with an undetermined ratio of 57% and formal

investigations only being conducted for 1% of these fires.

An additional problem appears to be the OCFD has failed to institute standard operating

procedures defining the necessary guidelines to ensure an effective team approach of conducting

fire investigations. Teams by design need to be "… committed to a common purpose,

performance goals, and an approach for which they hold themselves mutually accountable"

(Eicholz, 1997, p. 19). Additionally, "When team goals are clearly understood, the team

members are motivated because they see themselves as contributing to a worthwhile endeavor"

(Eicholz, p. 178). As has been shown, to determine the cause of a fire within the OCFD format

is to utilize two separate divisional groups of employees with primarily different job functions to

attain the common goal of determining the cause of a given fire. With this in mind , "teams

operate most efficiently if they tap everyone's talents and all members understand their duties

and know who is responsible for what issues and tasks" (Eicholz, p. 178). It is therefore

imperative to insure that the OCFD effectively determines the cause of all future fires, clear

procedures are established and specific training is provided to employees in the determination of

fire causes. As noted in the literature review several recognized standards are currently available

to address the development of training. The alternative is to bring training to the department

from outside sources.

However, providing training alone can not address the overall effectiveness of the OCFD

in determining the cause of fires. Barner (2001), has said;

Unless teams have clearly articulated and agreed on their performance metric for

measuring success, how can members, leaders, and senior management, measure their

performance? A solid explicit performance scorecard is essential to the success of any

team (p. 175).

As this relates to the research presented here, the current performance measurements

being utilized for fire cause determinations are insufficient to identify deficiencies in the system.

Consistent with the national trends, the OCFD currently uses fire investigation case clearance

rates as a measurement of performance. As this research has shown, this criterion - independent

of other controls - fails to identify the incidence of undetermined fires occurring, and is only a

representational percentage of those fires determined to be intentionally set. While clearance

rates could be considered an effective outcome based measurement for the fire investigation

office, it is a poor tool for evaluating the effectiveness of the OCFD in fire cause determinations.

More specifically "Outcome based performance measurement also seeks to shift from program

efficiency, to program effectiveness" (Ogata & Goodkey, 2002, p. 263). The OCFD is

efficiently reporting some form of cause determination on all fires currently in its incident

reports. However, the high incidence of these fire investigations resulting in undetermined fires

indicates the OCFD effectiveness at meeting the stated goals of a fire investigation is not being

met.

The internal survey produced two significant data variances worthy of discussion. The

first was the data variance created in responses to the tenth survey question, which sought to

gather responses regarding whether or not the OCFD had clear guidelines for calling a fire

investigator to an incident. The surveyed responses returned from Operations Personnel were

73% reporting yes the department had clear guidelines, while the fire investigators reported no to

the same question by 85% of the respondents. This divergence in the survey data prompted the

author to speak with respondents from both groups regarding this question. After numerous

discussions it was determined that OCFD guidelines are in fact anything but clear. There was no consistency in the process for initiating investigator request among operations personnel, as well as the OCFD did not have a Standard Operating Procedure or Policy in place for requesting a fire investigator response.

The second variance noted in the survey was the divergence in data produced between surveyed investigators and operation personnel in all areas of training. While operations personnel reported by substantial numbers that they are receiving inadequate training for the task of determining fire cause, the fire investigators responded they were adequately trained in all the areas surveyed by unanimous consensus. Once again this was attributed to the training levels of the respondents. Investigators not only attend the same basic fire academy as all employees but they are additionally cross-trained in law enforcement through the state academy. The surveyed fire investigators further receive formal training in fire investigation as well as sixteen hours of state mandated continuing law enforcement education annually.

These two variances can likely be associated with the overall issues identified by this research. Specifically, implementation of standardized fire cause determination training, establishing departmental performance goals to reduce undetermined fires, and developing a Standard Operating Procedure for the investigation and cause determination of fires would likely reduce the variances identified in the survey data.

<div align="center">RECOMMENDATIONS</div>

The conducting of this research project into the effectiveness of the OCFD in determining the cause of fires has resulted in the following recommendations. It should be noted the author readily acknowledges implementation of these recommendations will inherently involve both technical and adaptive challenges for successful outcomes to be realized. The recommendations

are being presented in the author's opinion from greatest impact significance to least impact significance.

1.   In order for the OCFD to improve its ability to determine the cause of fires, a departmental SOP must be created addressing the specific roles and responsibilities of all employees involved in determining the cause of fires. This document must address standardization of how and when fire investigators are requested and establish data reporting criteria for determining the cause of fires.

2.   The OCFD must implement minimum standardized training for all employees tasked with determining the cause of fires. It is imperative that fire investigators are included in the standardized training to insure continuity across divisional lines for performing fire investigations and determining fire cause.

3.   The OCFD should develop performance goals and identify specific performance measurement methodologies to ensure the effectiveness of fire cause determination investigations. In order to be comprehensive the goals and measurements must cross divisional lines and be inclusive of the entire process.

4.   The OCFD should improve the incident reporting database and give personnel charged with fire prevention tasks access to query data. Additionally, a format to standardize department data entries across divisional lines to simplify analysis should be a priority.

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