



## Report to the City Council

DATE ISSUED: June 23, 2010 REPORT No. 10-097

ATTENTION: Public Safety and Neighborhood Services Committee

SUBJECT: Proposed Council Policy 500-09 Fire Engine and Truck Staffing

### REQUESTED ACTION

- Approve a Council Policy to require minimum staffing of fire engines and fire trucks.
- Request the City Attorney review the proposed Council Policy for format and consistency.
- Request the City Attorney prepare the appropriate resolution for Council action.

### COMMITTEE CONSULTANT RECOMMENDATION

Approve proposed Council Policy 500-09 and forward to the City Attorney for review and preparation of an appropriate resolution for consideration by the full City Council.

### INTRODUCTION

The Fire-Rescue Department (Department) is a primary and integral component of the City's public safety system. The Operations Division of the Department consists of 47 fire stations citywide with an average of 275 firefighters on duty daily. Each fire station houses at least one fire apparatus, namely a fire engine or a fire truck, for the purpose of delivering firefighters, equipment, and water to extinguish fires and provide for first responder emergency medical services. The Department covers 321 square miles of territory, serves a population of 1.3 million residents and over 29 million visitors (in 2009, according to the San Diego Convention and Visitors Bureau) and responds to more than 100,000 emergency calls per year.

### BACKGROUND AND INDUSTRY STANDARDS

In order to plan and direct an effective force for emergency response, the Department relies on adherence to nationally recognized standards and California law for training and operations.

### **San Diego Fire-Rescue Department Operations Manual Standard Instruction 01, Section II**

#### H. Safety Practices and Procedures

##### 6. Buddy System

- a. Firefighters operating in an immediately dangerous to life or health (IDLH) atmosphere must operate in teams of at least two personnel (Buddy System). This requirement also applies to any Staff Officer entering the IDLH atmosphere.
- b. Each team must be in voice, visual, or electronic contact with one another. Team members shall be in close proximity to one another to provide assistance in case of an emergency.
- c. All members operating in a buddy system must exit the building together when any member of the buddy system exits. The purpose is to ensure no one leaves, or remains in the building, alone. If three members enter and a need arises to leave, all three must exit. If four enter and one member needs to leave, only one other person must exit with that individual.
- d. During preliminary operations, when two firefighters enter an IDLH atmosphere, at least two other fully equipped firefighters will be designated as the Rapid Intervention Crew and shall remain outside the IDLH area.

## I. Rapid Intervention

The objective of the Initial Rapid Intervention Crews (IRIC) and Rapid Intervention Crews (RIC) is to have a fully equipped rescue team to immediately react and respond to rescue distressed, lost, unaccounted for, or trapped firefighters.

### 1. IRIC (Initial RIC) (Two In/Two Out)

- a. It shall be the policy that no fewer than four fully equipped firefighters are on scene during interior operations that involve an unknown, potential, or an actual IDLH atmosphere.

## **California Code of Regulations, Title 8, Section 5144, Respiratory Protection at Work (CalOSHA)**

<http://www.dir.ca.gov/title8/5144.html>

Procedures for interior structure firefighting. In addition to the requirements set forth under subsection (g)(3), in interior structure fires, the employer shall ensure that:

- (A) At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;
- (B) At least two employees are located outside the IDLH atmosphere; and
- (C) All employees engaged in interior structural firefighting use SCBAs.

Note 1 to subsection (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

Note 2 to subsection (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.

### **FireScope 13.1**

#### Minimum Incident Command System (ICS) Standards for Type 1 Engines

Pump	1,000 Gallons per minute (GPM)
Water Tank	400 Gal.
Hose 2 ½"	1,200 Ft.
Hose 1 ½"	400 Ft.
Hose 1"	200 Ft.
Ladder	20 Ft. Ext.
Master Stream	500 GPM
Personnel	4

#### Minimum ICS Standards for Type I Trucks

Aerial (Platform or ladder)	75 Ft.
Elevated Stream	500 GPM
Ground Ladders	115 Ft.
Personnel	4

### **National Fire Protection Association 1710**

5.2.3 Operating Units. Fire company staffing requirements shall be based on minimum levels necessary for safe, effective, and efficient emergency operations.

5.2.3.1 Fire companies whose primary functions are to pump and deliver water and perform basic fire fighting at fires, including search and rescue, shall be known as engine companies.

5.2.3.1.1 These companies shall be staffed with a minimum of four on-duty personnel.

5.2.3.1.2 In jurisdictions with tactical hazards, high-hazard occupancies, high incident frequencies, geographical restrictions, or other pertinent factors as identified by the AHJ [agency having jurisdiction], these companies shall be staffed with a minimum of five or six on-duty members.

5.2.3.2 Fire companies whose primary functions are to perform the variety of services associated with truck work, such as forcible entry, ventilation, search and rescue, aerial operations for water delivery and rescue, utility control, illumination, overhaul, and salvage work, shall be known as ladder or truck companies.

5.2.3.2.1 These companies shall be staffed with a minimum of four on-duty personnel.

5.2.3.2.2 In jurisdictions with tactical hazards, high-hazard occupancies, high incident frequencies, geographical restrictions, or other pertinent factors as identified by the AHJ, these companies shall be staffed with a minimum of five or six on-duty members.

### **National Institute of Standards and Technology (NIST)**

Report on Residential Fireground Field Experiments (April 2010)

[http://www.nist.gov/manuscript-publication-search.cfm?pub\\_id=904607](http://www.nist.gov/manuscript-publication-search.cfm?pub_id=904607)

#### Notable Findings

- The four-person crews operating on a low-hazard structure fire completed the same number of fireground tasks (on average) 5.1 minutes faster than the three-person crew (15.44 minutes for four-person crews vs. 20:30 minutes for three-person crews). This marks a response improvement by four-person crews of nearly 25% over the three-person crews. (Page 35)
- NFPA 1710 requires that a fire department have the capability to deploy an initial full-alarm assignment to a scene within eight minutes. An effective response force was assembled by the five-person crews a full three minutes faster than the four-person crews. It is important to note that (by definition), the two- and three-person crews were unable to meet this standard at any time during the experiments. (Page 42)
- Water on fire:  
Three-person crews: 11:24 minutes  
Four-person crews: 11:11 minutes  
(Assuming best response times) (Page 49)
- The effect of crew size on physiological strain: average heart rates for members of small crews were higher. Danger is increased for small crews because the stress of firefighting keeps heart rates elevated beyond the maximum heart rate for the duration of a fire response, so the higher heart rates were maintained for sustained time intervals. (Page 50)
- A summary of the NIST conclusions is attached. (Attachment 1)

### DISCUSSION

The citizens of San Diego have consistently listed public safety as their highest priority City service through the San Diego Speaks budget meeting series, neighborhood budget forums and the recently completed report, Residents' Opinions on City Services.

Local, state and federal emergency service standards are consistent that elements of time and resources – personnel and equipment – greatly impact the success of fire and rescue responses.

The four-person staffing currently performed by the Department allows for the fastest, most efficient, and safest responses to fire incidents, thus safeguarding the lives and property of San Diegans and ensuring the best possible outcomes for firefighters.

In practice, the importance of four-person crews is discernable. Arriving on the scene of an active first alarm structure fire, San Diego Fire-Rescue personnel can immediately attack the flames both inside the structure and from the exterior. The Department's staffing configuration also limits the number of fires that grow to a second alarm, preserving the availability of those resources for other needs.

According to NFPA 1710, the national standard for arrival at an incident is five minutes 90% of the time. San Diego strives to meet the standard, but has been able to attain the standard 53.3% of the time thus far in 2010. The 2009 average was 55.15%. The national standard for assembling an effective fire fighting force, three engines, one truck, plus command, is nine minutes 90% of the time. Thus far in 2010, the Department has achieved the standard 66.14% of the time. The 2009 average was 73.20% of the time.

On February 6, 2010 the Department initiated a program to temporarily close or brown-out on a daily basis eight of thirteen preselected fire engines that are housed in stations with more than one fire apparatus. The goal of this program is to save up to \$11.5 million in the FY 2011 General Fund budget. This program has negatively impacted response times, the ability of first responders to effectively fight fires, and the ability of crews from surrounding fire stations to serve their communities while filling in for closed engines elsewhere.

Given that the Mayor's five-year budget outlook calls for continued major budget deficits in the upcoming years, it is probable that the Department will be asked to endure additional funding cuts, further reducing its ability to provide the citizens of San Diego with adequate and effective emergency response capabilities.

#### SUMMARY

The impacts of historic, current and ongoing challenges of the San Diego Fire-Rescue Department and the imperfect forecast are critical, and protecting the safety of San Diego requires prioritization and action by the City Council.

The proposed Council Policy 500-09 (Attachment 2) requires that fire engines and fire trucks be minimally staffed with four-person crews to provide for their ability to enter structures where fire incidents are occurring and provide rescue/life saving operations without waiting for additional fire apparatus to arrive on scene.

CONCLUSION

The City Council has the authority and responsibility to enact policies to direct the effective administration of public safety resources within the City of San Diego.

It is in the best interests of the citizens of San Diego to require the Fire-Rescue Department be staffed, equipped and funded to deliver the appropriate resources to emergency incidents. The proposed policy will assure that as the City addresses its budgetary challenges, an effective firefighting capability is not compromised by short-term budgetary proposals and will stand as the Council's pledge that public safety has the highest priority of the City of San Diego.

FISCAL CONSIDERATIONS

The proposal to require four-person staffing at a minimum for fire engines and fire trucks has no fiscal impact as four-person staffing is the current operational policy.



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PS&NS Committee Consultant



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Council District 3

Attachment 1: National Institute of Standards and Technology (NIST) Report Conclusions

Attachment 2: Proposed Council Policy 500-09

# Conclusions

**M**ore than 60 laboratory and full-scale fire experiments were conducted to determine the impact of crew size, first-due engine arrival time, and subsequent apparatus arrival times on firefighter safety and effectiveness at a low-hazard residential structure fire. This report quantifies the effects of changes to staffing and arrival times for low-hazard residential firefighting operations. While resource deployment is addressed in the context of a single structure type and risk level, it is recognized that public policy decisions regarding the cost-benefit of specific deployment decisions are a function of many factors including geography, available resources, community expectations, as well as all local hazards and risks. Though this report contributes significant knowledge to community and fire service leaders in regard to effective resource deployment for fire suppression, other factors contributing to policy decisions are not addressed.

The objective of the experiments was to determine the relative effects of crew size, first-due engine arrival time, and stagger time for subsequent apparatus on the effectiveness of the firefighting crews relative to intervention times and the likelihood of occupant rescue using a parametric design. Therefore, the experimental results for each of these factors are discussed below.

Of the 22 fireground tasks measured during the experiments, the following were determined to have especially significant impact on the success of fire fighting operations. Their differential outcomes based on variation of crew size and/or apparatus arrival times are statistically significant at the 95 % confidence level or better.

## Overall Scene Time:

The four-person crews operating on a low-hazard structure fire completed all the tasks on the fireground (on average) seven minutes faster — nearly 30 % — than the two-person crews. The four-person crews completed the same number of fireground tasks (on average) 5.1 minutes faster — nearly 25 % — than the three-person crew. For the low-hazard residential structure fire, adding a fifth person to the crews did not decrease overall fireground task times. However, it should be noted that the benefit of five-person crews has been documented in other evaluations to be significant for medium- and high-hazard structures, particularly in urban settings, and should be addressed according to industry standards.<sup>18</sup>

## Time to Water on Fire:

There was a nearly 10 % difference in the “water on fire time” between the two and three-person crews and an additional 6 % difference in the “water on fire time” between the three- and four-person crews (i.e., 16 % difference between the four and two-person crews). There was an additional 6 % difference in the “water on fire” time between the four- and five-person crews (i.e., 22 % difference between the five and two-person crews).

## Ground Ladders and Ventilation:

The four-person crew operating on a low-hazard structure fire can complete laddering and ventilation (for life safety and rescue) 30 % faster than the two-person crew and 25 % faster than the three-person crew.

## Primary Search:

The three-person crew started and completed a primary search and rescue 25 % faster than the two-person crew. In the same

structure, the four- and five-person crews started and completed a primary search 6 % faster than the three-person crews and 30 % faster than the two-person crew. A 10 % difference was equivalent to just over one minute.

## Hose Stretch Time:

In comparing four- and five-person crews to two- and three-person crews collectively, the time difference to stretch a line was 76 seconds. In conducting more specific analysis comparing all crew sizes to a two-person crew the differences are more distinct. A two-person crew took 57 seconds longer than a three-person crew to stretch a line. A two-person crew took 87 seconds longer than a four-person crew to complete the same tasks. Finally, the most notable comparison was between a two-person crew and a five-person crew — more than 2 minutes (122 seconds) difference in task completion time.

## Industry Standard Achieved:

The “industry standard achieved” time started from the first engine arrival at the hydrant and ended when 15 firefighters were assembled on scene.<sup>19</sup> An effective response force was assembled by the five-person crews three minutes faster than the four-person crews. According to study deployment protocol, the two- and three-person crews were unable to assemble enough personnel to meet this standard.

## Occupant Rescue:

Three different “standard” fires (slow-, medium-, and fast-growth rate) were simulated using the Fire Dynamics Simulator (FDS) model. The fires grew exponentially with time. The fire modeling simulations demonstrated that two-person, late arriving crews can face a fire that is twice the intensity of the fire faced by five-person, early arriving crews. The rescue scenario was based on a nonambulatory occupant in an upstairs bedroom with the bedroom door open.

Independent of fire size, there was a significant difference between the toxicity, expressed as fractional effective dose (FED), for occupants at the time of rescue depending on arrival times for all crew sizes. Occupants rescued by crews starting tasks two minutes earlier had lesser exposure to combustion products.

The fire modeling showed clearly that two-person crews cannot complete essential fireground tasks in time to rescue occupants without subjecting either firefighters or occupants to an increasingly hazardous atmosphere. Even for a slow-growth rate fire, the FED was approaching the level at which sensitive populations, such as children and the elderly are threatened. For a medium-growth rate fire with two-person crews, the FED was far above that threshold and approached the level affecting the median sensitivity in general population. For a fast-growth rate fire, the FED was well above the median level at which 50 % of the general population would be incapacitated. Larger crews responding to slow-growth rate fires can rescue most occupants prior to incapacitation along with early-arriving larger crews responding to medium-growth rate fires. The result for late-arriving (two minutes later than early-arriving) larger crews may result in a threat to sensitive populations for medium-growth rate fires.” The new sentence is consistent with our previous description for two-person crews where we identify a threat to sensitive populations.. Statistical averages should not, however, mask the fact that there is no FED level so low that every occupant in every situation is safe.

<sup>18</sup> NFPA Standard 1710 - A.5.2.4.2.1 ... Other occupancies and structures in the community that present greater hazards should be addressed by additional fire fighter functions and additional responding personnel on the initial full alarm assignment.

<sup>19</sup> NFPA 1710 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments. Section 5.2.1 – Fire Suppression Capability and Section 5.2.2 Staffing.

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Summary:

The results of these field experiments contribute significant knowledge to the fire service industry. First, the results establish a technical basis for the effectiveness of company crew size and arrival time in *NFPA 1710*. The results also provide valid measures of total effective response force assembly on scene for fireground operations, as well as the expected performance of time-to-critical-task measures for a low-hazard structure fires. Additionally, the results provide tenability measures associated with the occupant exposure rates to the range of fires considered by the fire model.

**CITY OF SAN DIEGO, CALIFORNIA  
COUNCIL POLICY**

SUBJECT: MINIMUM STAFFING FOR FIRE ENGINES AND FIRE TRUCKS  
POLICY NO.: 500-09  
EFFECTIVE DATE:

BACKGROUND

As of June 30, 2010, the City of San Diego has forty-seven (47) fire engines and twelve (12) fire trucks. The Fire-Rescue Department (Department) has initiated budgetary savings programs that impact response time, the ability of first responders to effectively fight fires, and the ability of crews from surrounding fire stations to serve their communities while filling in for closed engines elsewhere.

PURPOSE

This policy is intended to establish a permanent standard for the minimum staffing of fire engines and fire trucks.

POLICY

The City Council is deeply committed to improving public safety throughout the City of San Diego. The Fire-Rescue Department provides resources for the emergency response to fires and needed emergency medical services in an environment of continued development of dwelling units and associated population increases.

The City Council is committed to providing the appropriate resources for the fastest response time and cessation of emergency incidents by the Fire-Rescue Department.

It is the intention of the City Council that all fire engines and fire trucks positioned in fire stations be staffed and operational.

This policy of the City Council requires that all fire engines and fire trucks be minimally staffed with four-person crews.