In unique fire tests, outdoor decks will be under firebrand attack

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The National Institute of Standards and Technology will unleash its Dragon -- a NIST invention that bellows showers of glowing embers, or firebrands -- at a unique wind tunnel test facility in Japan, where researchers will evaluate the vulnerability of outdoor deck assemblies and materials to ignition during wildfires, a growing peril that accounts for half of the nation's 10 most costly fires.

In a new report, NIST researchers summarize suggestions for test designs and objectives offered by experts at a recent workshop convened in Los Angeles, Calif., with support from the U.S. Department of Homeland Security and input from the Office of the California State Fire Marshal. This input is now being formalized into plans for experiments that will be conducted in early 2012 at Japan's Building Research Institute (BRI) in Tsukuba.

There, NIST and Japanese researchers have merged two technologies, NIST's Firebrand Generator (the "Dragon") and BRI's Fire Research Wind Tunnel Facility, which is devoted to studies of how wind influences fire. The combination gives them the singular capability to replicate a firebrand attack and expose structures to wind-driven showers of embers under experimentally controlled conditions.

The brain child of mechanical engineer Samuel Manzello, the NIST Dragon is a two-meter tall, goose-neck-shaped stove pipe that breathes in wood chips and exhales firebrands at a controlled rate. Manzello created the Dragon to support NIST's program to better understand and prevent

fires at the wildland-urban interface (WUI), with the ultimate aim of reducing property damage and human casualties.

Firebrands, or embers, are generated as vegetation and structures burn in WUI fires. Post-fire damage studies have suggested for some time that firebrands are a significant cause of structure ignition in WUI fires. However, prior firebrand research has focused on how far firebrands fly, known as spotting distance, and has not yielded definitive results to guide development of building codes and standards.

In 2005, NIST began the cooperative research effort with BRI that ultimately led to the NIST Dragon becoming a permanent resident at BRI. NIST and BRI have used the combined facility to study the vulnerability of siding treatments, window glazing assemblies, and overhanging eaves to ignition during realistic firebrand showers. Results are shared with standards and regulatory bodies, insurers, and trade associations to inform their decisions on material and building requirements.

Another study examined the effectiveness of the standard wire mesh used to cover building vents on houses. Manzello and his team determined that the 6-millimeter (1/4-inch) spacing required in building codes were too porous to, and did not, prevent firebrands from igniting materials placed behind the mesh. Consequently, the California Code of Regulations was recently amended to require significantly smaller mesh sizes to cover vent openings.

Now, deck assemblies are slated to come under firebrand assaults from the NIST Dragon. Post-fire surveys conducted by NIST have documented that decks are vulnerable to ignition during wind-driven firebrand showers. However, codes and standards for decks have not been devised with detailed knowledge of the threat.

For example, in California, where wildland fires are an annual threat to many communities, the State Fire Marshal adapted an ASTM fire test designed for roofing materials to determine the response of deck materials to firebrand showers. The test entails placing a burning crib on top of a test deck and monitoring physical changes for a set period.

“It’s assumed that this test represents a worst-case firebrand shower scenario,” Manzello explains, “but no one knows for sure. The test does not simulate dynamic firebrand attack during a real wildland-urban interface fire. We are designing our full-scale tests to quantify the vulnerabilities and provide the basis for improvements in building codes.”

More information: S.L. Manzello and S. Suzuki. Summary of the 2011 Workshop on Research Needs for Full Scale Testing to Determine Vulnerabilities of Decking Assemblies to Ignition by Firebrand Showers. NIST Special Publication 1129, Aug. 2011.

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