2 + 2 Doesn't Always Equal Four: Implementing the OSHA "Two In and Two Out" Interior Firefighting Rule

Executive Planning

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ABSTRACT

Hillsborough County Fire Rescue (HCFR) provides firefighting services to 589,000 citizens in a 931 square mile unincorporated area surrounding the Cities of Tampa, Temple Terrace, and Plant City. The promulgation of the Federal Occupational Safety and Health Administration (OSHA) Respiratory Standard, specifically the two-in and two-out rule, had been identified as a problem in that Hillsborough County Fire Rescue is unable to comply with the two-in & two-out portion when the rescue exception is not necessary. The purpose of this study was to develop potential compliance methods utilizing both existing resources and expansion of resources through funding of additional personnel and equipment.

Descriptive, evaluative, and action research were utilized to answer the following questions: 1) What does HCFR currently do upon arrival at the scene of an interior firefighting situation when no rescue is presented? 2) How do other departments comply with the OSHA Respiratory Protection Standard? 3) How much of Hillsborough County is a non-compliance area for two-in & two-out? 4) What methods can HCFR employ to comply with the regulation?

A reaffirmation of HCFR field operations provided the answer to research question one. To answer research question number two, a survey was provided to one hundred fire rescue agencies to conduct information gathering of the present two-in and two-out compliance methods being utilized. Research question three was answered by conducting a review of geographic HCFR response capabilities utilizing a consistent measurement through the use of National Fire Protection Association criteria. Research question four

was answered by the amalgamation of the survey responses, regulatory criteria, and HCFR existing and potentially fundable resources.

The findings of the research indicated that over one third of Hillsborough County Fire Rescue's service delivery area is not able to comply with the intent of the two-in and two-out rule due to the existing deployment locations of suppression units and their present staffing levels. The two-in and two-out survey displayed compliance methods such as adding apparatus, response procedure adjustments, and adding more personnel. Five methods of attaining compliance were assembled from the description and evaluation of the study data and are presented in the Recommendations section and are supported by the survey responses listed in Appendix B.

To meet the intent of the regulation, the five methods of compliance in the answer to research question four are recommended. Training must also be conducted to ingrain the concepts of the regulation, as well as enforce sound safety procedures such as accountability, rapid intervention teams, and emergency procedures for lost or trapped members.

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INTRODUCTION

The revised OSHA Respiratory Protection Standard was issued on January 8, 1998 and contains a section requiring a minimum of two firefighters available outside a structure while interior firefighting operations are conducted inside by at least two other firefighters. The only exception to this regulation is if there is a rescue situation presented to the first arriving firefighters.

The “Two-in & Two-out" section of the regulation has been recognized as an operational goal of Hillsborough County Fire Rescue. The idea of a standby crew prepared to assist interior firefighters was first proposed in the National Fire Protection Association (NFPA) Standard 1500 in 1987. Many fire rescue providers complied with this scene staffing requirement by either response procedure changes, additional apparatus, or through the procurement of additional personnel. Hillsborough County Fire Rescue desires to comply with the regulation to improve firefighter safety, even though Florida is not a State that adopts Federal OSHA regulations requiring local government compliance with federal regulations. However, Thomas Seymour, the former Acting Director of the Safety Standards Program for OSHA states that “Every organization that uses respirators will be measured by this new rule whether it wants to be or not” (IAFC, 1998, p.1).

The problem is that Hillsborough County Fire Rescue is unable to comply with the two-in & two-out portion of the OSHA Respiratory regulation when the rescue exception is not necessary. In many areas of Hillsborough County, there is an inability to quickly provide the number of firefighters necessary to allow the first arriving firefighting crew to immediately take offensive interior firefighting actions. This is due to a normal staffing level of only three personnel per suppression unit and the second arriving unit being several minutes away. The purpose of this study was to provide potential compliance

methods for HCFR utilizing both existing resources and expansion of resources through funding of additional personnel and/or equipment.

Descriptive, evaluative, and action research was utilized to answer the following questions: 1) What does HCFR currently do upon arrival at the scene of an interior firefighting situation when no rescue is presented? 2) How do other departments comply with the OSHA Respiratory Protection Standard? 3) How much of Hillsborough County is a non-compliance area for two-in & two-out? 4) What methods can HCFR employ to comply with the regulation?

BACKGROUND AND SIGNIFICANCE

Since 1971, the federal OSHA Respiratory Standard has required employers to establish and maintain a respiratory protection program for employees who wear respirators. The revised 1998 standard has been strengthened, including specific requirements for Self Contained Breathing Apparatus (SCBA) use in Immediately Dangerous to Life and Health (IDLH) atmospheres (IAFC, 1998). IDLH atmospheres now include interior structural firefighting.

OSHA provides clarification of the firefighting levels that may exist, differentiating between interior structural firefighting and incipient firefighting. Interior structural firefighting means the physical activity of fire suppression, rescue or both, inside of buildings or exposed structures which are involved in a fire situation beyond the incipient stage (Federal Register, 1998, p. 1270). Incipient firefighting is a condition that involves a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class II standpipe or small hose lines without the need for protective clothing or breathing apparatus (OSHA 29 CFR1910.155, 1998).

The standard does not take effect until firefighters begin to perform interior structural firefighting. However, the deployment or use of personal protective equipment or standard firefighting hose lines

does not invoke or incriminate the user that an IDLH situation exists or that an advanced fire condition exists and interior firefighting is occurring.

The OSHA Respiratory Protection standard is mandatory for approximately half of the United States. The regulation requires that in a structural fire situation that is beyond the incipient stage, two fully trained and equipped firefighters must remain outside this structure that is assumed to contain an Immediately Dangerous to Life and Health (IDLH) atmosphere while at least two additional firefighters conduct interior firefighting operations.

Hillsborough County Fire Rescue

Hillsborough County Fire Rescue (HCFR) is located on the west central Florida coast and encompasses the Cities of Tampa, Temple Terrace and Plant City. HCFR operates emergency response apparatus out of forty-one (41) locations, covering nine hundred thirty-one square miles and provides fire and rescue services for 589,000 citizens (Hillsborough County Directory of Services, 1999). HCFR employs 589 uniformed career firefighters and paramedics operating on twenty-four hour shifts that are supplemented by over 200 volunteer firefighters in the rural parts of the County. A small percentage of HCFR's paramedic personnel assigned to rescue units are also certified as firefighters and eight of HCFR's Engine Companies are advanced life support (ALS) capable units, sometimes referred to as "Paramedic Pumpers." HCFR units responded to over 70,000 alarms in 1998, with an average 80/20 split in medical and fire calls respectively.

HCFR has implemented a response policy of dispatching one additional fire suppression unit on every structural alarm to provide adequate personnel at the scene for the implementation of a standby rescue team. This standby team is referred to as a Rapid Intervention Team (RIT) by NFPA 1500 (1997, p. 19). However, within HCFR, the RIT is not immediately established and no department

policy on minimum staffing before interior attack can be initiated is in place. The dispatching of this extra crew has not changed the immediate, aggressive action taken at the scene by the three-person firefighting crew before the arrival or assembly of additional personnel.

The assembly of at least four personnel at the scene to comply with the two-in & two-out portion within the OSHA regulation presents logistical and potentially large financial hurdles for many fire and rescue departments. HCFR has used three personnel as the minimum staffing on a suppression unit such as an engine or ladder company for many years. The need for integration of a fourth firefighter into the minimum fire scene staffing requirement quickly presents itself as a potential delay in the firefighting process for HCFR.

As with many other fire rescue agencies, the task of assembling at least four HCFR suppression personnel at an interior structural firefighting operation does not solely rest upon the number of personnel riding on the first arriving apparatus. Simultaneous response of multiple resources will many times provide a quick arrival sequence at the scene of a fire, potentially negating the concern for minimum staffing of each unit at four personnel. From the opposite perspective, these multiple units bringing the minimum number of personnel needed for interior firefighting in a rapid sequence is very dynamic in availability, and can dramatically change at any time throughout the service area of the department. At any given time, multiple units may be committed on other alarms, lengthening the time until the next closest available unit arrives to assist the first arriving unit of three personnel. This time delay between the first and second arriving suppression units is a major concern for the fire service manager that utilizes a minimum staffing of less than four personnel.

Compliance Limitations Facing HCFR

HCFR faces several obstacles in obtaining compliance with the OSHA Respiratory regulation. Primarily, the funding of additional firefighters for the fourth person on each suppression unit each day is difficult to financially justify. In addition, this was never the intent of the regulation (Federal Register, 1998, p.1247).

Due to HCFR's extensive geographical layout, the logistics of deploying two units that arrive nearly simultaneously to assemble enough personnel to immediately begin interior fire attack operations is the major dilemma facing HCFR. There are areas of Hillsborough County that present an environment in which the first arriving HCFR fire suppression unit must deal with extended time delays until additional apparatus and personnel arrive. If interior attack occurs during these situations, there is an obvious violation of the minimum staffing intent of NFPA 1500 and the OSHA Respirator rule. In addition, during the initial fire attack, there is a danger of no assistance to injured or trapped first arriving crew members and a possible limitation of the services provided to the citizens.

As a point of reference, the Insurance Services Organization (ISO) rating of the delivery of firefighting services is heavily based upon the distance of a structure from a fire station and a water supply. The lack of one of these two factors is commonly reflected in higher insurance premiums. In Hillsborough County, the ISO rating is a nine (9) instead of a five (5) if your structure is more than five miles from a fire station or more than one thousand feet from a fire hydrant (HCFR Fire Marshal, 1998).

Thirty-six of the forty-one HCFR fire rescue station locations house fire suppression apparatus, and several of these are single engine company stations that are normally staffed at three personnel. The location of these first arriving units is such that the next arriving unit to assist them at a structure fire is as much as an additional five minutes or more away. This prevents these units from taking an immediate

offensive posture after arriving at the fire scene when a rescue is not required. These units are in fire stations that are not necessarily rural but located in an area that can't be accessed quickly by adjacent firefighting apparatus and hence suffer from the inability to arrive with adequate personnel to follow the two-in & two-out rule.

This is the most obvious geographic two-in and two-out compliance problem facing HCFR. However, the possibility of any suppression unit being committed on other alarms may affect the offensive posture of virtually any unit first arriving at a structure fire if their adjacent station was previously dispatched to another alarm. Three person suppression units must always be aware of the offensive or defensive posture they must assume upon arrival if there is no rescue situation present and the next arriving unit is some time away.

One of the educational opportunities that can provide assistance to the fire executive in presenting these types of personnel and equipment deployment difficulties to their local government representatives is the "Executive Planning" course at the National Fire Academy. This course is an elective offered for completion of the "Executive Fire Officer" Certification as well as for the any aspiring or existing officer. The course provides training modules that prepare the fire rescue manager to make decisions regarding the future of their respective agencies. Strategic planning, analysis, and the proposal and implementation phases of projects are covered to enable the manager to present the plan to his or her government officials and display the method of tracking the results of its progress (NFA Executive Planning Manual, 1998).

The dilemma facing the fire rescue services with the arrival of the two-in & two-out rule challenges the Executive Planning student's ability to employ the concepts learned during this course of instruction. Key concepts learned such as the analysis of the lack of minimum fire scene personnel

problem must be documented, along with the methods to comply, the presentation to the manager's officials, and the measurement of the plans performance are critical displays of the use of the Executive Planning course content.

LITERATURE REVIEW

The United States Department of Labor Occupational Safety and Health Administration (OSHA) issued the Final rule on Respiratory Protection on January 8, 1998. Under 29 CFR Parts 1910 and 1926, the standard replaces the previously issued respiratory standard issued in 1971. This standard requires employers to establish or maintain a respiratory program. In addition, it requires the use of Self Contained Breathing Apparatus (SCBA) in an Immediately Dangerous to Life and Health (IDLH) atmospheres, including firefighting (OSHA Instruction, 1998, p. 23).

In this regulation, interior structural firefighting is defined as an IDLH atmosphere, requiring that two firefighters be stationed outside the burning structure while two additional firefighters are inside the structure. This requirement is a major concern for many firefighting service providers in that common staffing of response units may be below the minimum of four personnel required to comply.

Thomas Seymour, the former acting Director of the OSHA Safety Standards Program, states in the International Association of Fire Chiefs (IAFC) Comprehensive Analysis of the OSHA Respiratory Protection Standard that:

"The new rule has 15 major paragraphs of requirements along with four appendices, three of which are mandatory" (IAFC, 1998, p. 1). Paragraph (g) (4) of the OSHA Respirator Standard addresses the "Procedures for Interior Firefighting" and contains the two-in and two-out requirements.

This section is consistent with the OSHA Fire Brigade standard and the NFPA 1500 "Fire Department Occupational Safety and Health Program" (1997).

The issuance of this standard was not unforeseen, as the National Fire Protection Association (NFPA) had issued NFPA 1500 in 1987 urging fire rescue providers to ensure that four personnel were on scene before an interior attack was begun. This concept was driven by the need to reduce the number of firefighter injuries and deaths. Indeed, in 1998, the U. S. Congress allocated funds to the National Institute for Occupational Safety and Health (NIOSH) to study the continual problem of occupational firefighter fatalities and injuries.

With the advent of NFPA 1500 in 1987, many safety procedures are now in place that were at the time seen as overkill by many officers. Frank Schaper, in an article written before the issuance of the OSHA regulation, stated "In a nutshell, the fire service needs to continue to build a safety attitude in its managers, supervisors, and firefighters" (*Fire-Rescue*, 1997).

Darla Bean writes:

> Firefighters in Alaska are criticizing the new OSHA rule known as "two-in/two-out," saying it prevents them from attacking fires as soon as possible and possibly saving burning homes…The report from Anchorage said a house fire spread from the room in which it started to three rooms while the "two-out" had to stand there and watch *(OH&S Week*, 1999, p. 1).

In this same article, the International Association of Fire Fighters (IAFF) responded that it is just an isolated complaint and that the "Bottom line is they need better staffing in that department to ensure four man companies. There are other chiefs complaining that they don't have enough people to do this. It's a deployment issue, not a staffing one."

Michael Moore, Fire Protection Engineer with the U. S. Department of Labor, responds to a question in an OSHA Frequently Asked Question (FAQ) document (1998):

> Is the rule a staffing requirement?
>
> No. The two-in/two-out is and has been standard practice in the fire service for many years. It requires only the number of firefighters who must be on the scene before initiating the interior attack on an interior structural fire. OSHA's two-in/two-out rule is strongly supported by an analysis of information from the International Association of Fire Fighters, the National Fire Protection Association, and existing OSHA standards and interpretations. OSHA's respiratory protection standard codifies recommended practice. It does not require fire departments to hire additional firefighters nor does it require four firefighters on a piece of apparatus before it leaves the station. Most fire departments can assemble the number of firefighters necessary for an interior attack at the fire scene by waiting for other to arrive by other means of transportation. During this time, the fire may be attacked from the outside, preparations for the interior attack can begin or an emergency rescue of people trapped may take place (OSHA, 1998, p. 4).

There is active criticism of the limitations the two-in & two-out rule imposes on aggressive firefighters that are presented with non-rescue situations. Charles R. Angione states in *Florida Emergency Services News*:

> You would be in violation of the law if you performed an interior fire attack with fewer than the minimum number of firefighters assembled on the fire ground: four to do a "dry" search, five if you want to take in a hose line, seven if you want to do both fire attack and search/vent. Will the people who may be trapped inside understand and appreciate the legality that ties your hands? One gets the feeling, somehow, that in undermanned situations, firefighters on the RIT

> who suspect that someone may be inside will very likely "cheat" a bit. Good firefighters hate standing around at emergencies (1998, p. 11).

The OSHA Respiratory standard covers all private employees who engage in firefighting activities. For state and local government employees in 23 of the 50 States, these States have earned the approval of Federal OSHA to implement their own enforcement programs and are known as "state plan" States. Florida is not one of these "state plan" States and technically Federal OSHA has no authority over State and local government employees in Florida or other non "state plan" states. Enforcement in these States can be attained if the State has adopted NFPA standards, specifically NFPA 1500 (IAFC, 1998). The U. S. Environmental Protection Agency (USEPA) may also become an enforcing agency in non-OSHA plan States as they did with the OSHA 1910.120 standard.

HCFR is presently not legally affected by the federal OSHA Respiratory Standard. However, management is concerned that the regulation is a nationally accepted practice that HCFR is not utilizing. If an HCFR employee is injured or killed in a scenario in non-compliance with the two-in & two-out rule, the department could be criticized and found partially liable. There is active discussion at the Florida State government between the State OSHA office and the Florida Fire Chiefs Association that may provide guidance and or compliance requirements in the future for HCFR as well as all state and local government firefighting employees.

Statements by OSHA, NFPA, and IAFF that the two-in & two-out regulation is not intended as a minimum staffing rule influenced this project in that the methods of attaining compliance by affected firefighting agencies were sought out to discover how other departments arrived at compliance.

PROCEDURES

Existing HCFR Fire Attack Policy

The present operating status of HCFR was analyzed for procedures used at the scene of a structure fire when there is no rescue situation presented to the first arriving officer. This question was quickly answered in that HCFR personnel aggressively attack all structure fires. Any fire rescue agency evaluating compliance with the two-in & two-out portion of the OSHA regulation would have to pose this question internally to themselves to honestly determine their present paradigm of operations.

Surveying of Other Agencies for Two-in & Two-out Compliance Methods

A ten question survey was developed and distributed to 100 fire rescue departments of random geographical and staffing sizes in order to objectively gather data on how each department was addressing compliance with the two-in & two-out rule. Of these, eighty-nine were returned.

The questions attempted to garner information from career, volunteer, and combination departments, varying in geographical and member size, normal staffing, and multiple unit responses. Other questions also were posed to determine: 1) Whether the department used the pump operator or incident commander as one of the outside standby personnel, 2) If there was a minimum number of fire fighting personnel on scene before the crew could conduct an interior attack, 3) If minimum staffing was in place before the OSHA standard was issued in 1998, 4) If additional personnel or equipment were added to comply, and 5) If no additional resources were added, how was compliance reached.

Distribution of the survey was conducted in the United States however two responses were received from overseas departments. A sample of the survey is provided in Appendix A.

In an effort to improve the response to this survey, the departments were not asked to state whether or not they were in compliance but rather what was their policy on minimum scene staffing to implement an interior fire attack. The results were tabulated to provide a cross section of data to assist in answering research question number 2 and are displayed in Appendix B.

The limitations of the survey were that it was distributed to the available agencies present at the National Fire Academy during the Executive Planning course in October of 1998 and sent to the departments in the State of Florida to provide for an in-State viewpoint on the OSHA standard. The author generated the questions after a complete review of the standard as well as related publications for common questions on attaining the number of personnel at the scene to comply.

Identification of HCFR Non-Compliance Areas

The ability to place four or more HCFR suppression personnel at a fire scene with only three personnel per unit required the arrival of at least two units at the scene to meet the two-in & two-out rule. The non-compliance situation in Hillsborough County was evaluated for the geographic layout of the HCFR fire stations and how they deploy to an interior structural firefighting scenario. Each square mile of HCFR's jurisdiction, called a "box," was reviewed to determine two criteria. First, it was determined if the station was normally staffed with one fire suppression unit comprised of only three personnel. Second, for the purpose of this study, a maximum time of two minutes to initiate an interior attack after arrival of the first unit was established to standardize the amount of time that could elapse for conducting size-up, deployment of attack lines, and direction of personnel.

If the second arriving fire suppression unit was greater than two minutes behind the first, and the first arriving unit was staffed with three personnel, then that square mile "box" was deemed a non-compliance area.

In order to consistently measure the areas that the second HCFR fire suppression staffed unit could arrive at the scene, the use of the time distance table formula from NFPA 1231 (1998, p. 36) provided nationally accepted criteria for determining average response time of apparatus between known distances. This table provides a factor for various speeds of fire apparatus. An average speed

between forty and forty-five miles per hour produces a time of approximately two minutes per mile of travel. Any box that could not be reached by the second unit within this two minute time frame was considered a non-attainment square mile area or "box".

Determining Methods of Compliance for HCFR

After consideration of the preceding information, the improvement of compliance in these identified areas within Hillsborough County was identified as the final step in the compliance effort. Existing HCFR resources as well as expansion of HCFR resources were considered as compliance methods. During the revision of the HCFR Policies and Procedures manual in January of 1999, group discussions were held with field and staff officers to brainstorm potential compliance methods that resulted in several potential procedures.

Providing the minimum number of four personnel at the scene with only three personnel on board each unit requires the measurement of the time from the arrival of the first unit to the arrival of the second unit. Other factors affecting this scene staffing problem was whether the first responding Station had other support equipment in the station with them such as a ladder company, a second engine company, a rescue unit, tanker, or any other apparatus that were staffed consistently and could be used for fire suppression duty. If these units were stationed with the primary engine company, compliance was assumed when all units were available.

A further enhancement of compliance with existing resources could be attained if HCFR rescue units were utilized and staffed with fire suppression trained paramedics to provide additional personnel in non-compliance areas or when the first due apparatus is committed on a previous alarm.

Compliance attainment with additional monetary resources were reviewed and included hiring overtime personnel in affected areas of Hillsborough County, hiring a fourth person for each of the non-

attainment areas, and building additional fire stations to provide total overlap of responding suppression units.

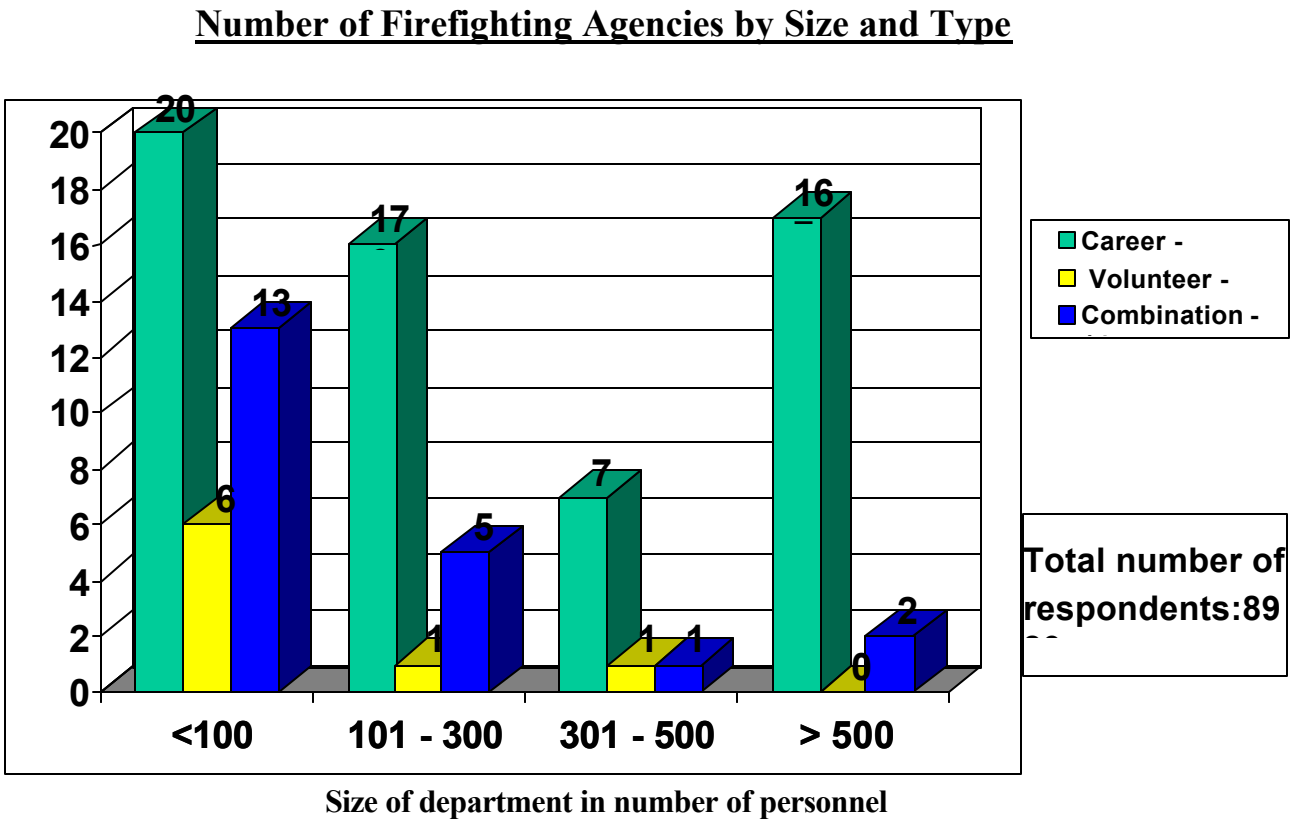
RESULTS

Answers to Research Questions

Research Question 1: This research question asked for the current protocol that Hillsborough County Fire Rescue utilizes at an interior firefighting situation. HCFR personnel implement interior fire attack at all structures where offensive tactic and strategy are appropriate. This is not in compliance with the two-in & two-out rule. In the author's experience as an operations officer, HCFR personnel consistently take an aggressive interior firefighting action when less than four personnel are on the scene. The standard staffing is three personnel on an engine (or ladder) company and, unless the attack protocol is revised and enforced, this will continue to be the case.

Research Question 2: A survey was developed to garner information on how other departments were handling the two-in and two-out compliance dilemma. The agencies surveyed varied from departments staffed with fully career firefighters to combination departments of both career and volunteer firefighters to fully volunteer departments. Of the one hundred departments supplied with a survey, eighty-nine of these returned a survey with all or most of the requested data. Of these eighty-nine responding departments, sixty were career (67%), twenty-one were combination (24%), and eight were volunteer departments (9%). Thirty-nine of these departments had less than 100 personnel, twenty-three had 101-300 personnel, nine departments had 301- 500 personnel and eighteen departments had over 500 personnel (see Figure1).

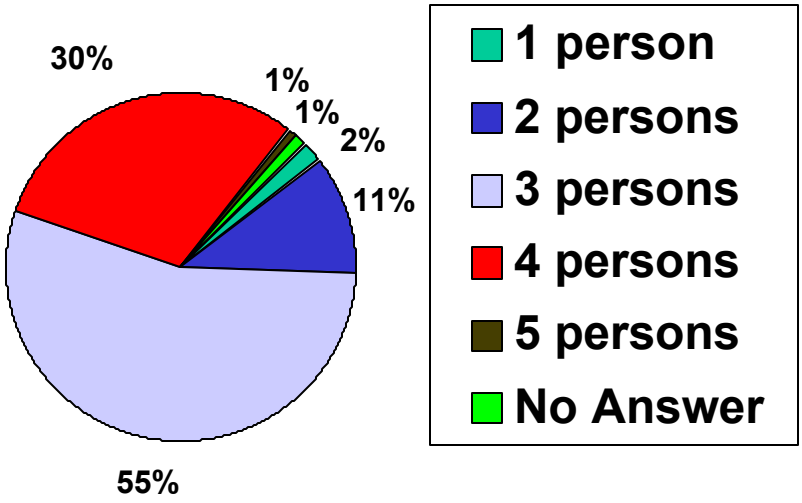
Figure 1



The next question dealt with minimum staffing on each unit. An assignment of three personnel per unit was the predominant minimum staffing of engine companies and comprised 55% of the total. The next highest reported unit staffing level was four personnel at 30% of the total (see Figure 2). The remaining departments reported unit-staffing levels of as little as one or as many as five personnel. Likewise, the need for multiple units on the scene to attain compliance was reinforced by the respondents reporting that 83% required more than one unit on the scene before interior attack could begin.

Figure 2

Minimum Staffing per Unit:



The decision to utilize the pump operator as one of the two outside firefighting personnel was nearly evenly split with 47% in favor of using the pump operator and 53% against it (see Figure 3). Utilizing the incident commander for one of the two outside personnel was nearly an exact division of the surveyed departments at 49% in favor and 47% against it, with the remaining not providing an answer (see Figure 4).

A minimum of four personnel at the scene to implement interior fire attack was policy for 48% of the departments. However, 22% and 24% required five and six personnel respectively (see Figure 5).

Figure 3

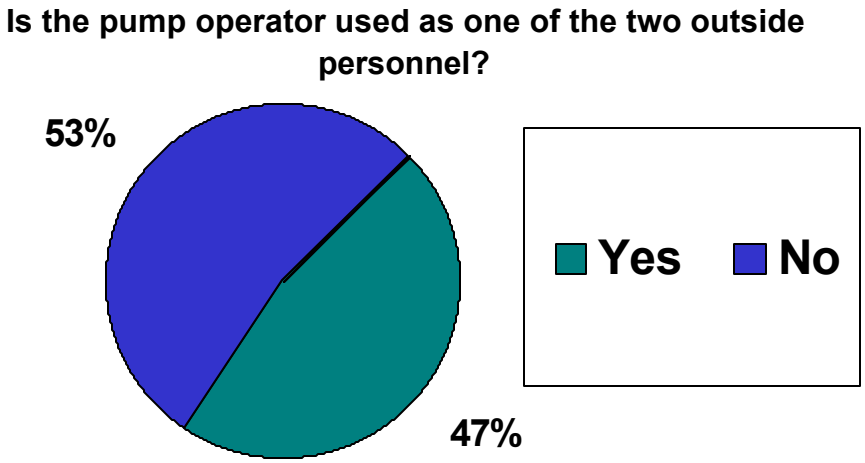
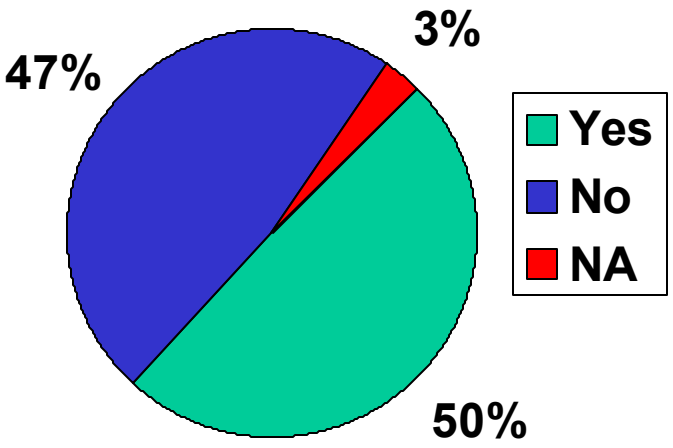


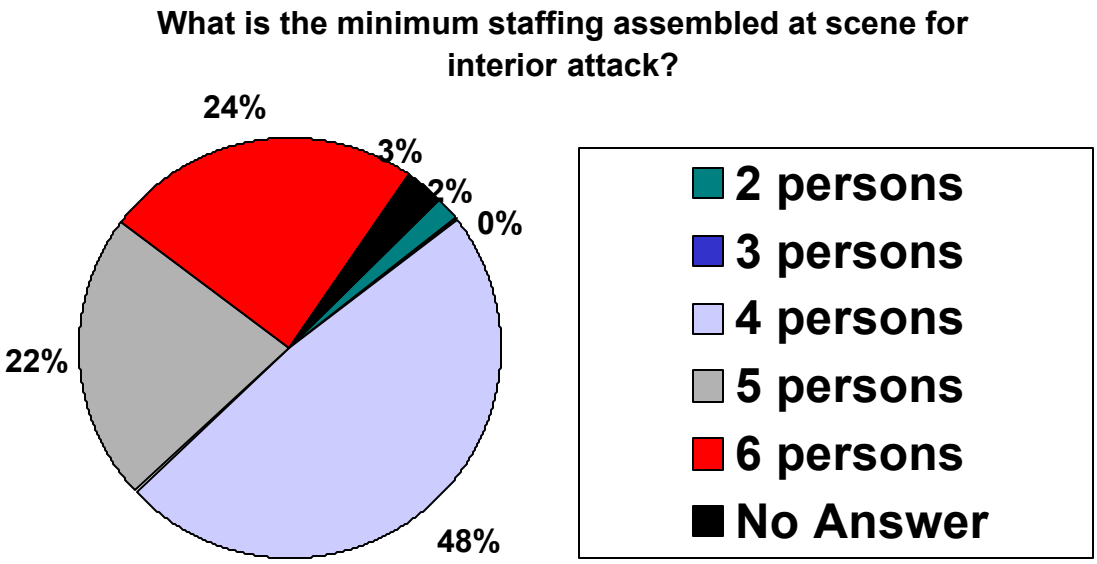
Figure 4



Is the Incident Commander used as one of the Two Outside Personnel?

- Yes = 49%
- No = 47%
- No Answer = 3%

Figure 5



Most of the departments surveyed (68%) stated they did not have an existing requirement for a minimum number of personnel at the scene before the OSHA rule was issued. The remaining two questions asked if additional personnel and equipment were added and if not, how were the existing resources reallocated to attain compliance. The specific number of each response to the survey questions is displayed in Appendix B.

Research Question 3: Of the 931 square miles of HCFR's territory, over one third of the County (336 square miles) could not be reached by a second unit within two minutes of the arrival of the first. This only included areas where the stations were staffed with three personnel at a single engine company station. The analysis determined these 336 square miles were representative of areas reviewed for road access and adjacent fire apparatus stations that could be dispatched to assist the first due unit.

If the first due unit had only three personnel, it must have an adjacent station that could access that square mile in question within two minutes of the first arriving apparatus or the square mile area was a non-attainment area. Every section of HCFR's townships and ranges were reviewed using these criteria and the non-compliant areas are displayed in Appendix C.

Research Question 4: After a review of HCFR's logistical situation concerning fire station locations and staffing, limitations presented by the regulatory criteria, and compliance methods utilized by other fire rescue agencies provided from the survey, the following five methods are listed as potential methods of compliance. The first two methods utilize existing resources, the remaining three methods require increasing levels of initial and ongoing expenditures and was obtained from the HCFR budget for fiscal year 1999-2000.

First, HCFR personnel can comply by electing to not make an interior attack on the structure fire upon arrival of the first fire suppression unit staffed with less than four personnel. The first arriving crew must assume a defensive role, such as placing hose streams in access points to attempt to restrict the advancement of the fire conditions until the next unit arrived with adequate personnel to provide the backup crew and allow interior firefighting to commence. This method of compliance is the default situation that the first arriving officer must employ if the normally adjacent units that provide adequate scene staffing are committed on previous alarms.

Second, paramedic personnel who are cross trained as firefighters could be assigned to rescue units that are in or near Stations where compliance is not attainable. This method is limited to the number of trained and equipped firefighter/paramedic personnel assigned to rescue units, which is presently twenty five (4%) of the total uniformed personnel.

Third, new personnel could be hired to staff each of the existing stations in non-compliant areas with four personnel. This would provide the minimum number of four personnel during all responses, based on the assumption that all personnel are present. The non-compliance areas would be the first to receive replacement personnel from overlapping compliant areas should a vacancy occur due to the various types of leave a firefighter might utilize. The estimated annual salary cost for a new firefighter is $40,605.00 including salary and benefits. The thirteen positions needed for each of the three shifts increase the total to thirty-nine personnel, which is multiplied by the annual salary for a cost of $1,583,595.00.

Fourth, overtime compensation of additional personnel could be employed to staff the stations that would be first due in the non-compliant areas of HCFR's jurisdiction. Stations 1, 10, 12, 16, 19, 21, 22, 25, 28, 29, 30, 32, and 34 operate in these non-compliant areas. This method would encumber approximately $7,768.00 on a daily basis to staff these 13 Stations. This is for one additional firefighter to cover the listed areas of non-compliance shown in Appendix C. This daily figure was computed by the average existing firefighter hourly rate at the overtime standard of time and a half, multiplied by the thirteen positions needed. The annualized cost of maintaining this staffing method is $2,835,612.00.

Fifth, new fire stations could be implemented in areas that would provide the overlap of units arriving in a manner to provide adequate staffing quickly at the scene. The costs of implementing this method are estimated at $1,000,000 per Station constructed including apparatus and an annual recurring salary cost of $700,000 for the twelve personnel to staff the three shifts. An additional 12 stations are presently established in the long range plan and would result in a cost estimate of $12,000,000 to construct and $8,400,000.00 in the first year salaries in 1999 dollars.

These methods are not all inclusive and other concepts may be possible in various geographical or political situations, such as contractual first response agreements with other jurisdictions providing firefighting services.

DISCUSSION

The study results were consistent with the findings of others expressed in the literature review. HCFR, as well as other fire rescue providers, know that the two-in & two-out rule is a well founded, safety based concept and needs to be complied with. However, the compliance methods can be difficult and costly. Not complying can be considered illegal (or just plain unethical) according to the State in which the firefighting agency resides. Taking a defensive posture at fire scenes due to a lack of personnel is both frustrating for the firefighters and could possibly increase property losses for the owner.

The study results also justified that neither the number of personnel the department employed, the size of the department's jurisdiction, nor whether the units were staffed with at least four personnel determined whether their department could deploy what they considered an adequate amount of personnel to the fire scene. Four personnel on each piece of responding apparatus is the easy answer to this problem. However, it is a cost incurring item that must be managed effectively. In many instances, the determining factor for compliance may be the near simultaneous arrival of a second suppression unit with additional personnel that exceed the minimum number needed to initiate the department's interior firefighting operations minimum scene staffing. This phenomenon essentially eliminates the minimum staffing argument of four personnel per unit if the dispersion of fire station locations is adequate.

Extensive discussion with HCFR Battalion Chief officers resulted in exposure of several items that may impede the implementation of the two-in & two-out rule. Specifically, the retraining of the company officer to not attack a free burning structure after over twenty years of conditioning will not be an easy task. The concept of an aggressive interior firefighting officer having to assume a defensive posture by placing hose lines in less than optimum positions to prevent fire advancement will not be easily accepted. This will continue to be resisted until enforcement occurs or acceptance is improved by the reinforcement of safety first for firefighters instead of public property.

An unexpected finding was that in the case of Hillsborough County Fire Rescue, the attainment of compliance occurred mainly due to a close proximity of units arriving in rapid sequence, not the assignment of at least four personnel to a unit. The individual units' relative location to each other in respect to the fire scene dictated the ability of the close arrival times of multiple units. The inabilities to make more than one unit arrive at the scene in short sequence prevented compliance when the first unit was staffed with only three personnel. In areas where the ability to comply is still not attainable after adjustments or improvements have been made, the first arriving suppression unit must wait for the next arriving unit to provide the scene staffing necessary for two-in & two-out.

Finally, the number of respondents to the survey that stated their minimum staffing at the scene was five or six personnel before interior attack was implemented was a significant 46%. This suggests that two-in and two-out rule is considered by many to be too permissive and that other tasks such as the incident commander and the pump operator are not expendable for the standby roles.

RECOMMENDATIONS

Hillsborough County Fire Rescue has an opportunity to take a proactive posture toward compliance with this regulation. As stated in the introduction, Thomas Seymour reminds us that all agencies will be measured by this new rule whether they want to be or not (1998). The author recommends that HCFR pursue the adoption of the increased funding methods listed in research question four to provide compliance procedures for the first arriving unit. It is recommended that an HCFR officer only consider the first method of compliance as a last resort due to prior commitment of normally available adjacent resources. Expansion of the use of existing resources and/or the addition of more personnel, such as the second through the fifth method, will help to continue the present level of service delivery (property conservation) and allow compliance with the regulation.

In addition, training must be conducted to provide the suppression officer a full understanding that when they arrive at a structure fire with less than two-in and two-out capabilities and the situation does not present a rescue scenario, that their crew must assume a defensive posture until additional resources arrive. In addition, two-in and two-out acceptance can be enhanced by HCFR continuing to emphasize the use of solid accountability for all personnel, the deployment of Rapid Intervention Teams (RIT), and established emergency procedures for HCFR members that may be lost or trapped. These policies exist in HCFR protocol but must be stressed to become part of the membership's paradigm.

The minimum number of personnel on the scene of a structure fire must be at least four personnel but the data collected show that many departments may be using more than four due to reluctance to utilize the Incident Commander or the apparatus engineer to supplement the backup crew. These concerns are reasonable criteria to assemble more than the minimum of four personnel at the

scene. Compliance interpretation must be established within each department's protocol. Four is the absolute minimum and is much better than the three that HCFR presently utilizes for interior attack.

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APPENDIX A

SURVEY OF IMPLEMENTATION METHODS FOR OSHA'S RESPIRATORY STANDARD
"TWO IN/TWO OUT"

Your agency name:

Contact Name & number:

This is a survey to gather implementation methods utilized by fire fighting agencies for compliance with the OSHA Standard requiring "Two in & Two out" procedures at interior firefighting operations. Please assist in this research effort by supplying the following information:

1. What best describes your fire suppression agency's makeup?
a. Career
b. Volunteer
c. Combination

2. How many personnel does your agency utilize?
a. 100 or less
b. 101 to 300
c. 301 to 500
d. Over 500

3. What is the normal minimum staffing required by your agency for an engine company? _____

4. Does your department have to respond two or more engines/ladders to provide enough firefighters at the scene to implement an interior attack?

5. Does your agency utilize the pump operator as one of the two outside personnel?

6. Does your agency utilize the Incident Commander as one of the two outside personnel?

7. What is the minimum number of firefighting personnel your agency must assemble at the scene of a fire requiring interior attack? Circle one: 4 5 6 or more

8. Had your agency established previous minimum personnel at a fire scene before the OSHA standard was issued?

9. Did additional resources (personnel and/or equipment) have to be added to your agency to comply with this standard?

10. If no additional resources were added, please give a brief explanation of how existing resources were reallocated:

APPENDIX B

Survey Results

1. What best describes your fire suppression agency's makeup?
a. Career -60
b. Volunteer - 8
c. Combination - 21

2. How many personnel does your agency utilize?
a. 100 or less - 39
b. 101 to 300 - 23
c. 301 to 500 - 9
d. Over 500 - 18

3. What is the normal minimum staffing required by your agency for an engine company?
1 person - 2
2 persons - 10
3 persons - 48
4 persons - 27
5 persons - 1
n/a - 1

4. Does your department have to respond two or more engines/ladders to provide enough firefighters at the scene to implement an interior attack?
74 - yes
15 - no

5. Does your agency utilize the pump operator as one of the two outside personnel?
42 - yes
47 - no

6. Does your agency utilize the Incident Commander as one of the two outside personnel?
44 - yes
42 - no
n/a - 3

7. What is the minimum number of firefighting personnel your agency must assemble at the scene of a fire requiring interior attack? Circle one: 4 5 6 or more
2 persons - 2
3 persons - 0
4 persons - 43
5 persons - 20
6 persons - 21
n/a - 3

8. Had your agency established previous minimum personnel at a fire scene before the OSHA standard was issued?
33 - yes
56 - no

9. Did additional resources (personnel and/or equipment) have to be added to your agency to comply with this standard?
10 - yes
70 - no
n/a - 3
6 - equipment only

APPENDIX B continued

10. If no additional resources were added, please give a brief explanation of how existing resources were reallocated:
Write-in answers ranged from:

a) Use of flying squads
b) Four personnel at the busiest stations
c) Relocation of companies
d) Relocation of deadlined apparatus's personnel
e) Engine and rescue company response
f) Must wait for second engine to arrive
g) Reorganized response assignments
h) Mutual aid
i) Added an engine to the response
j) Dispatch second rescue unit
k) We do what we can with what we have

APPENDIX C

The following square mile "boxes" were non-compliant for two-in and two-out in the Hillsborough County Fire Rescue service delivery area:

0201-0222, 27-35

0301-35

0401-10, 0415-18

0501-03, 10-14

0701-04, 07-08, 16-20

0803-04, 0809-10, 21, 28

0927-28, 33-35

1001-18

1101-05, 08-12, 13-17

1201-04, 09-12, 13-16, 21-24

1301-03, 09-12, 13-15, 18-20, 22-27, 34-36

1413, 23-26, 35-36

1635-36

2101-03, 22-27, 34-36

2221-28

2303-05, 08-10,

2815-17, 20-22, 28-29

3301-02, 11-14, 25-29, 31-36

APPENDIX C continued

3401-04, 09-16, 21-29, 33-36

3501-36 & 3601-36 **Total: 336 square miles**