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Statement—Fire Crew Size Press Briefing April 28, 2010

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Good morning. We're pleased to be here this morning to release the results of a major new study of the effects of varying crew sizes and arrival times on the ability of firefighters to effectively respond to residential fires.

The report of our conclusions is being issued by the National Institute of Standards and Technology and our research collaborators include the Commission on Fire Accreditation International-RISK, the International Association of Fire Chiefs, the International Association of Firefighters, and Worcester Polytechnic Institute.

We are also thankful to the firefighters and leadership from Montgomery County, Md., and Fairfax County, Va., for their invaluable assistance in completing this extensive set of experiments.

Our study is the first to quantify fire service lifesaving and firefighting operations for a low-hazard residential structure including the effects of changes in crew size, arrival time, and stagger on rescue and suppression effectiveness.

The study included more than 60 controlled fire experiments, both in our large fire laboratory and at the custom low-hazard residential burn building constructed at the Montgomery County Training Academy. The results of our study provide quantitative data to fire chiefs and public officials responsible for determining safe staffing levels, appropriate station locations, and necessary funding for community and firefighter safety.

Overall, the results of our study show that that the number of fire service crew members in each company responding to a fire in a 2,000 square-foot, two-story structure had a substantial effect on the crew's ability to protect lives and property. I would like to highlight three key findings

related to firefighter performance: overall scene time, time to water application, and rescue effectiveness:

- First, four- and five-person crews were able to complete the 22 essential firefighting and rescue tasks in a residential setting 30 percent faster than two-person crews and 25 percent faster than three-person crews. (See poster) Overall scene time is the time that it takes the firefighters to complete all 22 tasks. The overall scene time measure is critical to the fire crew's ability to complete their work safely and return to the station in order to be available for the next fire call. In addition, firefighter crews that complete several of the tasks simultaneously, rather than consecutively, are able to complete all tasks and are less fatigued. It is important to note that previous studies have documented significant benefits for five-person crews for medium- and high-hazard structures, particularly in urban settings, unlike the low-hazard residential fire scenario examined in this study.

- Second, we investigated the time to water application. Fire risks grow exponentially. Each minute of delay is critical to the safety of occupants and firefighters and is directly related to property damage. Results show that five-person crews were able to apply water to the fire 22 percent faster than two person crews. Four-person crews were able to apply water to the fire 16 percent faster than two-person crews and 6 percent faster than three-person crews. What this means for firefighter safety is that two-person crews arriving later to the scene faced a fire about 2.1 megawatts in size. On the other end of the spectrum, five-person crews arriving earlier to the scene faced a fire about half as big at 1.1 megawatts. (See poster.) For context, a 1 megawatt fire would be a fully-involved upholstered chair burning at its peak. A 2 megawatt fire, however, would be sufficient to produce near-flashover conditions in the 12 by 16 foot room of fire origin used in our experiments. Facing a fire of twice the intensity greatly increases the danger to the firefighters and increases the likelihood that the fire will spread beyond the room of origin.

- Finally, to estimate how various crew sizes would affect the exposure of occupants to toxic gases, we simulated slow-, medium-, and fast-growth rate fires using NIST's Fire Dynamic Simulator software. The simulation assumed an occupant unable to escape on their own from an upstairs bedroom with the bedroom door open.

We calculated occupant exposures both when firefighters arrive earlier to the scene, representing crews from fire stations nearby the burning structure, and those arriving later, representing crews arriving from more distant locations. The simulations showed that for a medium-growth fire, two-person crews would not be expected to complete essential tasks in time to rescue occupants from exposures to toxic gases that would incapacitate sensitive populations such as children and the elderly. Two-person crews arriving later would also likely find a significant portion of the general public incapacitated by the time of rescue. The simulations for early arriving five-, four- and three-person crews show that they would likely be able to locate and rescue an occupant before sensitive populations would be incapacitated.

Now, I'd like to spend a few minutes putting our findings into some context for you. Whenever, a study like ours is completed, it is tempting to try to boil it down to simplistic conclusions that work for all scenarios. I want to specifically urge you *not* to do that. I'll tell you why.

Our experiments apply to firefighting crew sizes in a low-hazard residential setting and not to larger, more hazardous structure, outdoor, or transportation fires.

We conducted our experiments with career firefighters. We expect our results to also be useful to combination departments or fire departments staffed with in-station volunteers ready to respond.

The number of responding apparatus for each fireground response was held constant (three engines and one truck, plus the battalion chief and aide) for all crew size configurations. The effect of deploying either more or fewer apparatus to the scene was not evaluated.

We also can't tell you, based on our study alone, how to deploy fire crews in a specific community. Decisions about crew size and how many apparatus to deploy in a specific community depend on a number of variables, including the population density, the distribution of structures, age and type of construction, the size of the fire station's first-due coverage area, and the resources available to that jurisdiction.

Rather than provide a one-size-fits-all answer, our study provides a scientific basis for the discussion in individual jurisdictions as they consider choices about matching resources deployed to the risk-level in their community.

What we *can* tell you is that for some measures—such as the size of fires at the time of water application and the ability of firefighters to complete their tasks and be ready for another call—there were successively greater advantages in residential settings for larger fire crews. For other measures, such as reducing the exposure of occupants to toxic gases, our results point to clear advantages for three-, four-, or five-person crews and earlier arrival times.

Responding to residential fires is both a dangerous and costly business. Firefighters provide this essential service to our communities in order to save lives and protect property. We hope that by collecting data in a rigorous way on how fire crews of various sizes are able to respond to these hazards, that local communities will be better able to optimize their fire service operations, helping to ensure the safety of the both the firefighters and the public.

At this point, we'll be happy to take your questions.

Thank you.