National Institute of Standards and Technology
U. S. Fire Administration
Federal Emergency Management Agency

FIRE.GOV

Better fire fighting through research

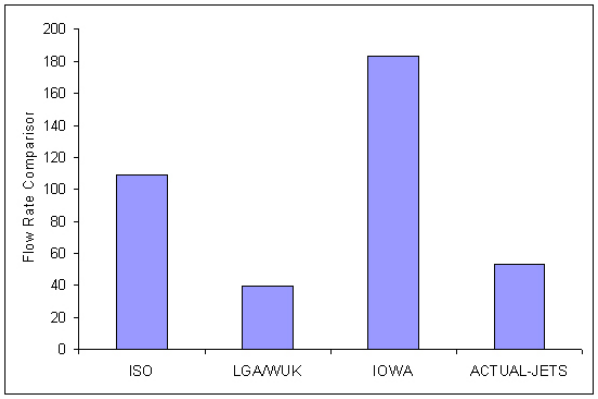
Summer -- 2002

Planning for the Water Flow You Need

Will there be enough water to fight the fires that may occur in buildings? This is not a new question and one that is of concern to firefighters throughout the world as buildings increase in size, the spacing between structures gets smaller, and more geographic areas are experiencing droughts. In the paper, *Improved Calculation of Fire-Fighting Water-Flow Requirement—The Key to Strategic Management of Fire-Hydrant Provision*, Senior Divisional Officer Neal Fowler (**Kent Fire Brigade, UK**) examines methods to assess fire fighting water flow requirements. The four methods examined are the North American Insurance Services Office Method (ISO), recent guidance from the Local Government Associations in partnership with a water industrial group Water UK (LGA/WUK), data correlated from actual fire incidents by Lund University (Sweden) researcher Stefan Sardqvist (actual-jets) and the Iowa State University Formula (IOWA). The bar graph shows the widely varying results of the four methods when applied to a specific case.

For many reasons, Officer Fowler recommends use of the actual–jets equation.

For additional information, contact Neal Fowler at neal.fowler@ukgateway.net or Stephan Sardqvist (working at the Swedish Rescue Services Agency) at stefan.sardqvist@srv.se



Comparison Between Methodologies For Calculation of Fire-Fighting Water-flow Requirement

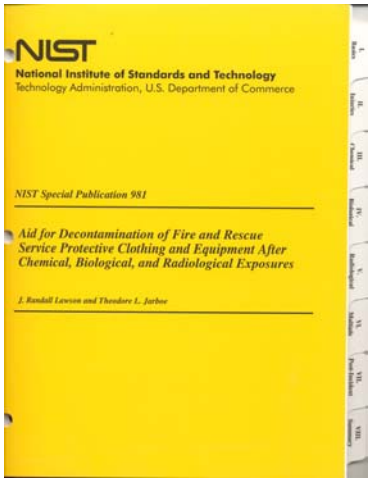
Decontaminating First Responders

The threat of chemical, biological and radiological (CBR) attack is apparent, and all first responders need to be prepared to address this possibility. First responders have been called upon to respond to every terrorist attack in North America. Their first priority as fire and rescue service personnel is the safety of all emergency personnel to avoid injury or loss of life. Randy Lawson of NIST and Chief Ted Jarboe of **Montgomery County Fire and Rescue** teamed up to consolidate CBR decontamination guidelines into a single report, sponsored in part by the USFA.

Cont. on page 2

Firefighter, standing in yellow water collector, being decontaminated by hose spray.

Decontaminating First Responders, cont.



NIST Special Publication 981

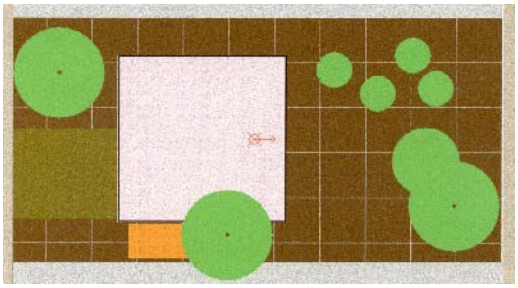
Click HERE to download report.

The report, *NIST SP 981*, *Aid for Decontamination of Fire and Rescue Service Protective Clothing and Equipment After Chemical, Biological, and Radiological Exposures*, provides first responders with basic emergency decontamination aid of personal protective clothing and equipment (PPE) in the event that it is exposed to CBR contamination. The report provides some basic guidelines for handling equipment exposed to relatively lower concentration CBR environments where human rescue is practical. *NFPA 1971, Standard on Protective Ensembles for Structural Fire Fighting* and other NFPA (National Fire Protection Association) standards are discussed. It is recommended that all relevant NFPA standards be kept with the NIST report. Guidelines for storing protective clothing and equipment safely after a CBR exposure also are included. For anyone in cold geographic regions or areas that have temperature extremes, another report may be of interest: *Guidelines for Cold Weather Mass Decontamination During a Terrorist Chemical Agent Incident* (published by SBCCOM… the US Army Soldier and Biological Chemical Command). It has information on cold weather contamination. The report was published on 12 April 2002 and to download it from their web site, go to: www.sbccom.army.mil ; next, click on SBCCOM ONLINE and search the report title.

For additional information, contact Randy Lawson, telephone: (1) + 301-975-6877; e-mail: james.lawson@nist.gov.

UWI Landscaping Assisted by Fire Models

Scientists and engineers in the Fire Research Division of the National Institute of Standards and Technology (NIST) are developing mathematical/ computational fire models to predict the spread of fires through both wildland fuels and structures. Such landscapes, where wildland fuels (trees, shrubs and grasses) and houses and/or other manmade structures coexist are known as the urban-wildland interface (UWI). As people have built in more remote areas, UWI fires have become much more common, dangerous and expensive.



Record of a generic property in the demonstration community of South Lake Tahoe. In its final form users will manipulate building materials and vegetation to study the effect on fire resistance.

Simulation based on a predicted grass fire spread. Click on picture **to view animation**.

The problem of UWI fires has become a more prominent issue, both in the United States and elsewhere. NIST researcher Ron Rehm has teamed up with colleague Lisa de Jong at the Pacific Southwest Research Station (PSW) of the Forest Service to address this pressing problem. The Center for Urban Forest Research of the PSW, located in Davis, CA, has as its mission, the study of natural vegetation in an urban or suburban setting. One project, which falls under the interagency National Fire Plan, is a comparison of alternates to "firewise" landscapes. It evaluates vegetation characteristics that homeowners value, such as beauty, shade, privacy and wildlife habitat, relative to the increased susceptibility of their residences to wildfire from the vegetation.

In this project, NIST fire scientists and engineers are developing a simple module describing fire spread to be incorporated into the more comprehensive model for alternate firewise landscapes. In final form, this model will allow homeowners to determine how vulnerable their house is to a wildfire that has entered their community. Next, it allows them to determine how changes in the vegetation on their property could reduce their risks.

The **video simulation** accompanying this article shows the calculated progression of a grass fire, arising from a wildfire that has invaded the community, over a homeowner's property. More refined simulations will allow the homeowner to assess the value of changes in landscape vegetation on the vulnerability of their house to fire.

For additional information, contact: Ron Rehm, (1) + 301-975-2704, ronald.rehm@nist.gov. OR Lisa de Jong (1) +530-754-8908, mailto:ldejong@ucdavis.edu.

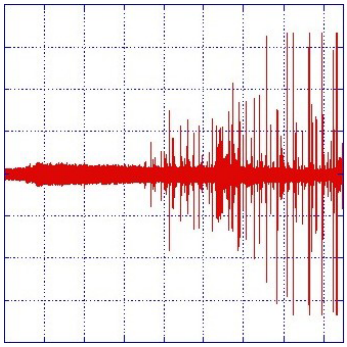
Vibrations May Warn of Structural Collapses

Researchers are analyzing patterns of spikes in data on a graph that may help them design an early earning system to identify a building collapse. The information was captured by sensitive instruments that detected tiny wall vibrations as a building burned in a controlled fire test in May 2002. NIST cooperating with the **Dale City and Prince William County (Virginia) Fire Departments** set fires in vacant stores in a shopping center in Woodbridge, Virginia scheduled to be demolished. Fire Research Engineers from NIST grantee Harvey Mudd College, in Claremont, CA, tested the capability of highly sensitive motion detectors to detect pre-collapse vibrations of walls in the lightweight steel frame building construction during fires large enough to cause collapse of steel deck roofs. The researchers hope to develop a methodology for interpreting the vibration data to enable the development of warning devices. A future warning device that uses this technology could be attached to burning buildings by firefighters or installed into the structure permanently. Advanced warning of unsafe structures can reduce the risks to firefighters and rescue workers from collapsing walls or falling roofs.

Previously, NIST and Harvey Mudd researchers used the same sensors to collect data on pre-collapse structural vibrations in two other burn tests: A wood framed house in Kinston, NC (the test is described in the Winter 2002 issue of FIRE.GOV) and a wood frame warehouse in Phoenix, AZ. All three NIST structural collapse experiments were part of a two-year series sponsored by the US Fire Administration.

For additional information, contact: Professor Ziyad Duron at Harvey Mudd College, (1) + 909-607-3883 or e-mail: ziyad.duron@hmc.edu.

Roof collapses in shopping center store fire.



Measurements of building vibration during fire up to roof collapse.

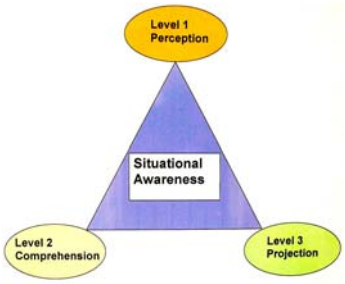
What Factors Determine Situational Awareness?

The fire environment calls for critical decision making under extreme stress and the decisions often determine whether or not one survives the fire. Situational awareness (SA) is a cognitive construct that is important to consider in human behavior in fires because SA is linked to human performance. Lack of SA leads to errors in judgment and response during critical events; SA is related to expertise and also is considered the basis for decision making. Lt. Stephen J. Walsh (**Quincy, MA, Fire Department**) conducted a study with professional firefighters and emergency medical technicians for over a decade to learn what factors indicate a presence of SA in the critical fire environment. Later, the results of the study were presented at the Worcester, MA, International Symposium of the International Association for Fire Safety Science. Seven SA factors were identified by the group: Training, experience, commitment, confidence, physical awareness, fear and size-up. To achieve better operational performances, trainers should be mindful of these factors to improve operational performance. Emergency responder will continue to train and gain experience. SA is one of the building blocks in expert performance. It is the first step in decision making.

As more trainers become aware of using SA, greater opportunities for usage will evolve. One potential usage of this cognitive process is in performance based code design and compliance, for example, considering critical tasks such as emergency evacuations.

To learn more about this study, contact Stephen Walsh, (1) + 781-925-9679, firefamily2000@hotmail.com.

Click **HERE** to see the report: *Improved Calculation of Fire-Fighting Water-Flow Requirement – The Key To Strategic Management of Fire-Hydrant Provision*



Enhanced accuracy in the three stages of situational awareness decreases risk.

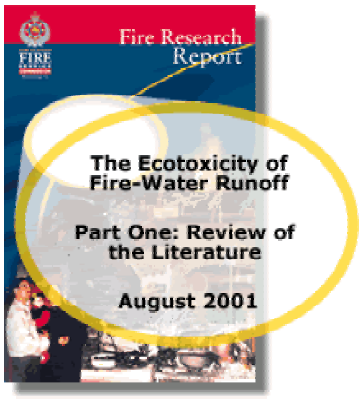
How Bad is Fire Water Runoff?

What are the environmental risks from the water used to put out a house fire … an automobile fire … a chemical plant fire? These were the primary questions addressed in three reports (*The Ecotoxicity of Fire-Water Runoff*) prepared for the **New Zealand Fire Service Commission**. Part 1 is a literature review http://www.fire.org.nz/more_info/reports/fund/reports/Report_17.htm ; Part 2 has the results from several incidents that were monitored http://www.fire.org.nz/more_info/reports/fund/reports/Report_18.htm; Part 3 sets forth a framework for risk management http://www.fire.org.nz/more_info/reports/fund/reports/Report_19.htm. As one might predict, the house fire represented the least amount of damage to the environment. In several structural fire incidents that were monitored, the runoff from an automobile shop fire was the most hazardous to aquatic life. A fruit shop fire runoff had metal concentrations comparable to, but smaller than, those from a large industrial plastics warehouse fire that occurred outside of New Zealand. The water runoff from the fire scene could be acutely toxic to the aquatic ecosystems.

The severity of the problem depends upon the types and size of the structures involved, the extent of the burn, and the contents within the structures. Fire authorities and the environmental authorities are encouraged to work together to create a framework for risk management by using available computer based tools, for example, Geographic Information System, to locate critical areas to assist in implementing prevention and management plans.

For information, contact Jefferson Fowles at jeff.fowles@esr.cri.nz

Or Dr. Paula Beever, Principal Fire Engineer, at paula.beever@fire.org.nz



One of three reports sponsored by the New Zealand Fire Service Commission.

NIST Helps Create New Fire Laboratory in Chile

NIST, through the U.S. Embassy in Chile, played a key role in an historic achievement in Chile, according to John A. Harris, Commercial Counselor at the U.S. Embassy in Santiago.

Following a dramatic increase in building construction in Chile during the last 10 years, fire losses also increased. Chile was a country that lacked local fire testing capabilities. In 1998, working through the Catholic University in Santiago, Chile, a concept for a fire laboratory was developed to meet three objectives:

To provide product fire testing to meet U.S. and international standards (a vital commercial benefit to Chile); to serve in educating and training fire professionals by Chilean and American experts; and, to conduct research and development in the field.

From NIST, David Evans, Anthony Hamins, Walter Jones, and Randy Lawson of Building and Fire Research Laboratory (BFRL) and Ileana Martinez and Harry Oppermann of Technology Services (TS), were instrumental in providing technical support and advice. Other U.S. experts also were involved.

In March 2002 the concept became a reality. A one-of-a-kind fire laboratory, integrating many U.S. products—controls, burners, and thermocouples—and the most important, U.S. knowledge and expertise, opened for business. The design of the laboratory is unique, with a rotating furnace that can test items of different sizes.

It complies with and applies U.S. and international standards, including those of the National Fire Protection Association (NFPA) and the American Society for Testing Materials (ASTM).

For more information, contact: Ileana Martinez, (1) + 301-975-2766, ileana.martinez@nist.gov.

Installation of The Materials Testing Oven for Chile's new fire testing laboratory.

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