Report on Texas fire urges firefighters to consider wind effects

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(PhysOrg.com)—Wind conditions at a fire scene can make a critical difference on the behavior of the blaze and the safety of firefighters, even indoors, according to a new report by the National Institute of Standards and Technology. The findings confirm earlier NIST research, but they take on a particular immediacy because they are based on detailed computer models of a tragic 2009 residential fire in Houston, Texas, that claimed the lives of two firefighters.

The NIST modeling was done at the request of the Houston Fire Department (HFD) and the Centers for Disease Control and Prevention's National Institute for Occupational Safety and Health (NIOSH), both of which wanted expert insight into the fire dynamics (behavior) that killed a 29-year veteran captain and a probationary firefighter.

Two NIST fire experts traveled to Houston shortly after the April 12, 2009, fire in a one-story ranch-style home located on the east side of the city. They examined the site and collected data about the behavior of the fire and the factors impacting that behavior—in particular, the wind at the time—in order to unravel the events that led to the deaths of the two men.

This was accomplished by creating sophisticated computer models of the fire and then visualizing them using two popular NIST software tools: the Fire Dynamics Simulator (FDS), which numerically characterizes the movement of smoke and hot gases caused by fire, wind and ventilation systems; and Smokeview, which displays the FDS calculation results as

animations. The simulations portrayed two different scenarios of the Houston fire. The first demonstrated the actual conditions that firefighters experienced that day, including the contributing role of wind, while the second was intended to show how the fire may have behaved in the absence of wind. The wind-included scenario indicated that the fire followed a wind-driven flow path between the den and the front door after the failure of a large span of windows in the den. Floor-to-ceiling temperatures rapidly increased—in some areas, in excess of 260 degrees Celsius (500 degrees Fahrenheit)—in this flow path where multiple crews of firefighters were working. In the NIST simulation that excluded wind, the flow path was not created, and the temperatures and conditions where the firefighters were working were significantly less hazardous.

The authors of the NIST report, Adam Barowy and Daniel Madrzykowski, stated that "the 'wind' and 'no wind' simulations clearly demonstrate how wind conditions can rapidly change the thermal environment from tenable (survivable) to untenable for firefighters working in a single-story residential structure fire." They add that the results from the Houston fire simulations are in agreement with those NIST has done in collaboration with the Fire Department of New York City and the Chicago Fire Department for wind-driven fires in high-rise structures. This, the authors said, stresses the importance of including wind conditions for all structural fire scene operations—both before and during firefighting—and adjusting tactics according to changing wind situations, especially regarding interior operations, to enhance the safety, and maximize the effectiveness, of firefighters.

More information: The NIST report that describes the details of the computer models and what was learned from them, Simulation of the Dynamics of a Wind-Driven Fire in a Ranch-Style House—Texas (NIST Technical Note 1729), is available online at www.nist.gov/customcf/get_pdf.cfm?pub_id=909779 .