Workshop Report: Today and Tomorrow’s Fire Data

Fire Analysis and Research Division
National Fire Protection Association

March 26, 2014
For more information about the National Fire Protection Association, visit www.nfpa.org or call 617-770-3000. To learn more about the One-Stop Data Shop go to www.nfpa.org/osds or call 617-984-7443.

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Background

On March 26, 27, 2014, in Gaithersburg, MD, NFPA’s Fire Analysis and Research Division, in cooperation with the National Institute of Standards and Technology, facilitated a workshop to bring together the research community and major fire organizations in the United States who are leaders in the collection and use of fire experience data. Its goal was to review how we currently gather, analyze and use fire loss data and explore how we might work together to make all those processes more effective.

The workshop began with a basic overview of the National Fire Incident Reporting System (NFIRS) and the analysis methods used by USFA, NFPA and CPSC to develop national estimates of fire loss based on this data. The insurance industry and IAFC presented on other fire loss data collection activities, and a group of presentations on wildland urban interface data collection was made. Representatives of federal, state and local fire agencies then described how they use this data for decision making on resource allocation, program priorities, etc.

On the second day, several current research projects designed to enhance data collection were described, as well as NFPA standards development activity relevant to this activity. Next, a series of discussion sessions on data needs and gaps and enhanced data gathering were conducted. A final discussion session painted a picture of the future of fire loss data collection and analysis and outlined steps toward that vision. Following the workshop, participants identified their priorities for future activities designed to ensure a robust national fire data collection and analysis program that continues to meet the evolving needs of the fire community.

This Report is a summary of the workshop presentations and discussions. Appendix A consists of the participant list, agenda and presentations; Appendix B describes the detailed outcome of each of the discussion sessions on the second day of the workshop. Finally the report includes priority strategies identified by participants after the workshop.

Thanks are extended to the program committee members:

Marty Ahrens, National Fire Protection Association
Karen Deppa, National Association of State Fire Marshals
Chris Farrell, National Fire Protection Association
Anthony Hamins, National Institute of Standards and Technology
Shawn Kelley, International Association of Fire Chiefs
David Miller, Consumer Product Safety Commission
Lori Moore, Internal Association of Fire Fighters
Brad Pabody, United States Fire Administration
Kathleen Almand, National Fire Protection Association

and to the National Institute of Standards and Technology, in particular Anthony Hamins, Kris Overholt, and Craig Weinshenck, for hosting the workshop.
Summary of Workshop Presentations

Welcome and Workshop Charge

Marty Ahrens, National Fire Protection Association, welcomed participants to the workshop and provided the following workshop charge:

The goal of this workshop is “Collecting, analyzing, and using fire experience data to reduce the nation’s fire problem”. How can we be sure that the fire service, policy makers, codes and standards developers, life safety educators and others have the information they need to protect the public, and the firefighters who protect them, from fire? What’s working well? Where are the holes? How can we improve?

She encouraged workshop participants to provide input and recommendations for future actions and a collective response to those recommendations.

Overview of National Fire Incident Reporting System (NFIRS)

Jim Heeschen, U.S. Fire Administration, presented an overview of NFIRS, and the nine NFIRS data collection modules and their purpose. He reviewed the web based data resources at the National Fire Data Center and concluded his presentation with information on the enhancements to NFIRS which are underway and planned: a new data entry browser interface (complete); data warehouse and mining capability (limited release July 2014); and future phased updates as follows:

- Phase 1 - Rules and Core Services Update
- Phase 2 – Web Based Modernization and GIS
- Phase 3 – Vendor Integration and Incident Management Services
- Phase 4 – NFIRS User and Data Interface Enhancements

Panel Session - Fire Data Analysis Approaches

Marty Ahrens, NFPA; Jim Heeschen, U.S. Fire Administration; and David Miller, Consumer Products Safety Commission presented each agency’s approach to analysis of the NFIRS data. Each builds upon a national estimates approach developed jointly by the three organizations over 25 years ago which combines the details collected by NFIRS with estimates derived from NFPA’s annual fire department experience survey. Each organization described the differences in their treatment of the national data, including the handling of unknowns in the data, and what data is and is not included in some estimates. The Panel shared several examples of excerpts of reports on national fire loss, illustrating the differences in analysis approaches. The Panel session concluded with a review of other data resources available from each organization.
Other Fire Data Collection Activities

Laura Bell and Tommy Hicks, International Association of Fire Chiefs, reported on the IAFC Near Miss Reporting System and its innovative approach to data collection, including anecdotal reporting. They are currently making modifications to incorporate a more structured format that would allow more systematic data analysis. Kevin Kuntz, Verisk Analytics, reviewed the ISO Public Protection Classification System and the data collection efforts which support the identification of community risk factors and mitigation strategies.

Wildland Urban Interface (WUI) Fire Data Collection

The speakers in this session described various approaches to fire incident data collection at the wui. Alex Maranghides, National Institute of Standards and Technology, described NIST’s in depth incident investigation approach which involves collecting all data (baseline of exposed structures both damaged and destroyed) and defensive actions employed, with a goal of quantifying exposure at the structure level and reconstructing actual fire and event timelines. This approach provides a deep understanding of wui fire spread which can inform future prevention and mitigation strategies. Hylton Haynes, NFPA, on behalf of Keith Smith, USFS, described IRWIN, Integrated Reporting of Wildland Fire Information, a data integration system that orchestrates data exchange between operational applications such as state computer aided dispatch systems, the Wildland Fire Decision Support System (WFDSS), geospatial information systems, and others. He described the key challenges related to data interchange. He then reviewed the Wildland Fire Data Collection Initiative, being conducted through the National Wildland Fire Management Cohesive Strategy, a partnership between the National Association of State Foresters, USFA and, NFPA. The initiative seeks to integrate wildland fire data collection with NFIRS data collection.

Panel Session: Applying Fire Data to Policy Analysis, National Standards Development, State and Local Applications

This Panel session presented various perspectives on the use of fire loss data to inform decision making at the national, state and local level. Anthony Hamins, Building and Fire Research Laboratory, described NIST as a consumer of fire data to prioritize its research. Reliable, accurate, complete, timely data is needed on fire risk and trends over time, as well as detailed information related to causal and performance factors such as ignition, fire spread and fire protection features. Chris Farrell, NFPA, reviewed the role of fire loss data in informing standards development at NFPA and explained how people could participate in the codes and standards process. Keith McCarthy, State of Florida and president of the National Fire Information Council, described the statutory role of fire data in his state, including training, prevention, education and fire and arson information. Karyl Kinsey, Austin Fire Department, presented a local jurisdiction’s view on the use of fire data, including city-wide risk analysis to allocate inspections resources, assessment of key performance measures, post incident reviews, and other uses. She also discussed some theories of how individuals select code choices when completing forms. Mike McAdams, Montgomery County Maryland, provided his perspective on the value of data at the local level and emphasized the need for collection methods that are intuitive, data that is reportable and actionable at the local level.
New Data Collection Activities/Research

Catherine Patterson, Department of Homeland Security, presented an overview of the Assistance to Fire Fighter Grants program and its two components: Fire Prevention and Safety and Firefighter Safety Research and Development. She reviewed the current size of the program and the data basis for performance measures in the program analytics. Several current research projects funded through the DHS program were then reviewed.

Karen Deppa, National Association of State Fire Marshals Foundation, described their project on Addressing Undetermined and Missing Origin and Cause Entries in Fire Incident Reporting. The goal of the program is to obtain better understanding of reasons behind missing data, and address barriers to reporting. She concluded with a review of the study’s recommendations which focus on report updating, mitigating litigation concerns, clarifying the relationship of NFPA 921 to fire incident reports and training and resources at the local level. The project also included a strong endorsement for the next version of NFIRS to address these issues. Phil Tamarro, International Association of Fire Fighters, described their project on Youth Fire Setting – a pilot database development activity designed to better capture the extent of this problem. He emphasized the need to link this data collection effort to NFIRS and other data collection activities. Lori Moore, IAFF, described NFORS – National Fire Operations Reporting System. This pilot data collection system development focuses on operations required to manage fire incidence at the local level. In its third year, the project is focusing on data reports and software to prepare for a pilot rollout in 2015. The goal of the program is to gather data to inform and enhance local resources for response. Jennifer Taylor, Drexel University, presented the current status of their project on Fire Injury Research and Safety Trends. The goal of the program is to research and develop the minimum data elements necessary to conduct public health surveillance of nonfatal firefighter injuries to contribute to a comprehensive, national database. She described related recent Drexel research on the Firefighter Near Miss Reporting System, and the project on Understanding Culture: Assessing the Firefighter Safety Climate. Ed Plaugher, Chair of NFPA 950, Standard for Data Development, Exchange and Use for the Fire Service, described efforts to establish protocols that will make it possible to link different datasets.

Discussion Sessions

The remainder of the workshop consisted of three focused discussion sessions, designed to identify data needs and gaps in the current collection analysis activities and how new data gathering and integration strategies might address these needs. Finally the participants discussed a possible path forward. The full list of action items from these sessions is located in Appendix B to this summary.
Priority Strategies

Following the workshop, participants were asked to prioritize the various action items identified in these sessions both from a short term and long term perspective, and to indicate what role their organization might like to play in implementation. The four key action items identified as of highest priority by participants (for both the short and long term) were (grouped by strategies addressing the current system and strategies addressing planning for future systems):

**Improve the quality of fire data input.** Workshop participants gave high priority to this strategy and supporting strategies including creation of incentives for quality data reporting, improvement in usability/automation, support for NFIC, and in particular education and training for fire fighters.

**Address reasons for under-reporting of fires and undetermined fire causes.** Workshop participants reinforced the need to implement those strategies identified by NASFM in their DHS research study, including the need to address litigation concerns regarding incident reporting and education and training for those reporting at the local level.

**Identify and link all relevant existing data systems.** Workshop participants reinforced the importance of this strategy in each discussion session. Supporting strategies that were also given high priority include the development of standards for data exchange such as NFPA 950, identification of partners for data collection, avoidance of competition between NFIRS and other databases, and consideration of IRWIN as a model for a systematic strategy and design for database integration.

**Develop a strategy for long term maintenance/future updates for NIFRS.** Workshop participants focused on the need to create a clear list of goals and vision, to move towards a system which: is continuously adaptable to changing data needs while retaining core set of data fields for benchmarking; includes a strategy for integration of other databases; and makes use of existing formal processes, such as NFPA 901, with full community input to develop a specific path forward. All participating fire service organizations expressed an interest in collaborating to achieve this vision.
Data Workshop Confirmed Participants
Today and Tomorrow’s Fire Data
Collecting, analyzing, and using fire experience data to reduce the nation’s fire problem
March 26, 27, 2014
National Institute of Standards and Technology, Gaithersburg, MD

Marty Ahrens, NFPA
Kathleen Almand, NFPA
Anthony C. Apfelbeck, City of Altamonte Springs, FL
Laura Bell, IAFC
Patricia Blankenship, USFA
Nelson Bryner, NIST
Dave Butry, NIST
Richard Campbell, NFPA
Tom Cleary, NIST
Gregg Cleveland, La Crosse WI Fire Department
Karen Deppa, NASFM
Drew Dawson, National Highway Traffic Safety Administration
Chris Farrell, NFPA
Shannon Frattaroli, Johns Hopkins University
Alex Furr, USFA
Dick Gann, NIST
John Hall, NFPA
Anthony Hamins, NIST
Tom Hargrove, Scripps News
Hylton Haynes, NFPA
Jim Heeschen, USFA
Tommy Hicks, IAFC
Dave Icove, University of Tennessee
Gayle Kelch, USFA
Shawn Kelley, IAFC
Karyl Kinsey, Austin, Texas
Kevin Kuntz, ISO/Verisk
Alex Maranghides, NIST
Greg Mears, NFORS
Mike McAdams, Montgomery County Fire and Rescue
Keith McCarthy, NFIC
Tim Merinar, NIOSH
David Miller, CPSC
Johnathan Moore, IAFF
Data Workshop Confirmed Attendees
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Lori Moore-Merrell, IAFF
Pat Morrison, IAFF
John R. Myers, NIOSH
Frank Nagy, USFA
Allison Nicodemus, Maryland SFO
Kris Overholt, NIST
Tom O’Toole, IAFF
Catherine Patterson, DHS
Ed Plaugher, Chair NFPA 950/951
Kevin Quinn, NVFC
Greg Rogers, Vision 20/20
Jennifer Schottke, ESRI
Karen Short, Fire Sciences Laboratory
Ronald J. Siarnicki, NFFF
Keith Smith, NASF
Rick Stoll, ISO/Verisk
Phil Tamarro, IAFF
Jennifer Taylor, Drexel University
Adam Thiel, Fire Chief City of Alexandria, VA
Craig Weinshenck, NIST
Michael Wieder, FPP, IFSTA
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Day 1

8:30 a.m.       Opening Remarks and Workshop Goal        Marty Ahrens, NFPA
                  Alex Furr

Current Fire Loss Data Activities

8:45           The National Fire Incident Reporting System      Jim Heeschen, USFA
9:15           Panel Session - Fire Data Analysis Approaches  Jim Heeschen, USFA
                  USFA, NFPA, CPSC
                  Marty Ahrens, NFPA
                  David Miller, CPSC

10:00          Discussion

10:30          Break

11:00          Other Current Fire Service Data Activities
                  Near Miss Reporting      Laura Bell/Tommy Hicks, IAFC
                  ISO Incident collection  Kevin Kuntz, ISO

11:30          Discussion

12:00          Lunch

1:00           Wildland/Urban Interface Fire Data Collection
                  NIST WUI Fire Investigation Approach  Alex Maranghides, NIST
                  Overview of IRWIN           Keith Smith, NASF
                  Outcome of NFPA Workshop: Hylton Haynes, NFPA
                  Gaps and challenges for WUI data collection

1:45           Discussion

2:15           Using Fire Data

Panel Session: Applying Data to:
Policy Analysis, National Standards Development,
State and Local Applications

2:15           Anthony Hamins, NIST
                Chris Farrell, NFPA
                Keith McCarthy, NFIC
                Karyl Kinsey, Austin, Texas
                Mike McAdams, Montgomery
                County, Maryland

3:30           Discussion

4:30           Adjourn Day 1
Day 2

8:30
New Data Collection Activities/Research
- AFG Grant Projects Overview
  Catherine Patterson, DHS
- NFIRS Unknown Project
  Karen Deppa, NASFM
- Juvenile Fire Setters Project
  Phil Tammaro, IAFF, MA
- NFORS Project
  Lori Moore, IAFF
- Fire Department Data and Injury Prevention
  Jennifer Taylor, Drexel University
- NFPA 950 and 951: Standards for Data Development, Exchange and Use for the Fire Service
  Ed Plaugher, Chair NFPA Data Exchange Committee

10:00 Discussion

10:30 Break

11:00 Discussion Session 1 - Data Needs and Gaps:
What are the core questions that fire data systems need to address? What are we missing with current systems?
Facilitators:
Kathleen Almand, NFPA,
Anthony Hamins, NIST

12:00 Lunch

1:00 Discussion Session 2 – Data Gathering:
How do we make data gathering more efficient for the fire service? What synergies might be applied? How do we integrate new data development activities? What is the role for technology?
Facilitators:
Kathleen Almand, NFPA,
Anthony Hamins, NIST

2:00 Discussion Session 3 - Preparing for NFIRS 6:
What types of research and evaluation activities should be undertaken first? What type of development process might be used to ensure the best possible outcome?
Facilitators:
Kathleen Almand, NFPA,
Anthony Hamins, NIST

3:30 Summary/Recommendations

4:30 Adjourn
Opening Remarks from NFPA’s Marty Ahrens

Good morning. Thank you all for coming to our workshop on Today and Tomorrow’s Fire Data. I also want to extend my thanks to NIST for hosting us here, and specifically Anthony Hamins for all his work behind the scenes making it happen.

I’m also grateful to Kathleen Almand, Vice President of Research at NFPA, for her support. When I mentioned that I wanted this kind of meeting. She said “We could do that. I think Anthony has also wanted to do something like this.” So here we are. I also want to thank the advisory panel of Karen Deppa, David Miller, Lori Moore, Chris Farrell, Shawn Kelly, Brad Pabody and Anthony Hammins. Although Brad can’t be here today, I appreciate his incredible support and Jim Heeschen’s willingness to fill in for him this morning. Lastly, I am grateful to all of the speakers and to all of you who took time out of your busy schedule to be here.

The subtitle of this workshop, “Collecting, analyzing, and using fire experience data to reduce the nation’s fire problem,” summarizes its goal. How can we be sure that the fire service, policy makers, codes and standards developers, life safety educators and others have the information they need to protect the public, and the firefighters who protect them, from fire? What’s working well? Where are the holes? How can we improve?

Each of us brings a piece of the puzzle to the table. You were invited because we believe you can help complete the picture.

America Burning was published in 1973. The authors lamented how little we actually knew about the nation’s fire problem, and how poorly the information that did exist was disseminated. In 1974, the Federal Fire Prevention and Control Act established the National Fire Prevention and Control Administration, now the USFA. The National Fire Incident Reporting System, (NFIRS) was one of the primary goals. NFPA is one of the biggest users of NFIRS data. Like everyone who analyzes it or puts data into it, we see quite a few things we would like to change. We also hear regularly from international colleagues how lucky we are to have it. Is NFIRS perfect? Far from it. Could it be better? Definitely. I don’t know of any data system that’s problem-free. Even the US Census struggles with issues of undercounting certain populations. While we’re complaining, we can forget how far we have come.

But it’s also clear that there are some important questions NFIRS cannot currently answer and may never be able to answer. NFIRS focuses on fire department responses. The report essentially documents where and when the incident occurred, what the fire department did in general terms, and for fires, the causes, losses, and detection and automatic suppression status. There are issues with data quality and too many unknowns.

Local officials want to be able to evaluate how well their fire department performs in relation to others. Incident commanders need to know the implications of different staffing patterns. What tactics work better than others? NFIRS doesn’t provide much in this area.

How many wildland fires are there? What are the losses? The federal and state agencies with wildland firefighting responsibilities use a very different data collection system. We don’t even have clear agreement on the definition of a wildland fire.
Many firefighters have been in the firehouse when a frightened parent comes in with a kid, saying “I found him playing with fire. Talk to him.” It’s not a fire department response. We don’t know how often this occurs.

Firefighting has risks. How can we reduce them? It’s important to learn lessons from serious incidents, but it’s better to prevent that tragedy from happening.

There are lots of databases out there—fires, inspections, and so on. How can these be integrated?

Important work is being done by quite a few different groups. Much of it has been grant funded. As we know, grant funding does not last forever. How can the important research that’s being done through the AFG program be incorporated into something more permanent?

Assuming it exists, can we find the data?

How do we prevent duplication of efforts?

Those of us who do not work for the federal government can sometimes forget the constraints that federal employees work under. When USFA was developing NFIRS 5.0, they also had to maintain NFIRS 4.1. They didn’t get additional resources for the additional work. In many cases, decisions about contractors are made by people not directly involved. Data is only one small part of these agencies. Budgets are set at higher levels. If the Secretary of an agency submits a budget that does not have adequate resources for fire data needs, agency employees cannot publicly say they need more. Cyber-security is taking a bigger chunk of resources than in the past.

You’re here because you care about data. Our speakers will provide some background about the data issues they are working to address. These presentations are springboards to discussion. By the end of the day tomorrow, we should have a list of short- and long-term recommendations and action items. We will be publishing the proceedings. The people in this room represent many key stakeholders. If we can agree on a direction, we can focus our efforts. We can be so much more effective when we work together.

Once again, thank you all.
The National Fire Incident Reporting System

An Overview

Jim Heeschen, Statistician
National Fire Data Center / U.S. Fire Administration
Federal Emergency Management Agency
Department of Homeland Security

The National Fire Incident Reporting System

What is the National Fire Incident Reporting System?

- Voluntary - 23,000 Departments Participate from all 50 states
- Incident-based
- Locally driven - quality, completeness, content
- More than 1.2 million fires reported for 2012
- 22 million total incidents reported for 2012

NFIRS Participation

Fire Departments Reporting Per Year 1980-2012

Fire Incidents Reported Per Year 1980-2012

NFIRS Background

- Initial National Fire Incident Reporting System was created in 1975
- NFIRS Version 2.0, 1976
- NFIRS Version 3.0, 1980
- NFIRS Version 4.0, 1985
- NFIRS Version 4.1, 1990
- NFIRS Version 5.0, 1999
- NFIRS Version X.X, ???

How do we collect fire data?

NFIRS data flow

- Fire Departments
- State Fire Offices
- U.S. Fire Administration/National Fire Data Center
The NFIRS Cycle: Fire Incident Data In / Information Out

NFIRS Modules

- The Basic Module (NFIRS-1) captures general information on every incident (or emergency call) to which the department responds.
- The Fire Module (NFIRS-2) is used to describe each fire incident to which the department responds. For wildland fire incidents, the Wildland Module can be used instead of the Fire Module if that option is available by your state reporting authority.
- The Structure Fire Module (NFIRS-3) is used to describe each structure fire to which the department responds. This module is used in conjunction with the Fire Module.
- The Civilian Fire Casualty Module (NFIRS-4) is used to report injuries or deaths to civilians or other emergency personnel (e.g., police officers, non-fire department/EMS personnel) that are related to a fire incident. This module is used in conjunction with the Fire Module and, if applicable, the Structure Fire Module. Non-fire-related injuries or deaths to civilians can be reported on the EMS Module.
- The Fire Service Casualty Module (NFIRS-5) is used to report injuries and deaths of firefighters. The module can also be used to report the exposure of a firefighter to chemicals or biological agents at an incident where that exposure does not result in any symptoms at that time but that manifest themselves at a later date. This module may be used with any of the other modules.
- The EMS Module (NFIRS-6) is completed by fire departments that provide emergency medical services. The module is used to report all medical incidents where the department provided the primary patient care. This includes incidents where there were civilian fire-related casualties and a Civilian Fire Casualty Module was completed and where there were firefighter fire-related casualties and a Fire Service Casualty Module was completed. (This module does not serve as a patient care record, but it can be used in conjunction with the local requirements for patient care.)
- The Arson Module (NFIRS-11) is completed to report additional information on fires that have been coded by the department as “intentionally set.”
- The HazMat Module (NFIRS-8) is completed to report releases of 55 gallons or more of hazardous materials or when special HazMat actions were taken. As appropriate, the module is used in conjunction with the Fire Module or other modules to provide detailed information about incidents involving hazardous materials.
- The Wildland Fire Module (NFIRS-7) is completed to report incidents that involve wildland or vegetation fires. The module is used in lieu of the Fire Module for wildland fire incidents.
- The Apparatus or Resources Module (NFIRS-9), a department-use module, is completed to report data specific to each piece of apparatus that responds to an incident. It includes information that can be used to calculate response time and time-out of service. This module is not used if the Personnel Module is used.

NFIRS Data Analysis

- National fire data analyses are done by USFA to answer questions about the frequency, causes, spread, and extinguishment of fires and on the causes and nature of injuries.
- Information about the national fire problem is disseminated to the public via the USFA website and published reports and analyses.
**Fire Statistics**

The USFA website contains statistics on fires that occur in the United States and analytical and topical reports that describe the national fire problem. Also included are statistics related to firefighters and fire departments.

http://www.usfa.dhs.gov/statistics

**NFIRS Enhancements**

In order to facilitate a modular approach to the NFIRS enhancement process, the work has been separated into discrete phases:

**Completed/Imminent**

- **Data Entry Browser Interface.** (Complete) This feature provides for a totally web based data entry tool eliminating the need to download and install client software on the user’s computer. Use of approved 3rd party commercial software as an alternative will still be permitted. (Released July, 2010)

- **Data Warehouse & Mining.** (Development complete) This feature will provide flexible and efficient ways of retrieving and exporting data. (Planned phase 1 limited release date: Summer, 2014)

**NFIRS Enhancements**

**Phase 1 - Rules and Core Services**

- Will update the NFIRS Core Services which include the NFIRS Object & Data model. In addition the Core Rules Engine will be updated.

- Additional new functionality provided includes:
  - Improved system stability.
  - Ability of states to set incidents to be released by default or on a schedule, improving speed of data availability.
  - USFA users will be able to maintain many of the system rules themselves using configurable business rules, reducing code changes and maintenance cost.
  - Users will be able to request a reset of their passwords through the system, reducing the need for support services.

**NFIRS Enhancements**

**Phase 2 - Web Based Modernization and GIS.**

- Connect Web Users Interface (UI) to the new architecture (along with UI usability enhancements)
- Develop additional data services
- Integrate ISAAC and web based user management
- Develop GIS based solutions

**NFIRS Enhancements**

**Phase 3 – Vendor Integration and Incident Management Services.**

- Develop Vendor related services and web interface
- Develop notification and messaging features
- Expose services as web services to external parties

**Phase 4 – NFIRS User and Data Interface Enhancements**

- The system will provide online help with user manuals, and on-screen help. In addition, tutorials on common functions will be developed to aid the users.
- The system will provide data interfaces with other organizations. The interfaces will be set up using SCA and comply with DHS/FEMA/USFA security guidelines.

**NFIRS Enhancements**

Once complete, changes to the system will result in the following:

- Improved user experience through improvements to the user interface.
- Improved system performance.
- Overhaul of the USFA NFIRS 5.0 system software, applications and infrastructure.
- Addition of new or enhanced capabilities to USFA NFIRS 5.0 software.
- Brings NFIRS system software in line with Department of Homeland Security (DHS) and Federal Emergency Management Agency (FEMA) enterprise standards.
Contact Information

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Fire Data Analysis Approaches

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Outline

• National estimates of the fire problem
  — NFPA survey combined with NFIRS
  — NFIRS data elements and the fire problem
  — Building vs. structure
  — Home vs. residential
  — Handling unknown, inconsistent data, partially unknown data, and “not required”
  — What’s excluded?
  — Examples

Outline (continued)

• Firefighter fatalities
  — USFA and NFPA definitions

• Incorporating other databases and data activities
  — CPSC’s use of data for regulatory activities
    • NEISS and more
  — CPSC and unreported household fires
  — USFA’s fire department census and other databases
  — NFPA’s fire service inventory and fire incident database (FIDO)
  — What’s publicly available?
  — Closing points

Building vs. Structure Fires

• Mobile property used as a fixed structure is considered a structure fire

• USFA
  — Generally uses building fires, omitting fires in a structure other than a building

• CPSC
  — Structure fires

• NFPA
  — Structure fires

Residential vs. Home

• Residential includes
  — One or two-family homes, including manufactured homes, apartments or multi-family housing, dorms, hotels, and board and care

• USFA
  — Residential; analysis specifies type

• CPSC
  — Residential

• NFPA
  — Homes which include one-or two-family homes and apartments or multi-family housing

What gets excluded from analyses?

• USFA
  — Mutual aid given
  — Confined structure fires not excluded, dependent upon analysis

• CPSC
  — Mutual aid given
  — Confined structure fires excluded from analyses not involving products associated with confined fire incident types
  — Fires and losses from intentionally set fires (except for child play)

• NFPA
  — Mutual aid given
  — Confined structure fires are excluded from some analyses, such as electrical fires, but included in others
What is being counted, calculated?

- All fires
- All fires reported to local fire departments
- All fires reported to NFIRS
- Fires with known data
- Fires with relevant data
- Fires with specific data

General approaches to statistics

- Classic sample-based estimates
  - NFPA survey
  - Limited in detail
- Incomplete census
  - Only count what is actually reported
  - No adjustments for unreported fires or unknown data
- Probability model - John Hall’s term to describe national estimates model with allocation of unknown data

NFPA Survey

- Allows for big-picture estimates
  - Sent to all local FDs protecting 50K or more and sample of smaller departments
  - Summary data published in *Fire Loss in the United States during...*
- Used with NFIRS to compensate for fires reported to fire departments but not to NFIRS
  - Multiplier to apply to NFIRS
    - \[ \text{NFPA survey results/NFIRS totals} \]
  - Approach described by Hall and Harwood and
  - Used by all three organizations

NFIRS data elements and the fire problem

- Broad cause categories
  - In multiple data elements, like USFA’s hierarchical sort
  - Pulling from separate data elements
    - NFPA, CPSC, sometimes USFA

USFA’s cause hierarchy

- Focuses on structure fires
- Integrates multiple fields
  - Initial: 35 categories
  - Mid-level: 16 categories
  - General: 7 categories
  - Pools hierarchically - “trickle down”
- Portrays broad facet of issue
- Restricts double counting
- Identifies unknowns as separate causal category

Types of CPSC analyses

- Annual Fire Loss Estimates
  - By equipment
  - By heat source/item first ignited
  - Double counting – can be a candle/curtain fire
- Estimates for individual consumer product categories
**NFPA’s major causes**

- Done separately for each data element
  - Double counting is possible
- NFPA allocates unknown data proportionally
  - Assumes that if known, the unknown data would resemble the known
  - Non-confined and confined structure fires are analyzed separately and then summed
  - Unknowns are allocated separately for each data element

**Handling unknown data**

- What’s considered unknown?
  - Data that’s not required and often not provided
  - Little data required for
- NFPA allocates unknown data proportionally
  - Assumes that if known, the unknown data would resemble the known
- Non-confined and confined structure fires are analyzed separately and then summed
- Unknowns are allocated separately for each data element

**CPSC Analysis Methodology**

- Allocate unknowns using *raking*
  - Unknown treated to resemble the known
  - Multiple variables allocated at once without prioritizing
- Non-confined and confined analyzed separately and summed
- Intentional fires and losses excluded

**Samples from published reports**

- **Cooking**
  - Combination of cooking equipment involved in ignition plus fires with confined cooking fire incident type
    - Heating stove?
  - Smoking materials
    - Heat source of: cigarette, pipe or cigar, or heat from undetermined smoking material
    - Share of “Heat from open flame or smoking materials, other?”

**Cooking: USFA**

- In 2009-2011 an estimated average of 165,800 cooking fires in *residential buildings* per year resulted in an annual average of:
  - 125 civilian deaths,
  - 3,600 civilian injuries
  - $324 million in direct property damage
- Includes residential building fires with hierarchical cause code “cooking”
  - Confined cooking fire in residential building
  - Non-confined with kitchen heat producing equipment involved
  - Heating stove with item first ignited cooking materials

**Cooking: CPSC**

- From 2009 to 2011, CPSC staff estimate an annual average of 146,700 fire department-attended residential structure cooking fires:
  - 160 deaths
  - 3,450 injuries
  - $396 million in property loss
- Includes confined cooking fires and all specific non-confined Kitchen and Cooking Equipment codes
  - plus allocation of blank and unknown equipment
  - no allocation of “No equipment” cases
Cooking: NFPA

- In 2007-2011, an estimated average of 156,600 home structure fires per year resulted in an annual average of
  - 400 civilian deaths,
  - 5,080 civilian injuries
  - $853 million in direct property damage
- Includes all confined cooking fires, non-confined fires with cooking equipment, and proportional shares of
  - Non-confined fires with equipment involved undetermined (20%), blank (40%) or coded as none without confirming heat source (17%)
  - “Kitchen and cooking equipment, other” (0.5%)

Smoking materials: USFA

- In 2009-2011, an estimated average of 7,500 smoking-related fires in residential buildings per year resulted in an annual average of
  - 340 civilian deaths and 975 civilian injuries
  - $320 million in direct property damage
  - 93 percent nonconfined, 7 percent confined
- Smoking-related defined as “Smoking” category from hierarchical cause code

Smoking materials: CPSC

- From 2009 to 2011, there were an estimated annual average of 10,200 fire department-attended smoking material fires resulting in an average of
  - 450 deaths
  - 1,100 injuries
  - $412 million in property loss
  - Includes non-confined fires only
- Includes “Cigarette”, “Pipe or cigar” and “Heat from undetermined smoking material”
  - plus allocation from “Undetermined heat source”
  - no allocation from “Heat from other open flame or smoking material”

Smoking materials: NFPA

- In 2007-2011, an estimated average of 17,900 home smoking material fires per year resulted in an annual average of
  - 580 civilian deaths and 1,280 civilian injuries
  - $509 million in direct property damage
  - Includes 13,100 (73%) non-confined and 4,800 (27%) confined fires
  - Confined and non-confined fires were analyzed separately and summed
  - Includes proportional shares of
    - Non-confined fires heat source undetermined (34% of fires, 57% of deaths) and 3% of heat from other open flame or smoking materials
    - Confined fires in which the heat source was undetermined 2% or not reported (81%) and 1% of heat from other open flame or smoking materials
  - Does not include heat source of hot ember or ash

Unknowns cause most of difference

FIREFIGHTER FATALITIES
On-duty firefighter fatalities: NFPA

- Full census
- On-duty
  - At scene, responding to or returning from any type of alarm
  - Participating in other FD activities
  - On call or stand-by other than at home or work
- Fatalities may be due to
  - Injury
  - Illnesses such as cardiac events with exposure or onset on-duty
- Death may occur years after
- Definition has been in place for years, allowing for trend analysis

On-duty firefighter fatalities: NFPA

- Types of firefighters included
  - Career and volunteer local firefighters
  - Seasonal, full-time and contract employees of state and federal agencies with fire suppression as part of job description
  - Prison inmates serving on firefighting crews
  - Military personnel performing assigned suppression activities
  - Civilian firefighters at military installations
  - Members of industrial fire brigades

Firefighter fatalities: USFA

- Similar to NFPA
- Plus Hometown Heroes Survivors Benefit Act
  - Since 12/2003
  - Includes heart attacks or strokes occurring within 24 hours of “nonroutine stressful or strenuous physical activity while on-duty”
  - Adds about 10-15 percent per year
  - Also used by National Fallen Firefighter Foundation (NFFF) and Public Safety Officer Benefits (PSOB) Program

INTEGRATING OTHER DATABASES AND DATA ACTIVITIES

How CPSC uses fire data in regulatory activities

- NFIRS Fire Loss Estimates
  - Informs task prioritization
  - Estimating potential benefits from proposed rules
- National Electronic Injury Surveillance System (NEISS)
  - Estimating injuries from fires
- Injury or Potential Injury Database (IPII)
  - Assign cases for investigations
  - Learn details about types of incidents that are occurring

CPSC’s NEISS

- National probability sample of hospital ERs
  - About 100 hospitals
  - Collect information about injuries (fire related and non-fire related) and consumer products
  - Variance estimates, confidence intervals, statistical inference
- Non-fire department-attended fires as well as fire department attended fires
NEISS Fire Injury Study

- Follow-up data collected on NEISS fire injuries
  - July 2002 – December 2004
  - Heat Source, Equipment Involved, Item First Ignited, Fire Department Attendance
- Most fire injuries (estimated 56% in 2003 – 2004) were in non-attended fires
- Insufficient data to support estimates for many consumer product categories
  - Hampered by low response rate

CPSC’s Residential Fire Survey

- Telephone Survey of U.S. households
  - Conducted in 1974, 1984, and 2004 - 2005
  - In 2004 – 2005, of the approx. 580,000 households dialed, 916 said they had a fire in the past 90 days.
  - Estimated 7.2 million unreported fires (97% of fires) in 2004 – down from 22.9 million in 1984.
  - Fire households were compared to non-fire households
  - Unreported fires are mostly cooking fires (65%)

USFA’s fire department census

- 1998 Blue Ribbon Panel/launched in 2001
- Actively managed, voluntary program
- Current directory of registered fire departments includes address, department type, website, number of personnel, and number of stations
- 26,500 fire departments registered / 88 percent of estimated fire departments

Other NFPA activities

- Fire Service Inventory
  — Source for fire department profile
- Anecdotal fire incident database (FIDO)
  — Seeks fire department report on all firefighter deaths, fatal fires, large loss fires, sprinkler activations, and other notable fires
- Needs assessment
  — Survey done every few years of fire department capabilities and resources

USFA

- All reports and materials are free of charge
  — NFIRS Public Data Release (PDR) files
  — Topical Fire Reports
  — Fire Service training materials
  — Public Education resources
  — And More

— Website: http://www.usfa.fema.gov/index.shtm
CPSC
- cpsc.gov
  - Technical reports
  - Injury statistics
  - NEISS
- saferproducts.gov
  - Product-related incident reports mostly from consumers

NFPA
- Published reports and fact sheets about research are available at www.nfpa.org/research
  - We do not provide raw data or release something from a fire department unless the fire department consents

Closing points
- For national estimates
  - Different methodologies yield different results
  - While criteria vary somewhat, biggest differences are due to how unknown data are handled
- When looking at trends, be sure the definitions, methods and criteria are the same

What else?
Public Protection Classification and ISO Data

Our Unique and Valuable Data Assets

- **16.5B** 16.5 billion records in commercial and personal lines
  - Over 1,800 insurers provide data
  - Over 1 billion records submitted each year
- **25** 25 years of VIN auto information
- **3M+** Detailed information on over 3.0 million commercial buildings
- **840M+** Insurance fraud database with more than 840 million claims
  - Used by 90% of the P&C industry
  - Over 30 million annual claim assignments for property losses
  - Used by 19 of the top 25 insurers
- **90+** Models covering natural hazards in over 90 countries
- **50M** Mortgage analytics based on over 50 million applications, borrowers and third parties
- **67M** Healthcare data-driven solutions process over 67 million claims per day and over 2 billion member claims per month
- **4.75M** 4.75 million Material Safety Data Sheets (MSDSs) covering hazardous chemicals in the supply chain
- **1.3B** Depersonalized information on 1.3 billion credit and debit card accounts

ISO Public Protection Classification

- ISO’s PPC program accurately measures the effectiveness of public fire protection for structures in more than 47,000 fire protection areas across the country
- PPC considers the overall fire suppression service capability relative to the risk in the graded area
- Better fire protection – as measured by the PPC – generally leads to a better loss experience for insured structural damage

PPC Value for Communities

- Provides a direct and visible incentive for communities to improve the quality of their fire protection
- Promotes business / industry expansion
- Many local officials rely on PPC to assist with protection decisions
  - Budgeting purposes
  - Justification for changes and improvements
  - Free advice regarding improvements to their PPC
- Better PPC can result in insurance savings

PPC Value for Property Owners

- Potential lower insurance premiums
- Recognition of building sprinkler systems
- Improved fire suppression capabilities
- Lower fire losses
- Competitive advantage for new business development
PPC Value for Insurers

- Proven statistical correlation between improved PPC and lower property losses
- Help with marketing, underwriting, and pricing policies
- Identifies different rating factors
  - Properties without a public water supply
  - Automatic aid
  - Nearest recognized responding fire station

FSRS Components

- Emergency Communications (10 Points)
  - Emergency reporting methods
  - Qualifications and training of telecommunicators
  - Dispatch circuits

- Fire Department (50 Points)
  - Engine / Ladder / Service companies
  - Pump capacity / Hose / Equipment
  - Training
  - Deployment analysis (2.5 road miles for ladder-service and 1.5 road miles for engine company or NFPA 1710 evaluation)
  - Automatic aid

FSRS Components

- Water Supply (40 Points)
  - NFF evaluations
  - Capacity of water source
  - Capacity of mains
  - Hydrant distribution / Inspection of hydrants / Fire flow testing
  - Hauled water evaluations / Suction supply / Dry hydrants

- Community Risk Reduction (5.5 points)
  - Adoption and enforcement of fire prevention codes
  - Public fire safety education
  - Fire investigation programs

FSRS Geographic Database

<table>
<thead>
<tr>
<th>More than ...</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FPA's</td>
<td>47,500</td>
</tr>
<tr>
<td>Recognized / Unrecognized fire stations</td>
<td>52,000 / 1,500</td>
</tr>
<tr>
<td>Automatic aid fire stations</td>
<td>10,500</td>
</tr>
<tr>
<td>Water supply systems</td>
<td>31,300 (28,000 recognized)</td>
</tr>
<tr>
<td>Hydrants</td>
<td>6 million</td>
</tr>
<tr>
<td>Hauled water systems</td>
<td>3,200</td>
</tr>
<tr>
<td>Suction points / dry hydrants</td>
<td>2,400</td>
</tr>
</tbody>
</table>

Statistical Plan Support

- Statistical Plan Support - Premium/Loss data
  - Commercial
  - Business Owners
  - Homeowners
  - Dwellings
- Construction Type (e.g. joisted masonry, non-combustible, fire resistive)
- Classification/Occupancy (e.g. offices, motel-hotel, schools)
- Public Protection Classification
- Territory – ZIP Code level

SCOPES for Commercial Properties

- Methodology for specific fire rating of commercial properties
- Consistent approach to insurance pricing
- Key data for commercial property underwriting workflow
- Statistically validated
- Industry standard in the United States
- Supplied by database of 3.5 million commercial properties
- Based on COPE
Building Code Effectiveness
Grading Schedule

• Code adoption and enforcement
• Promotes code compliance
• Reduction of property losses
• 1 – 10 Scale
• Over 16,000 departments and 20,000 communities

• Local / State adopted codes
• Staffing to workload
• Extent of training
• Certifications of staff
• Plan Review
• Inspections

Questions
NIST WUI FIRE INVESTIGATION APPROACH

Alexander Maranghides
NIST

Collecting, Analyzing, and Using Fire Experience Data to Reduce the Nation’s Fire Problem

Typical WUI Data Collection

• Drive-by study (1 to 2 days in the field)
• Focuses primarily on destroyed structures

NIST WUI Case Studies

• Collect all data (baseline of exposed structures both damaged and destroyed)
• Collect defensive actions
• Quantify exposure at a structure level
• Reconstruct event timeline
• 2 to 3 years of effort!

Collecting Critical Baseline Information

Baseline* Info Will Help Focus In On The Problem Areas

* Baseline: all destroyed, damaged and undamaged homes within the fireline

Post-WUI Fire Data Collection and Analysis

<table>
<thead>
<tr>
<th>Sample Population</th>
<th>Destroyed Structures with Wood Shake Roofs</th>
<th>Destroyed Structures with Spanish Tile Roofs</th>
<th>Typical Comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical (only destroyed homes)</td>
<td>74</td>
<td>12</td>
<td>37</td>
</tr>
<tr>
<td>Complete (all structures within fire line)</td>
<td>275</td>
<td>12</td>
<td>154</td>
</tr>
</tbody>
</table>

Technical Valid Comparisons

100% of exposed homes with wood shake roofs 24% of exposed homes with Spanish tile roofs

From NIST Witch/Guejito Report #2

Timeline Reconstruction

• Technical discussions with first responders and residents
• Images and video during the fire
• Radio Logs
• Automatic Vehicle Location (AVL) systems
**Event Reconstruction**

- Timeline reconstruction
- Pre-fire imagery
- Pre-fire LiDAR
- Post-fire imagery
- Digital Elevation Map
- Weather data
- Building construction attributes (pre and post)

**Published Reports**

- **NIST TN1635 (Witch #1)**
  - Timeline reconstruction
  - Structure Ignitions
  - Defensive Actions
  - Methodology for future developments

- **NIST TN1706 (Witch #2)**
  - Exposure quantification!!!
  - WUI EXPOSURE SCALE
  - Defensive Actions
  - Effectiveness of Mitigation

- **NIST TN1708 (Amarillo #1)**
  - Deployment methodologies
  - Damage Assessment Summary

**Ongoing Reports**

- **AMARILLO #2**
  - Fire Behavior
  - "Area/Neighborhood" Case Studies

- **WALDO #1**
  - Timeline reconstruction
  - Defensive Actions
  - Fire Behavior

- **WALDO #2**
  - Exposure quantification
  - "Area/Neighborhood" Case Studies

**Post Fire Data Collection**

- WUI 1 i-Phone application (Beta tested at Waldo Fire, CO and CALFIRE 2013)
- WUI 0, WUI 1 and WUI 2 manuals in 2013/2014

**WUI Data Collection**

- Limited data being collected
- Pilot program with CA
- Data collection has to be in line with the mandate of the agency performing the data collection

  *Technology (like the i-pad application) is only 10% of the solution*

- Integration into NIFC* is a possible path forward for part of this data collection

* National Interagency Fire Center, Geographic Area Coordination Centers, 209 Program

**Different Approaches – Different Results**

- **NIST WUI Approach**
  - Trained data collectors
  - Entire event
  - Detailed local environment
  - Exposure context
  - Detailed defensive actions
  - Analysis of successes and failures

- **Traditional methods (NFIRS, local data collections)**
  - Limited training
  - Partial event data
  - Limited detail
  - Limited exposure context
  - Limited Defensive actions
  - Limited ability to interpret successes and failures
IRWIN IS NOT

- Another username and password
- Intended to replace or eliminate existing applications
- A monolithic database of all wildland fire data
- The 100% solution to our data challenges

IRWIN IS...

- A capability that orchestrates data exchange between operational applications
  - Reduce redundant data entry
  - Increase data consistency
  - Provide authoritative operational data

YEAR ONE

- First six applications
  - WildCAD (Computer Aided Dispatch)
  - Integrated Fire Management (IFM) – St of Alaska CAD
  - FireCode
  - Wildland Fire Decision Support System (WFDSS)
  - ICS209
  - Enterprise Geospatial Portal (EGP)
- Additional Data Integrators
  - Remote Sensing Application Center
  - State of Utah
  - State of Texas

CURRENT STATUS

- Integrated Testing with all applications
  - Feb 5-6; Feb 25; Mar 10; Mar 21
- Testing by dispatchers
  - Mar 13 – IFM; Mar 20 – WildCAD
- On schedule to “Go Live” April 1, 2014
- Planned: Holistic testing centers
  - Observation of the impacts of IRWIN on workflows
  - Lessons learned / future focus

YEAR TWO

- Discovery and prototype
  - Fire Incident Mapping Tools (FIMT)
  - NWCG Unit IDs
  - e-Suite
  - AK Fire Service CAD - FireBeans
  - Unified Incident Command Decision Support (UICDS – DHS)
  - Resource Ordering and Status System (ROSS) (new version)
  - NPS and FWS Fire Reporting Systems
  - Inciweb
- Live by March 2015
  - ROSS targeted for 2017
OUT YEARS

Year Three
- WFMI Fire Reporting (BIA, BLM, NPS)
- Fire Management Information System (FMIS - FWS)
- FireStat (USFS)
- FAM Web Data Warehouse

Year Four
- NFPORS / FACTS
- InciWeb
- Weather (WIMS, ROMAN)
- Aviation (AFF)
- ICBS
- IQCS
- Financial Systems

At Any Time
- CAD Lite
- Other CADS

KEY DATA EXCHANGE REQUIREMENTS

Data Exchange Standards
- Provides clear definitions and common values
- Data must be passed in the standard

NWCG Data Standards & Terminology SC
- Approximately 75 approved standards
- 3 New Geospatial Data Layer Standards for review
- 21 new/revised Data Elements Standards in development
- Approximately 12 more to be assigned

Authoritative Data Sources
- Map data elements across all applications
- Define each application’s position in a hierarchy
  - Determines which application can create or update data

NWCG Data Management Committee
- Responsible for business data requirements
- Subgroups: Fire Reporting, Geospatial & Data Standards & Unit IDs

Conflict Detection
- Uses Point of Origin and Discovery Date/Time to identify potential conflicts
- Derive based on Point of Origin
  - State, County, GACC, Point of Origin Owner Unit, Landowner Kind and Category

GEOSPATIAL DATA
ENTERPRISE GEOSPATIAL PORTAL (EGP)

- Geospatial presentation of IRWIN data

THE GOOD (OR GREAT)

- IRWIN will reduce redundant data entry and provide consistent, current data across participating applications
  - Averaging 3-5 seconds in testing to:
    - Get a FireCode from a CAD
    - Create a record in WFDSS
    - Display incident in EGP
    - Have incident available in ICS 209

THE BAD (OR CHALLENGING)

- Data exchange will require modification and standardization of existing business practices
  - Dispatch centers and Incident Management Teams will have to adapt their business practices

THE UGLY

- We’ve never done this before, it will be bumpy and IRWIN will not accommodate every exception to the rule.
- Complexes
  - NWCG Task Group to address Complexes this year
- NWCG Unit IDs
  - Current Approved Unit IDs don’t cover all land owners

‘THE STORM BEFORE THE CALM’

- IRWIN GO LIVE target April 2, 2014

IRWIN PROJECT CONTACTS

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Gaps and challenges for WUI data collection

Hylton Haynes, M.S., CF

Wildland Fire Data Reporting Initiative

- National Wildland Fire Management Cohesive Strategy – stated goals
- Partnership: NASF, USFA, NFPA
- 18 researchers, managers and analysts from federal, state and local agencies
- Organizations represented: IAFC, TFS, OFS, NH DRED, AFD, USFS, DOI, NASFM, MT DNRC, NFIC

Challenge

- How can wildland fire organizations consolidate existing wildland fire agency and NFIRS fire reporting data sets effectively and efficiently to produce an accurate wildland fire risk profile?
- Simple questions like:
  - How many wildland fires occur each year?
  - How much damage do they do?
  - How many people are injured or killed by these fires?
  - How much does it cost to fight them?
  - How many structures were destroyed?

Systems

- Federal Agency Reporting
  - FIRESTAT (USFS)
  - WFMI (BLM, BIA, NPS)
  - FMIS (FWS)
- State Agency Reporting
  - NFIRS via Vendors or directly
  - Various State Applications
- Local Fire Department Reporting
  - NFIRS via Vendors or directly
- State Agency Reporting via Vendors or directly
- Various State Applications
- FAMWEB Data Warehouse

IRWIN – Integrated Reporting of Wildland-Fire Information

Source: Firewise Foundation, U.S. Department of Interior

Texas A&M Forest Service Online Fire Reporting User Interface

Source: Don Hanneman, Texas A&M Forest Service
California All Incident Reporting System (CAIRS)
Source: Internet: http://osfm.fire.ca.gov/cairs/cairs.php

RESEARCH

- U.S. Fire Burden $310 billion [Year 2008]
- Wildland-Urban Interface $14 billion

| Period    | NIFC | NFIRS & NFPA Survey*
|-----------|------|----------------------|
| 2002 - 2006 | 42% more fires per year
| 2007 - 2011 | 78,000 per year

2. Thomas & Butry, 2012
3. National Interagency Fire Center, 2014

Federal & State Forestry Fires Reported per Year (1992-2010)
Source: Steve Norman, USDA Forest Service EFETAC

Outdoors Fires per Year reported with NFIRS (2002-2011)
Source: Steve Norman, USDA Forest Service EFETAC

GAPS – challenges of integration

- Lack of a standardized approach to data analysis
  - Census data analysis versus the national estimates methodology
- Multiple fire reporting systems built for different purposes
  - Resource versus incident based
  - Land management agencies may be less concerned about factors contributing to structure fires in a wildland area
- Redundancy: mutual aid conflict with AHJ (local, state or federal)
  - Inflate the number of incidents
  - Inflate the number of acres
  - No globally unique identifier

Missingness
Source: Karen Short, USDA Forest Service, RMRS
GAPS cont’d

• Geospatial precision
  - Fire Program Analysis Fire Occurrence Database (FPA FOD) fire location at least as precise as a PLSS section (Short, 2014)

<table>
<thead>
<tr>
<th>Year</th>
<th>NASF</th>
<th>NFIRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>50%</td>
<td>92%</td>
</tr>
<tr>
<td>2011</td>
<td>24%</td>
<td>82%</td>
</tr>
</tbody>
</table>

• Data integration of historical wildfire activity as required by FPA FOD was limited due to the following factors:
  - Lacking viable non-Federal records from certain States and years
  - Information seldom conforms to interagency standards
  - Reports of the same incident often exist in multiple systems, and redundant records cannot be readily identified and purged
  - Completeness of integrated dataset is difficult to gauge quantitatively

WFDRI – action items
1) Data and Terminology Standardization
2) Analysis Standardization
3) Data Quality and Completeness

REFERENCES
http://www.nfpa.org/~/media/C4BFD30DCD6344E397650B189686F96E.ashx

THANK YOU
hhaynes@nfpa.org
1-617-984-7449
Using Fire Data to Prioritize Fire Research to Reduce the Risk of Fire in Buildings and Communities

Workshop on Today and Tomorrow’s Fire Data
March 26, 2014
Anthony Hamins
Fire Research Division

NIST: Basic Stats and Facts
- A non-regulatory agency within the Dept. of Commerce
- 2800 federal employees, 2600 associates & facilities users/yr
- Composed of four labs and three centers:
  - Physical Measurement Laboratory
  - Material Measurement Laboratory
  - Engineering Laboratory
  - Information Technology Laboratory
  - Center for Nanoscale Science and Technology
  - Center for Neutron Research
  - Center for Advanced Communications

Goals of NIST’s Engineering Laboratory (EL)
1. Smart Manufacturing, Construction and Cyber-Physical Systems
2. Sustainable and Energy-Efficient Manufacturing, Materials and Infrastructure
3. Disaster-Resilient Buildings, Infrastructure and Communities

Fire Research at NIST
Research supporting the technical basis for:
- Measurement results
- Standard Reference Materials
- Models
- Standards and Codes
- Investigations
- Best practice guidelines
- Software decision-tools
- Databases

Prioritizing Research
NIST is a consumer of fire data to prioritize its research
Reliable, accurate, complete, timely data is needed
- Fire risk (deaths, injuries, direct losses) and trends over time
- Factors related to ignition
- Factors related to fire spread
- Factors related to losses (presence of sprinklers, alarms)

Data Sources: Mainly NFIRS as interpreted by...
- NFPA
- USFA
- CPSC
- NIST (Butry: societal fire costs & uncertainty, cost-benefit analysis of sprinklers, wildfires, furniture fires,...)
Prioritizing Research

Changing Problem Size
- How big is the problem? What are the costs/losses?
- What are the trends?

Potential Impact of Proposed Solutions
- What portion of the problem can be addressed?
- How effective is a product, technology or guidance?
- What are the barriers to development and implementation?
- Is the solution cost-effective?
- How broadly/fast will a new product/technology be adopted?

How Big is the Problem? (NFPA)

3,100 fatalities & 18,000 injuries (2010 Civilian losses)
72 fatalities & 72,000 injuries (2010 Firefighter line of duty)
2010 U.S. Total Cost of Fire: ~ $330 B ± 100B (~2 % GDP)

Source: Hall, NFPA

How Big is the Problem? (NFPA)


First Item Ignited Fires Deaths Injuries Property Damage ($B)

- Furnace 17,900 320 870 0.5
- Smoking Materials 13,400 710 1,240 0.4
- Open flame (candle, lighter, matches) 25,500 440 2,140 0.7
- Electrical distribution/lighting 21,200 370 840 0.7
- Heating Equipment 67,400 620 1,610 1.0
- Cooking 150,200 500 4,660 0.8
- Undetermined 83,000 90 1,690 2.0

Totals 378,600 2,850 13,090 6.1

Leading Ignition Sources Fires Deaths Injuries Property Damage ($B)

- Intentional 17,400 320 870 0.5
- Smoking Materials 13,400 710 1,240 0.4
- Open flame (candle, lighter, matches) 25,500 440 2,140 0.7
- Electrical distribution/lighting 21,200 370 840 0.7
- Heating equipment 67,400 620 1,610 1.0
- Cooking 150,200 500 4,660 0.8
- Undetermined 83,000 90 1,690 2.0

Totals 378,600 2,850 13,090 6.1

How Big is the Problem? (NFPA)

Home structure fires account for large part of life safety problem
- 366,000 home structure fires per year (about ¼ of fires)
- ~84 % of fire fatalities
- ~80 % of fire related injuries
- ~50 % of fire property damage
- Smoking was the leading cause of civilian home fire deaths.
- ~60% of home fire deaths were from fires in homes with no smoke alarm present (37%) or without an operating alarm (23%).
- Cooking was the leading cause of home structure fires and non-fatal home fire injuries. 42% of reported home structure fires started in kitchen.
- Upholstered furniture was first ignited in 19% of fires starting in a living room, family room or den, accounting for 45% of the deaths and 34% of the injuries

NIST Fire Research Program Objectives

2 programs, 4 thrust areas, ~20 projects:
Fire Risk Reduction in Communities: To improve the resilience of communities and structures to unwanted fires through innovative fire protection and response technologies and tactics
Fire Risk Reduction in Buildings: To increase the safety of building occupants and the performance of structures and their contents by enabling innovative, cost-effective fire protection technologies
Fire Safety Standards Research
Science-based performance metrics for the development of test methods, standards and regulations.

- Standard Reference Polyurethane foam for furniture flammability
- Toxicity of commodity materials
- Reduced Ignition Propensity (RIP) Cigarettes
- Mattress flammability

Fire Fighter Safety: Emergency Equipment Standards and Guidelines

- SCBA facepiece
- Personal Alert Safety System (PASS) device
- Thermal Imaging Cameras
- Fire fighter clothing
- Elevator use and safety
- Firefighter training standards

Public Safety
- Performance metrics for smoke alarms
- Test methods for local suppression systems for residential kitchen fire protection
- Standards for fire model validation that enable performance based codes
- Fire resistant partitions in structures
- Life Safety Code development
- Sprinkler system installation and performance
- Fire and ex

- Life Safety Code development
- Fire resistant partitions in structures
- Sprinkler system installation and performance
- Fire and ex

Cyber Physical Systems and Fire Fighting

Objective: Inform the development of a Roadmap that identifies the research needed to enable the key standards, codes, technologies and best practices that accelerate Smart Fire Fighting and improve the safety and effectiveness of firefighters

Workshop Breakout Groups
- Group 1 – Data Gathering
- Group 2 – Data Processing
- Group 3 – Decision Making
- Group 4 – Cross-Cutting (Structural)
- Group 5 – Cross-Cutting (Non-Structural)

Investigation and Post-Fire Analysis

- Probable technical cause
- Lessons learned
- Improve standards, codes, practices
- Improve forensic methodologies
- Future research priorities

What Would be Useful to Know?

- What was the fire timeline?
- Building configuration
- Layout, contents, alarms,…
- Fire Scene
- How fast did the fire spread?
- What was the exact point of fire origin?
- What was burning when? Was it flaming or smoldering?
- What was the ventilation conditions in the room of origin? And beyond?
- People
- What did people do? (nothing, hide, fight fire, assist others,…)
- Technology
- Alarms present? What kind? (dual, ionization, photo, interconnected?)
- Fire Service
- What did the fire service do when? What were the outcomes?
- What is the relationship between rate of FF injuries when fire alarms are functioning compared to when they are not functioning, or when first item ignited is furniture, or when,….­

Traditional Fire Fighting

Paradigm Shift

From:
- Information-limited decision making
- Lack of awareness
- Untapped/unavailable data
- Traditionally based tactics
- Isolated equipment and building elements
- Human operations

To:
- Global information-rich decision making
- Situational Awareness
- Data collection, analysis & communication
- Data-driven, physical-based tactics
- Interconnected equipment and building monitoring, data, and control systems
- Human-controlled & automated operations

Waldo Canyon, Colorado Springs, CO (2012)
Witch Creek Fire, San Diego, CA (2008)
The Station Nightclub, RI (2003)
Cook County Administration Bldg Fire (2003)
World Trade Center (2001)
Phoenix, AZ (2001)
Houston, TX (2000)
Keokuk, IA (1999)
Cherry Road, Washington, DC (1999)
Watts St, New York City (1994)
Kobe, Japan (1995)
Cherry Road, Washington, DC (1994)
Hughes (1994)
Tonawanda IA (1992)
World Trade Center (2001)
Cork County Administration Bldg. (2003)
The Station Nightclub, RI (2003)
Charlotte, NC, "Walden Fire" (2007)
Witten Creek Fire, San Diego, CA (2006)
Arsonista, TX (2011)
Waldo Canyon, Colorado Springs, CO (2012)
Cyber Physical Systems and Fire Fighting

Jeff Chen & Jeff Roth, Analytics Unit, FDNY

A predictive building fire risk engine for NYC’s annual building inspections

FDNY Building Inspections

• 330,000 buildings in inspection portfolio
• 10% inspected per year
• 9 hours of inspections/week by each company

Jeff Chen & Jeff Roth, Analytics Unit, FDNY

• Data is used to select NIST’s research portfolio
• Data, information, and knowledge are critical to the future of fire fighting and fire protection engineering
• Emerging technologies present tremendous opportunities to enhance fire fighting safety and effectiveness

Summary
Florida Statute 633.136

1. Establish and maintain an electronic communication system capable of transmitting fire and emergency incident information to and between fire protection agencies.

2. Initiate a Fire and Emergency Incident Information Reporting System that shall be responsible for:
   a. Receiving fire and emergency incident information from fire protection agencies.
   b. Preparing and disseminating annual reports to the Governor, the President of the Senate, the Speaker of the House of Representatives, fire protection agencies, and, upon request, the public. Each report shall include, but not be limited to, the information listed in the National Fire Incident Reporting System.
   c. Upon request, providing other states and federal agencies with fire and emergency incident data of this state.

3. Adopt rules to effectively and efficiently implement, administer, manage, maintain, and use the Fire and Emergency Incident Information Reporting Program. The rules shall be considered minimum requirements and shall not preclude a fire protection agency from implementing its own requirements which may not conflict with the rules of the division.

4. By rule, establish procedures and a format for each fire protection agency to voluntarily monitor its records and submit reports to the program.

5. Establish an electronic information database that is accessible and searchable by fire protection agencies.

Florida Statute 633.136 Continued

Florida Statute 633.136 Continued

Florida Statute 633.136 Continued

Florida Statute 633.136 Continued

Chapter 69A-66.001

Florida Fire Incident Reporting System (FFIRS), means the Florida statewide fire data information system that resides within the Division of State Fire Marshal, Department of Financial Services. FFIRS works in collaboration with NFIRS to report and analyze fire incidents.

(1) The purpose of these rules is to establish standards and procedures for fire department reporting of fire incidents to the Division of State Fire Marshal.

(2) The standards and procedures contained in these rules apply to the Division of State Fire Marshal and to each fire department in the State of Florida participating in the Florida Fire Incident Reporting System (FFIRS) program.

(3) FFIRS is a means for fire departments to report and maintain computerized records of fires and other fire department incidents in a uniform manner. By participating in the FFIRS program, fire departments become a part of the cooperative effort among fire organizations to make Florida a safer state.

(4) These rules are minimum requirements and do not preclude a fire protection agency from implementing its own requirements which shall not conflict with these rules.
CHAPTER 69A-66 Continued

• 69A-66.002 Definitions
• 69A-66.003 Training
• 69A-66.004 Submission of Fire Incident Data
• 69A-66.005 Submission Deadlines for Fire Incident Data
• 69A-66.006 Reporting
• 69A-66.007 Fire Department Identification (FDID) Number

The Florida Fire Incident Reporting System Section has submitted an average of 2.3 million incidents to the NFIRS database annually over the past 5 years. How do we apply so much information to state applications?
How does Austin use NFIRs data?

- Cautiously
- Lots of variety in how officers code incidents
- Narratives are invaluable in clarifying how well code measures what it is meant to measure

Local examples:
- 100 codes & room of origin measure
- Undercounts of smoking and fireworks fire causes
- Carbon monoxide calls often really false alarms

Data quality a continuing issue, no easy solutions
- Competing data bases, data silos — NFIRs not the main “database of record” for arson, firefighter injuries, civilian injuries.
- Limited resources for integrating databases, improving training, and building in quality control

But even with more resources, there would still be data reliability issues
- At AFD, even the data “champions” have difficulty agreeing on what’s the best coding decision
- Problems inherent in the structure of the coding scheme itself
- “Miscodes” often make sense, they aren’t unreasonable or random, they just aren’t reported the way the creators of NFIRs 5.0 intended.

NFIRs 5.0 is a categorization system structured in a highly analytic fashion with many detailed codes

<table>
<thead>
<tr>
<th>NFIRs field name</th>
<th># of codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident type</td>
<td>176</td>
</tr>
<tr>
<td>Property use</td>
<td>153</td>
</tr>
<tr>
<td>Actions Taken</td>
<td>66</td>
</tr>
<tr>
<td>Area of fire origin</td>
<td>84</td>
</tr>
<tr>
<td>Item first ignited</td>
<td>78</td>
</tr>
<tr>
<td>Heat source</td>
<td>37</td>
</tr>
<tr>
<td>Ignition factor</td>
<td>55</td>
</tr>
<tr>
<td>Equipment involved in ignition</td>
<td>286</td>
</tr>
</tbody>
</table>

NFIRs is a “thinking slow” coding scheme for a “thinking fast” occupation

(Kahneman, 2011)

Research in cognition identifies two alternate modes of information processing humans have developed

- Thinking slow – deliberative, thorough, analytic, break into component parts, consciously weigh alternatives – “rational decision making”
- Thinking fast -- environmental cues trigger pre-existing categories stored in memory that are linked to action plans, scripts. Happens automatically -- seems “intuitive”
Early research focused on the limits of “thinking fast”

- Tend to think especially memorable events are more likely to happen than they really are (plane crashes, murders)
- Initial judgment shapes what gets paid attention to later on (confirmatory biases)
- Tunnel vision, lose sight of the big picture because too focused on detail

Lately, greater appreciation of the value of thinking fast

- One of the first studies to point to the benefits was Gary Klein’s 1985 study of fire commanders
- Purpose was to try to understand how decisions were actually made in real life under time constraints
- Funded by the military, which wanted to know why their commanders were not using decision aid tools developed for the battlefield

Fire commanders use recognition- primed decision making

- Under time constraints, people don’t consider and weigh alternate options
- Instead, they recognize patterns in environmental cues that match prototypes stored in memory.
- Prototypes have associated actions and scripts (mental models) that become the basis for decisions
- Prototypes and mental models become more sophisticated with experience – expertise matters

Well, what does this have to do with NFIRs?

- NFIRS clearly organized in the first mode, very analytic and deliberative
- Reflects a fire researcher’s way of looking at the world, not a firefighter’s
- Minimal use of cues, prompts, reminders.
- Grouped in ways that may not reflect the way firefighters experience incidents.

Example:

Fire and smoke-related incident type codes scattered. Hostile fires in the 100 series, controlled burns and smoke-related in the 500 & 600 series.
- Similar stimulus conditions (smoke), codes far apart

Oddly enough, NFIRS 5.0 only indirectly measures some of its “biggest” concepts

- Key divisions of structure versus non-structure fires and categories of fire causes are not asked directly
  - Yet officers readily refer to these concepts in their narratives
  - Despite all the focus on fire, there are no fields asking what was the state of the fire upon arrival.
- “Big concepts” are only created at the data analysis or report stage, by aggregating groups of codes
  - Structure fire= Incident types 111-123
  - USFA’s cause matrix
Recommendations for developing NFIRS 6.0

- Sponsor cognitive mapping studies of how firefighters actually categorize incidents
  - Text analysis of NFIRS narratives; cluster analyses of key words and concepts coded
  - Card-sorting techniques utilized by cognitive researchers (web-based versions available)
  - Look for shared category structures
- Re-structuring coding scheme to emphasize recognition over recall
  - A coding rule documented only in the Complete Reference Guide will never be as effective as a coding rule that is built into the question wording and flow

- Replace long code lists with branching tree structures (more fields, fewer codes per field).
  - Working memory can handle 5 to 9 items at a time ("The magic number 7 plus or minus 2," Miller, 1956)
- Consider organizing more as an interview than a form
  - Survey researchers have a great deal of experience eliciting information and many are well aware of cognitive research
- Usability testing (Test, rinse, repeat.)

With the right investment of time and resources up front, we can develop a new NFIRS that is both:

- Intuitive for firefighters – let’s them tell the story of their experiences
- Provides reliable data for fire research and for the fire service
Collecting, analyzing and using fire data to reduce the nation’s fire problem.

March 26, 2014

Goals

- Discuss data from the local fire lens
- Discuss collection methods
- Discuss definitions
- Process of data at the fire house

Collecting data

<table>
<thead>
<tr>
<th>Title</th>
<th>Complexity</th>
<th>Time</th>
<th>View</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firefighter Rescuer</td>
<td>Data few</td>
<td>3 - 5 minutes</td>
<td>1</td>
</tr>
<tr>
<td>Firefighter EMT</td>
<td>Data some</td>
<td>5 – 8 minutes</td>
<td>1</td>
</tr>
<tr>
<td>Firefighter Paramedic</td>
<td>Data most</td>
<td>12 minutes plus</td>
<td>1</td>
</tr>
</tbody>
</table>

Process of input

- Desktop
- Mobile Device
- I phone

Choosing the words

Definitions (What is the correct word)

- Engine 3 people
- Ladder Truck 3 people
- Special Service 3 people

This is important to compare the same elements.
Feedback to personnel

What are the elements in the run sequence the station personnel can change?

- Phone to dispatch.
- Turnout time.
- Travel.
- Arrival on the scene.

Daily Reporting

<table>
<thead>
<tr>
<th>Building Fire</th>
<th>Alert Call to Alert</th>
<th>Turnout Out the door</th>
<th>Enroute Traveling</th>
<th>AOS Wheels stopped</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>1:30</td>
<td>1:16</td>
<td>2:29</td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>1:30</td>
<td>2:06</td>
<td>3:12</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>1:30 :34</td>
<td>2:50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Link the data to value

1. Collection methods that are intuitive.
2. Data that is reportable.
3. Data that is actionable.
Grants Management Division (GMD) Overview

Grants Programs Directorate
Assistance to Firefighters Grant Program
March 26, 2014

FY 13 AFG $335 million
FY 14 AFG $340 million

FY 13 AFG $335 million
FY 14 AFG $340 million

Fire Prevention and Safety

- General education and awareness
- Code enforcement and awareness
- Fire and arson investigation
- National/state/regional programs and studies

Firefighter safety research and development

- Clinical studies
- Technology and product development
- Database system development
- Dissemination and implementation research
- Preliminary studies.

AFG Application Summaries
2010 thru 2013

Service Areas, Department Types, and Activity Quantities

<table>
<thead>
<tr>
<th>Service Area</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. of Applications Submitted</td>
<td>16,231</td>
<td>16,494</td>
<td>11,657</td>
<td>10,653</td>
</tr>
<tr>
<td>% Awarded within Area</td>
<td>16%</td>
<td>8%</td>
<td>19%</td>
<td>25%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Department Type</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Paid/Career</td>
<td>2,363</td>
<td>565</td>
<td>24%</td>
<td>2,588</td>
</tr>
<tr>
<td>All Volunteer</td>
<td>8,828</td>
<td>1,212</td>
<td>14%</td>
<td>8,440</td>
</tr>
<tr>
<td>Combination</td>
<td>3,896</td>
<td>961</td>
<td>25%</td>
<td>4,220</td>
</tr>
<tr>
<td>Paid On Call/Stipend</td>
<td>1,144</td>
<td>178</td>
<td>16%</td>
<td>1,246</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity Unit Qty Requested</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMS Equipment</td>
<td>13,739</td>
<td>523</td>
<td>4%</td>
<td>10,115</td>
</tr>
<tr>
<td>EMS Training</td>
<td>17,027</td>
<td>193</td>
<td>1%</td>
<td>4,575</td>
</tr>
<tr>
<td>Equipment</td>
<td>398,599</td>
<td>114,673</td>
<td>29%</td>
<td>375,167</td>
</tr>
<tr>
<td>Facility</td>
<td>52,802</td>
<td>12,944</td>
<td>25%</td>
<td>54,768</td>
</tr>
<tr>
<td>PPE</td>
<td>477,431</td>
<td>94,306</td>
<td>20%</td>
<td>314,746</td>
</tr>
<tr>
<td>Training</td>
<td>78,663</td>
<td>27,797</td>
<td>35%</td>
<td>161,972</td>
</tr>
<tr>
<td>Vehicle</td>
<td>5,580</td>
<td>416</td>
<td>7%</td>
<td>5,931</td>
</tr>
<tr>
<td>Wellness</td>
<td>31,524</td>
<td>5,099</td>
<td>16%</td>
<td>38,344</td>
</tr>
</tbody>
</table>

*FY2013 submission numbers do not include State Fire Training Academy applicants
*FY2012 activity specific data is based on applications, FY2010-2011 is based on units

Performance Measures

- Consider existing resources and data availability
- Explore opportunities to inform the FY-2014 AFG cycle and future Performance Assessment System Reports to Congress
- Consult with firefighting and EMS stakeholders in FEMA’s National Prevention Division and the U.S. Fire Administration and the CIP to identify additional data analysis approaches.
- Develop additional draft performance measures that ensure logical links between program inputs and activities with key outcomes and outcomes.
- Confirm utility and feasibility of draft measures with representative subject matter experts on both performance assessment and fire safety.
- Implement revised performance assessment measures with a focus on robust, reliable, and repeatable data availability and analysis techniques. Impoverish

Thank You!
Grants Programs Directorate
Assistance to Firefighters Grant Program
March 26, 2014

Fire Prevention and Safety
- General education and awareness
- Code enforcement and awareness
- Fire and arson investigation
- National/state/regional programs and studies

Firefighter safety research and development
- Clinical studies
- Technology and product development
- Database system development
- Dissemination and implementation research
- Preliminary studies.

Performance Measures
- Consider existing measures and data availability
- Explore opportunities to inform the FY2014 AFG cycle and future performance assessment system report to Congress
- Consult with firefighting and EMS stakeholders in FEMA’s national priorities
- Alter the UFA, and the CDP to identify additional data analysis approaches
- Develop additional draft performance measures that ensure logical links between program outputs and activities with key outcomes and outcomes
- Confirm utility and feasibility of draft measures with representative subject matter experts on both performance assessment and fire safety
- Implement revised performance assessment measures with a focus on robust evaluation and revision of data availability and analysis techniques improve

AFG - SAFER - FP&S

Thank You!
Conquering the Unknowns:
Addressing Undetermined and Missing Origin and Cause Entries in Fire Incident Reporting

TODAY AND TOMORROW’S FIRE DATA WORKSHOP
MARCH 27, 2014
GAITHERSBURG, MD

Karen F. Deppa
NASFM Foundation

Project Overview

- General recognition that our nation’s fire data is hampered by high percentage of missing and “undetermined” responses in the causal factors sections of National Fire Incident Reporting System (NFIRS) reports
  - Causal factors include ignition source, heat source, factors contributing to ignition, area of origin, equipment contributing to ignition

- NFPA Home Structure Fires Report (Ahrens, April 2013)
  - For non-confined home structure fires, cause of ignition known in:
    - 70% of the fires
    - 43% of the civilian deaths
    - 68% of the civilian injuries
    - 57% of the direct property damage
  - Factor contributing to ignition coded as none, undetermined or left blank in:
    - 47% of the non-confined home structure fires
    - 66% of the associated deaths
    - 45% of the associated injuries
    - 55% of the associated direct property damage

- Anecdotes and hypotheses about why this is so – but real need for more and better data

- Grant to NASFM Foundation from FEMA’s Assistance to Firefighters Grants – Fire Prevention & Safety Program, FY 2011
  - Final report issued January 2014

- Goals
  - Obtain better understanding of reasons behind missing data, or excessive use of “undetermined” or “none” in causal factors section of fire incident data reports
  - Report on findings, emphasizing how departments can overcome barriers to more effective fire incident data reporting
  - Identify gaps in available resources to educate/train fire department personnel on complete and accurate recording and reporting of fire incident data

- What We Did
  - Appointed Advisory Committee
  - Collected fire department policies, guidelines, communications on fire incident data collection
  - Conduct in-depth interviews with personnel who input fire incident data (20 departments in 8 states)
  - Administered online survey to confirm issues from in-depth interviews (~3,500 responses from 43 states)
  - Conducted in-depth interviews with data specialists in non-fire professions
**Identified Problem/Gap**

**Associated Recommendation**
- Possible strategies to address the recommendation

**Available information about investigated fires is too often not included or underreported in NFIRS**

**Close the Loop**
- Dispel misconception that reports cannot be updated in NFIRS once submitted.
- Enable investigators to update fire incident data reports.
- Assign one department member to update fire incident reports and follow up after investigations.
- States that complete investigations for departments should send them the final report and encourage NFIRS update.
- Link NFIRS and other related databases (e.g., BATS) to avoid redundant data entry.

**Some incomplete cause and origin data reflects a hesitation to declare a cause due to liability concerns**

**Clear the Litigation Cloud**
- Provide option of indicating a level of certainty that underlies causal determinations.
- Inform instructions with a formal interpretation of NFPA 921 to clarify levels of certainty for different types of incidents.
- Provide immunity from liability for those who report fire incident data while acting “in good faith and without malice”.
- Explore whether incident reports and investigation reports are treated differently in lawsuits and courtrooms – is it valid to make a distinction?
- Form a "brain trust" of trained investigators to share expertise/resources, and collaborate on investigations

**The current NFIRS system is viewed as overly complex and not user-friendly**

**If the System Is Broke, Fix It!**
- Time for NFIRS 6.0!
  - Codes that reflect incidents that modern departments face
  - Simple, user-friendly design
  - Use of modern technologies and capabilities
  - Examples of model reports for different incident types
  - Option for Turbo-Tax-style interview vs. form
  - Standardized software language and process to certify vendors
  - Rigorous testing of redesign for validity, reliability, use-ability
  - Clear instructions for how departments can get reports on their own data back out of the system
  - Model "user" reports

**NFIRS training does not convey the importance of data collection; belief that NFIRS reports end up in a “Black Hole”**

**Fill the Black Hole**
- Training for chiefs, officers, front-line personnel on concepts and reasons behind the need for reporting.
- Training on how fire incident data can be used to advance fire prevention and suppression goals.
- Offered at no cost where possible.
- Use of alternative training formats (online, video, smartphone).

**Protocols and systems to improve QA/QC in fire incident reporting are needed**

**Put In Quality Data, Take Out Quality Data**
- Designate a "Data Champion" in the department to be responsible for quality assurance/quality control.
- Provide a way for departments to report "no incidents" periodically vs. not reporting at all.
- Emphasize importance of dedicated State NFIRS Program Managers to work with departments.
- Adopt a Standard Operating Procedure/Guideline on completing incidents reports and review regularly with personnel.
- Revitalize NFIC with a focus on developing strategies and training to improve the quality of NFIRS data.
Thank You!

- Questions?
- Full report at [http://www.firemarshals.org/resources/fireincidentdatacollectionresearch.html](http://www.firemarshals.org/resources/fireincidentdatacollectionresearch.html)
- For more information:
  Karen Deppa, Director of External Relations,
  NASFM Fire Research & Education Foundation,
  kdeppa@firemarshals.org
National Youth Firesetting Database Project

Phil Tammaro
IAFF 3rd District Burn Coordinator
YFS Database Project Manager

The Problem of Youth Involved Fires

• Current sources for incidence data incomplete
  – NFIRS: Requires fire dept. response
  – Local or regional programs

• 2011 NFPA report “Children Playing with Fire”
  – 53,000 fires, 110 civilian deaths, 880 civilian injuries,
  $286 million property damages

• Expert consensus = Major under-reporting issue

Non Profits
Fire Service
Social Services
YOUTH FIRESETTING INTERVENTION PROGRAMS
Burn Centers
Mental Health
Fire Investigators
Law Enforcement

Example: Non-fire service YFSI program > only 33% referrals from fire depts.

NFIRS + National YFS Database

True National Scope of the YFS Problem

AFG FP&S Grant Project

• Phase I – FY 2010
  – Develop “framework” for future comprehensive database
  – Bring together key stakeholders: brainstorm & consensus
  – Document need for national database

• Phase II – FY 2011
  – Research existing YFS databases
  – Create YFS Data Dictionary
  – Pilot test YFS data collection system

Multidisciplinary Advisory Committee

• Jim Crawford Vision 20/20
• Marty Ahrens NFPA
• Brad Pabody USFA National Fire Data Center
• Karen Deppa National Association of State Fire Marshals
• Justin Dillard Image Trend Software
• Sanjay Kalasa Firehouse Software
• Martin King West Allis, WI Fire Department
• Karla Klas University of Michigan Trauma Burn Center & ABA
• Don Porth SOS FIRES
• Genn Penney Palm Beach County Fire Rescue, NFPA 1035
• Paul Schwartzman Finger Lakes Regional Burn Foundation
• Tom Flamm IAFF Charitable Foundation
• Phil Tammaro IAFF Charitable Foundation-Burn Fund
• Brent Smith Cedar Rapids, Iowa Fire Department
## Summary of Nationwide Precursory Research on Existing YFS Databases

<table>
<thead>
<tr>
<th>Category</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contacted states and/or known major YFS programs</td>
<td>65</td>
</tr>
<tr>
<td>Responses Received (includes Martin King’s previous research inquiry as applicable)</td>
<td>59</td>
</tr>
<tr>
<td>National Database</td>
<td>4</td>
</tr>
<tr>
<td>States Reporting Existing Statewide Database</td>
<td>7</td>
</tr>
<tr>
<td>States Reporting Plans Underway to Develop Statewide Database</td>
<td>11</td>
</tr>
<tr>
<td>NFIRS or No Electronic Database</td>
<td>13</td>
</tr>
<tr>
<td>Basic Database (i.e. spreadsheet)</td>
<td>16</td>
</tr>
<tr>
<td>“Advanced” Database</td>
<td>16</td>
</tr>
<tr>
<td>Provided Screenshot Examples of Database</td>
<td>16</td>
</tr>
<tr>
<td>Provided Data Collection Sheet</td>
<td>16</td>
</tr>
<tr>
<td>Propose to Include in Phase 2 Review</td>
<td>4 - 7*</td>
</tr>
<tr>
<td>Potential Pilot Group</td>
<td>18</td>
</tr>
</tbody>
</table>

*Note: Burn NTRACS/NBR not included in this number. Not YFS, but model example of comprehensive, flexible secure local program database (Burn NTRACS registry) with annual upload of mandatory minimal data set to de-identified national database (NBR).*

## Database Dictionary

### Minimum Dataset
1. Gender
2. Age at time of incident
3. Grade in school at time of incident
4. Youth address - zip code
5. Previous firesetting incidents by youth
6. Family type of youth
7. Day of week of incident
8. Time of day of incident
9. Location of incident
10. Ignition source
11. First item ignited
12. Associates involved in incident
13. Referral to program initiated by
14. Final disposition of case
15. Was an incident report created in NFIRS

### Integration into Other Fire Data Collection
- NFIRS: simple checkbox “youth involved” would greatly increase data capture & YFS incidence reporting
- Fire service doing YFS work, but not being reported centrally = funding, staffing, support barriers
- Accurate data might alter priority CRR issues: Iowa example
- Clearer picture of schools & hospitals not reporting incidents & injuries

### Next Steps
- Develop demo database into robust live product
- Expand basic national database into local program case management (must benefit locals)
- Acquire long-term funding & managing organization
- Research project: Pilot data compared to NFIRS
- Recommendations on potential NFIRS revisions for better data capture

### Gaps and Barriers
- Known problem for over 35 years
- Funding and “ownership”
- No data, no problem, no money
- Unique database, no benchmark model: integrating interests of multiple disciplines and agencies

### Burn Related Data
- American Burn Association’s National Burn Repository
- Karla Ahns Klas, BSN, RN, CCRP Chair ABA Burn Prevention – apologies couldn’t attend due to ABA conference
- Potential areas of fire data integration: YFS, fireworks, home medical oxygen & smoking, injuries/deaths, cooking, etc.
TODAY AND TOMORROWS FIRE DATA:

Collecting, Analyzing, and Using Fire Experience Data to Reduce the Nation’s Fire Problem

Project History

2011 National Fire Service Data Summit

Vision to Reality

FIRE FIGHTER SAFETY AND DEPLOYMENT STUDY

Project Goals

Assure Adequate Fire Resources
Optimize Fire Operations
Reduce Firefighter Injury and Death
Minimize Civilian Injury and Death
Minimize Property Loss

National Fire Operations Reporting System

Vision to Reality

www.n-fors.org

PROJECT POWERED BY A COLLABORATIVE EFFORT WITH

National Fire Operations Reporting System

2011 National Fire Service Data Summit

2011 & 2012 Fire Prevention & Safety Grant
2013 FP&S Application Pending

Collaboration with the Fire Industry

Vision to Reality

www.n-fors.org

PROJECT POWERED BY A COLLABORATIVE EFFORT WITH

Project History

2011 National Fire Service Data Summit
Project Importance

• Fire Service is Part of a Larger Community
• Capability, Availability, and Performance Matter
• It is the How, more than the What
• Outcomes Matter Most!
• NFIRS Documents the Incident of Fire
• N-FORS Documents the Operations Required to Manage It

How Should We Make Decisions?

Fiscal

Availability

Affordability

Capability

Quality

Effectiveness

Multi-Year Initiative

Currently in Year 2 of 3

• Fire Industry Collaborative Process
• Focus on Fire Operations and Metrics
• Design a Fire Operations Data System
• Create an Atmosphere for Safe Data Use
• Ultimately Create Software for Local Operational Performance Improvement

N-FORS Dataset

Dataset Components

• N-FORS Configuration (C-Elements)
  • Demographic Data used to better understand and analyze fire operations
  • Completed initially and then updated as necessary
• N-FORS Event (E-Elements)
  • Operations Data associated with a structural fire event
  • Describing the FD’s availability, capability and the effectiveness of the fire operations
  • Minimal Data Entry with each Fire Event

N-FORS Configuration Data Elements

N-FORS Configuration Sections

• Fire Department Information
• Community Demographics
• Codes and Standards
• Community Resources
• Firefighters and Fire Officers
• Apparatus/Vehicles
• Capability and Equipment
• Deployment Policy

N-FORS Event Data Elements

N-FORS Event Sections

• Deployment
• Utilization
• Fire Event Demographics
• Dispatch
• Response
• Fire Ground Operations
• Times
• Outcome
• Health and Wellness
Proposed Year 3 N-FORS Software

Proposed Year 3 of 3 (FP&S)
- Continue Fire Industry Collaborative
- Develop the N-FORS Software
- Local Fire Department Tool
- National Fire Operations Database
- Develop N-FORS Reports
- Local Reporting and Business Analytics
- National Aggregate Reports
- Benchmarking and Best Practices

Year 3 N-FORS Software Rollout

Proposed N-FORS Rollout
- Available to all local US Fire Departments in 2015
  - User Materials
  - Recommended Data Elements
  - Recommended Operational Reports
- Development of a Sustainability Model and Plan
  - Long-Term Viability
  - Ongoing Technical Assistance/Support

VISION OF A PERFECT DAY

Structural Fire
- Automated Alarm
- Suppression System Activated
- Known 2 Story Structure
- Sensors
  - 2 Occupants on 2nd Floor
  - Personal Health Records
  - 2 Geriatric Occupants

FIRE RESPONSE

- Resources Located using vehicle location and CAD analysis
- Additional Rescue Resources Deployed Including EMS
- Hospital Notified of Potential Victims

ON-SCENE SIZEUP

Data Feeds
- Structure Floor Plan
- Room Temperatures
- Occupant Location
- Suppression System Status
- Active Utilities
ATTACK PLAN

- Data on Building Type
- Front and Rear Access
- Front Suppression
- Rear Rescue
- Crew and Equipment Location Tracking

OUTCOME

- Occupants Rescued
- Fire Contained
- Automated Documentation
  - CAD
  - Structure
  - Scene Events
- Minimal Crew Effort
- NFIRS Data Uploaded
- N-FORS Data Uploaded
- Reports Available for

PERFORMANCE EVALUATION AND PREVENTION

- Feedback via Reports
  - Fire Chief
  - Crew
  - Community
- Analysis of Similar Risks
  - Community
  - Structure
- Suppression System Limitations Identified
- Prevention Plan Enacted

COMING 2015

www.N-FORS.org
Firefighter Injury Research and Safety Trends

Today and Tomorrow’s Fire Data, March 2014
Jennifer Taylor, PhD, MPH
Associate Professor
Department of Environmental and Occupational Health
Drexel University School of Public Health
Philadelphia, PA

Relevance

#1 - Define and advocate the need for a cultural change within the fire service relating to safety; incorporating leadership, management, supervision, accountability, and personal responsibility.
#2 - Enhance the personal and organizational accountability for health and safety throughout the fire service.
#7 - Create a national research agenda and data collection system that relates to the initiatives
#9 - Thoroughly investigate all firefighter fatalities, injuries, and near misses.
#12 - National protocols for response to violent incidents should be developed and championed.

Advisory Board and Council

Drexel’s Fire Service Research

- Data Systems Development and Evaluation
  - Non-fatal injury
  - Near-miss
  - Policy
- Methods
  - Data Linkage
  - Narrative text mining
  - Interviewing and focus groups
  - Survey development and assessment
- Emerging Topics
  - EMT Assaults
  - Women in the Fire Service
  - Community Use of 911
What is the Fire Service telling us they need?

- Data that tell a story at the local level
- Data collection that does not increase the reporting burden for firefighters
- Data that describe all firefighter injuries
- A clear connection between the data collection system and benefits for the Fire Service

FIRST Goals

- To research and develop the minimum data elements necessary to conduct public health surveillance of non-fatal firefighter injuries.
  - To learn from existing firefighter injury data collection.
  - To explore how non-firefighter injury data sources can contribute to a comprehensive, national database of firefighter injuries.
  - To examine relevant federal, state, and local regulations which empower or challenge the functions of FIRST.
  - To provide recommendations to FEMA for a national implementation plan.

FIRST Main Results

- 3 paths...
- Developing fire department-level systems by linking injury reports to other existing data and standardizing the resultant master database for comparative purposes.
  - Linking first report of injury to human resources demographic information, risk management data, disability data, and dispatch run data were critical to create a robust and longitudinal understanding of injuries to firefighters.
- Developing state-level systems by linking workers’ compensation, hospital and emergency department encounters to a statewide registry of firefighters and standardizing the resultant master database for comparative purposes.
  - This is a faster method to national implementation than #1, but sacrifices some of the granularities of injury data present at the department-level (e.g., on-scene/first aid injuries).
- Changing policy to adopt industry and occupation codes in all hospital-level healthcare encounters in the United States.
  - In the FIRST grant, we succeeded in getting to the halfway point in this process. Achieving such a change in policy will enable all inpatient and emergency department hospital visits by career and volunteer firefighters to be systematically captured.

FIRST: Recommended Core Variables

- Injured Person Demographics
  - Age
  - Rank
  - Hire Date
  - Career/Volunteer
  - Fire/EMS
  - Gender
  - Race/Ethnicity
  - Residential Zip Code
  - Employer Zip Code
  - A unique identifier

- Injury Characteristics
  - Date and Time
  - Location Zip Code
  - Nature
  - Cause/Mechanism
  - Body Part
  - Activity at time of injury
  - Lost Time Y/N
  - Cost

- Department/State Level Data
  - Incident Counts (Fire/EMS)
  - Number of FFs (Fire/EMS)
  - Distribution of Rank
  - Distribution of Gender
  - Distribution of Race/Ethnicity
Informs New Research

- Philadelphia Fire Department
  - Over 200,000 medical calls annually.
  - 40 ALS ambulances, each staffed with two Paramedics.
- Interviewing male and female paramedics assaulted during a medical call.
- Prevention Strategy Report to PFD and IAFF Local 22

Policy

Path 3: Petition to change data collection policy to adopt industry and occupation standards in all hospital-level healthcare encounters in the United States.

- Specifically, add SOC (occupation) and NAICS (industry) standards to the uniform bill (UB04)
- UB04 used by the Centers for Medicare and Medicaid Services (CMS) and private insurers.

Recommendation

Use standard classification systems for “body region” and “cause of injury” to allow comparisons

- FDSOA 2011 Meeting
- For example:

National Coalition

Federal Agencies
- Occupational Safety and Health Administration, U.S. Department of Labor
- National Institute for Occupation Safety and Health, Centers for Disease Control and Prevention
- Centers for Disease Control and Prevention
- National Institute for Occupational Safety and Health
- American Public Health Association, Injury Control and Emergency Health Services Section

Fire Service Organizations
- National Volunteer Fire Council
- National Fallen Firefighters Foundation
- International Association of Fire Chiefs
- National Fire Protection Association
- International Association of Fire Chiefs

Members of Congress
- Sen. Bob Casey, Jr
- Rep. Michael Fitzpatrick
- Rep. Allyson Schwartz
- Rep. Chaka Fattah
- Rep. Robert Brady

Petitioning X12 and NUBC

<table>
<thead>
<tr>
<th>ANSI ASC X12</th>
<th>NUBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create the Standard</td>
<td>Submit proposal to NUBC</td>
</tr>
<tr>
<td>Publication of new standard</td>
<td>UB is updated to reflect change</td>
</tr>
</tbody>
</table>

States

- Notify states of change
- States implement via legislation or rule making
Florida Hospital Encounters, 2010
What is the real cost?

1,361 Injuries
@ $4.5 million

4,590 Injuries
@ $30 million

Methods

- LexisAcademic: Searched state statutes, laws, codes & mandates
- Online survey distributed through NASFM & NAFTD to list serve members
- 84% response rate

State Policy Inventory

<table>
<thead>
<tr>
<th>State</th>
<th>Law Requiring the Reporting of Firefighter Injuries</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida</td>
<td>Fla. Stat. § 633.808 and 633.809</td>
<td>&quot;(4) Adopt rules prescribing recordkeeping responsibilities for firefighter employers, which may include maintaining a log and summary of occupational deaths, diseases, and illnesses.&quot;</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>Oklahoma Municipal Code, Laws 1977, c. 256, § 11-29-102</td>
<td>&quot;...'&quot;</td>
</tr>
</tbody>
</table>
(3) The Texas Commission on Fire Protection shall notify the Employer of the Fire Protection Services of the completed injury report."

FIRST-Reliability Study (FIRST-RS)

FEMA AFG grant # EMW-2012-FP-00205 (2013-2016)

Methods: Near Miss Data

Artificial Intelligence: Narrative Text Analysis (Natural Language Processing)
Why do we capture Near-Misses in the Fire Service?

Adverse Event Reporting System (AERS)

www.firefighternearmiss.com

Drexel Firefighter Injury Research

- National Firefighter Near Miss Reporting System
  - IAFC Contract, 2007-2011: Data Quality and Research Opportunities
  - NIOSH grant "Near Miss Narratives from the Fire Service: A Bayesian Analysis", 2011-2013 SR03OH009984-02
  - "Let the computer do the work for you"
  - Problem: no coded data elements for injury or cause in Near Miss
    - Created 2 new data elements:
      - Injury yes/no
      - Cause of injury

Narrative Text Mining: Schematic

"While working on a house fire near the chimney, one of my personnel came through the ceiling while checking the area. He was not hurt, but it could have been bad."

Results: Single Word Fuzzy Bayes

TextMiner Single-Word Fuzzy Bayes Predictive Success Rates

Single Word Fuzzy Proximal predictions: near-miss versus injury

TextMiner Single-word Fuzzy Bayes Predictive Success Rates Proximal Cause: Injury vs. Near-Miss Events (n=855)
Fuzzy bayes: Proximal Code results improve with pairs and sequences

- Three Word Sequences: 85%
- Word Pairs: 82%
- Single Word: 65%

```
“Been Burned Away”  FALL
“Full Protective Clothing”  BURN
(Downed, Power)  ELECTRIC CURRENT
(Door, Imager)  BURN
(Roof, Spongy)  FALL
```

Injury Near-Miss

- Fire Emergency Events: Injury Outcome
  - n=764
  - 28% Injury
  - 72% Near-Miss

```
Fire Emergency Events: Proximal Mechanism of Injury
n=764
```

Drexel Firefighter Injury Research

- National Firefighter Near Miss Reporting System, 2005-2011
- Reviewed 769 “non-fire emergency event” reports
- 185 reports identified as emergency medical calls

Leading Mechanisms of Near-Miss or Injury:
- Assault
- First Responder Struck by Motor Vehicle
- MV Collision

Understanding Culture: Assessing Firefighter Safety Climate

FEMA AFG grant # EMW-2011-FP-00069 (2012-2015)

Safety Climate Conceptual Framework

- Antecedents to Safety Behaviors
  - Safety Climate
  - Management commitment
  - Supervisory support
  - Safety systems
  - Job risk
  - Work culture
  - Internal group pressure

- Safety Motivation

- Safety Knowledge

- Safety Compliance
  - Following procedures
  - Using protective equipment
  - Preventing risk interactions

- Safety Citizenship
  - Helping
  - Verbalzing behavior
  - Volunteering
  - Maintaining safety
  - Reporting unsafe conditions

Safety Outcomes
- Near-Miss
- Accidents
- Injury
Phase I: Qualitative Research

Year 1-1.5:

- Thirteen fire departments: ~90 focus groups and individual interviews
- All ranks
- East, Central, and Western regions of the United States
- Career and volunteer
- Ensure that the safety climate survey is specific to the U.S. fire service

Phase II: Quantitative Research

Year 1.5-3:

- The safety climate survey will be administered to a geographically stratified random sample of U.S. fire departments:
  - 90 fire departments
  - 280 fire stations
  - 6,000 active firefighters
- Psychometric Validation: structural equation modeling and factor analysis.
- Valid + Reliable = Trust
- Free survey and user guide disseminated

The Safety Attitudes Questionnaire

- The physicians and nurses here work together as a well-coordinated team.

Agree/Strongly Agree:

- MD = 77%
- RN = 40%

Contact Information

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1.1 Scope

1.1.1* This standard is designed to standardize
data for operable information sharing in support of
the all-hazards response.

1.1.2 To describe a digital information structure
and associated requirements and workflows
common to fire and emergency services delivery
and management for emergency response and
administrative use.

1.2 Purpose.

1.2.1 The purpose of this document is to provide a
standard framework for the development,
management, and sharing of data for all-hazards
response agencies and organizations.

1.2.2 This standard defines system structure,
design, process and performance management, and
data requirements to support the fire service and
enable consistent and accurate data exchange
between systems.

1.2.2.1 Standard data formats and other key attributes
support the administration, planning, prevention,
preparedness, mitigation, response, and recovery missions
of local, state, and federal fire service operations and
administration.

1.2.2.2 Data elements shall be enabled for geospatial
attribution.

1.2.2.3 Data use shall be determined locally by the AHJ
including analytical and geospatial data use in decision
making in an interoperable data environment.

1.3 Application.

1.3.1 This standard will leverage
existing industry standards.

Nothing herein is intended to restrict
any jurisdiction from exceeding these
minimum requirements.

1.4 Equivalency

Nothing in this standard is intended to
prohibit the use of systems, methods,
or approaches of equivalent or
superior performance to those
prescribed by this standard. Technical
documentation shall be submitted to
the authority having jurisdiction to
demonstrate equivalency.

1.5 New Technology.

1.5.1 Nothing in this standard shall be
intended to restrict new technologies
or alternate arrangements, provided
the level of compliance prescribed by
this standard is met.
Chapter 2  Referenced Publications

2.1 General.
The documents or portions thereof listed in this chapter are referenced within this standard, and shall be considered part of the requirements of this document.

2.2 NFPA Publications

2.3.1 ISO Publications

2.3.2 Other NIST Publications.

• North American Datum of 1983 (NAD 83)
• Federal Geographic Data Committee Homeland Security Working Group Standard for Symbology
• Federal Geographic Data Committee United States Thoroughfare, Landmark, and Postal Address Data Standard (DRAFT)

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used.

3.2.3 Shall.
Indicates a mandatory requirement.

3.2.4 Should.
Indicates a recommendation or that which is advised but not required.

3.3.7 Data.
The lowest fractional element from which information and then knowledge can be derived; as electronically, acquired, captured, stored, queried, analyzed, or transmitted; and being electronic or computerized in nature.
NFPA 950

Chapter 4 Processes

4.1 * General.
This chapter establishes requirements for data acquisition, management, and sharing of data as it pertains to fire and emergency services functions.

4.2 Acquisition.
Data elements referenced within this standard shall be captured and updated on a regular basis as per requirements set forth in Chapters 5 & 6.

4.3 Data Management.
Policies and procedures shall be in place to support data elements within this chapter:

NFPA 950

Chapter 5 Data Administration

5.1 External Data.
5.2 Internal Data
5.2.1 At a minimum, policy shall meet the following requirements (All categories);
5.2.1.1 Quality assurance and control.
5.2.1.1.1 The state of completeness, validity, consistency and timeliness of data shall be documented in the metadata as described in 5.2.1.3
5.2.1.2 The underlying accuracy and precision of data shall be expressed within the limits and tolerances of the devices and means used to collect the data.

5.3 * Data Exchange.

NFPA 950

Chapter 6 System and Data Design Standards (Scalable)

6.1 General.
6.1.1 This chapter provides minimum requirements for specific data types and information management systems for data acquisition, display, interchange, and management.

6.2 Addresses.
6.2.1 Addressable locations shall contain street number, prefix direction (where applicable), prefix type (where applicable), street name, suffix direction (where applicable), street type, municipality, postal code, county, state in accordance with the FGDC United States Thoroughfare, Landmark, and Postal Address Data Standard.
Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs. A.1.1.1 The standardization of existing and future mission critical data for emergency services facilitates safe, effective, and efficient decision making.

Figure B.1 provides additional information on existing industry standards for data development, management, and sharing that might be relevant to all hazards response agencies and organizations. Figure B.1 Existing Emergency Services Data Related Standards.

Figure B.1 Existing Emergency Services Data Related Standards.

The intent of this document is to provide guidance in the development of an integrated information management system that facilitates information sharing. The resulting system should be designed to support a communications pathway for all relevant components of the national preparedness and response framework.

This document provides information for the development of consistent methods, processes, and tools to capture, utilize, and share data within scalable information systems. This framework supports and sets the stage for effective data exchange at all operational levels and components.

As an example, time and location are identified as critical components. Specific format for time and location are established in this guide. This guide provides explanation to the authority having jurisdiction (AHJ) as to why a specific format for time and location is necessary and how it should be used within the organization’s operational environment.
Chapter 1  Administration

1.2 Purpose.

The purpose of this guide is to help public safety users envision, plan, and build an operable, scalable, and integrated information management system.

1.2.1 A standard approach is essential to manage, use, and exchange data. This guide assists fire department administration and support personnel in establishing a vision for information management within their organization.

1.2.2 Technology planning is an essential step in creating an integrated information management environment. NFPA 950 mandates a methodology for a step-by-step process for technology planning. This guide recommends a framework for the governance and oversight needed to establish an effective planning process based on NFPA 950.

1.2.3 To create an integrated information management system, the AHJ must understand the specific requirements for the interoperable use of the data. NFPA 950 sets forth the overarching technical standards these requirements must satisfy. The information in this document assists the agency in creating a flexible and scalable system that supports data sharing.

1.2.4 Adhering to these standards supports the wide variety of applications required by the fire service. This guide provides references and resources for fire service personnel to help identify applications of and uses for data to improve the organization’s ability to perform fire prevention, damage mitigation, emergency response, and recovery from emergency incidents.

1.2.5 This document is a reference tool and job aid providing practical guidance and specific steps forward.

1.3 Application.

1.3.1 This guide was designed to be used by fire and emergency service organizations to develop an information structure and associated requirements and workflows common to fire protection delivery and management for emergency response and administrative use.
Chapter 1 Administration

Application

1.3.2

When implemented, this guide also creates an environment whereby fire and emergency service organizations will be able to identify best practices, internal and external to the agency, to ensure data operability in mutual and automatic aid environments.

1.3.3

The purpose of this guide is to describe for all levels of the organization the mechanisms for establishing a standards-based information management environment, which is an essential element for optimal functioning of a fire department. Effective information management is a key to be utilized in keeping fire fighters safe, improving outcomes, and satisfying performance metrics. An integrated information technology strategy that adheres to the specifications of NFPA 950 will accomplish these goals by achieving the following objectives:

1. Establish and maintain accurate and up-to-date understanding of operations and the events that affect them
2. Collect, organize, exchange, and discover through research relevant and authoritative information
3. Proactively support community fire planning needs and activities
4. Exchange information to establish data streams into and out of the field
5. Integrate data from multiple internal and external sources
6. Enable a higher level of collaborative decision making with other stakeholder partners
7. Maximize value from technology investments

1.3.4

To achieve an NFPA 950-compliant data environment, senior executive leadership must support the decision to implement the framework principles described in this guide.

For many in the fire and emergency services, managing information technology is a new endeavor. Therefore, this guide is written to enhance knowledge of fundamental information management principles in the context of the work that is done in the fire and emergency services. It is intended to enhance the knowledge of all members of the organization, as well as related entities, which is essential for successful implementation. This allows leadership the framework for implementing the department’s technology plan in the context of a shared vision.

1.3.5

NFPA 950 is a standard that identifies the critical building blocks of a fire department information management system. The standard provides a common framework for all departments regardless of size, shape, and technological resource availability. Embracing this framework will provide the foundation as an organization begins to assess its particular landscape, analyze its specific technology requirements, and develop a plan that fits its unique environment. These are the pieces of the puzzle that are needed to begin or complete the building of a system.

1.3.5.1 provides a framework for how an organization-wide strategy for information management can support the entire organization. A wide range of players within an organization contribute data, perform analysis, and exchange important field intelligence. Utilization of these key elements provides the framework for organizations and their members to perform their mission effectively and will enhance the overall safety environment. These different functions within a fire and emergency service organization also have different requirements for data and applications. The integrated information management platform illustrated in Figure 1.3.5.1 will support all of these key elements and the ability to leverage their respective expertise, perspectives, and skills within this data environment.

1.3.5.1 Figure

Chapter 2 Referenced Publications

2.1 General

The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document. 2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471. NFPA 950, Standard for Data Development and Exchange for the Fire Service, 2015 edition. 2.3 Reserved 2.4 Reserved
The definitions contained in this chapter shall apply to terms used in this standard. Where terms are not defined in this chapter, or when another chapter they shall be defined using their industry standard meanings within the context in which they are used. Merriam-Webster’s Collegiate Dictionary, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2.1 Authority Having Jurisdiction (AHJ).
An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, or installations or systems.

3.2.2 Guide.
A document that is advisory or informative in nature and contains only explanatory provisions. A guide may contain mandatory statements such as “the guide can be used,” but the document as a whole is not suitable for adoption into law.

3.2.3 Standard.
A document in which terms contain only mandatory provisions using the word “shall” to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Mandatory provisions are not to be considered a part of the requirements of a standard and shall be listed in an appendix as explanatory notes or other means as permitted in the Internal Rule for NFPA Technical Committees.

4.1 General.
The goal of NFPA 950 is to create integrated information management systems. The purpose of this chapter is to describe the process of developing an information system to acquire, manage, use, and share information so as to support emergency service functions. Section 4.3 provides the “why,” and Section 4.4 provides the “how.”

Each of the steps outlined in Sections 4.2 through 4.4 are requisite to successful implementation of NFPA 950.

4.2 Technology Strategic Visioning:
A strategic visioning process helps to clarify where the organization, its employees, the political leadership, and other stakeholders see the organization in the future in terms of its fundamental objective and/or strategic direction. To be meaningful and relevant, a vision must be realistic and believable. A strategic vision must inspire and motivate.

4.3 Technology Strategic Planning:
Technology strategic planning is the tool that should complement and reinforce a strategy developed to achieve the organization’s vision. Section 4.3 covers the fundamental steps in the strategic planning process.

4.3.1 Establishment of a strategic vision and mission is an important step in driving the technology strategy.

4.3.2 A properly written strategic plan will provide the organization with the necessary guidance to develop resources needed to satisfy the vision. An effective strategic plan should be all-encompassing and constructed only after a deliberative process such as that suggested in A-4.3 by definition getting this step is a journey, not a destination.

4.3.3 Critical to the strategic planning process will be learning how to incorporate technology planning into the fabric of the organization’s culture and core functions. Technology planning must be developed in a clear and common understanding of the workforce’s functions (that) support the agency’s vision and that are based on established industry best practices.

4.3.4 NFPA 950 describes and prescribes the workflows that accomplish functions of the fire service. In addition, it provides a framework for the information system and its associated workflows. It is critical that any agency’s relevant functions are incorporated into the technology planning process. Fundamentally, this process is the vision that technology planning is integral in supporting the overall strategic plan and vision.

5.1 Internal and External Data.

5.2 Management/Organization.

5.3 Data Models and Data Dictionaries.

5.4 Data Sources and Acquisition: to create a new dataset.
Chapter 6  Data Sharing and Exchange

6.1  Introduction.
This chapter sets forth the technical specifications and business rules all fire departments should follow in creating an interoperable data sharing and exchange environment. The technical specifications for acquisition, display, and management are set forth in the previous chapters. This chapter includes a description of the fundamental data components that need to be exchangeable and specifies the format for each of those data components. This in no way limits the AHJ from creating local policies with additional requirements, but for data exchange to be compliant, all components must, at a minimum, be in the formats specified within NFPA 950.

6.2  Addresses.
This standard follows the protocols established by the Federal Geographic Data Committee and maintained by the U.S. Census Bureau. This format is most often and easily recognized by geocoding engines. It is readily accepted and recognized by responders and the general public. Addressing in many jurisdictions has traditionally evolved from non-standards-based conventions that do not follow these standards. This often causes challenges for agencies attempting to comply with nationally recognized standards such as NFPA 950. Several approaches exist to resolve these discrepancies. The jurisdiction should adopt a strategy that best fits the data and resource environment within which they operate. The most direct and short-term method for becoming compliant with NFPA 950 is to supplement the street address with a geographic coordinate (in accordance with NFPA 950, USNG, or lat/long). While this will not make an address data NFPA-compliant, it will allow the agency or department to deliver services on time in the right place without a significant change to the jurisdiction’s naming conventions. Over time the agency can move toward becoming compliant through various conversion and translation methods. Recommendations and resources regarding these options are in the annex. The committee recommends these options to help solve system shortcomings in the near term to support operational success. This will allow the agency or department to become increasingly compliant over time without impeding short-term operational success.

6.3  Date
This standard follows the most commonly recognized protocol currently in use in the United States. The committee recognizes that other date schemas are available and preferred by some agencies. This format is widely recognized by civilian and governmental agencies.

6.4  Time.  It is recommended that the time stamp be recorded based on the incipient incident record time reference.

6.4.1  Decimal time is a universal standard format that allows for numeric computations.

6.4.2  Time is referenced to the local time zone and UTC. The committee acknowledges that storing the date twice is redundant but recognizes the inconsistency of time zone applications across regional boundaries.

6.4.3 Time calibration is a critical component of all incident record keeping because of the legal implications associated with incident response. As such, calibration provides a legal framework for incident records.

6.5  Incident Typing Information.

6.5.1  NFPA 950 recognizes the standard format for incident typing as based on the National Fire Incident Reporting System (NFIRS) and the National EMS Information System (NEMSIS) currently required by most U.S. states and territories. This framework establishes a transfer-able data set and as such meets the intent of NFPA 950. As such, this standard does not imply the use of any particular software for recording incident data. This component of the standards refers only to the typing standards within these frameworks.

6.5.2  The “plus 1” append provides the local jurisdiction with an opportunity to amend data for local use. This gives jurisdictions the ability to review subsets of data for incident analysis.

6.6  Text.
ASCII is a universally accepted text standard. As such, compliance with this protocol will enable ready transfer of text data using all of the standard data exchange methods specified herein.
Chapter 6  Data Sharing and Exchange

6.7  CAD, RMS, CAD/CAD, CAD/RMS, and RMS/RMS Exchange.

6.7.1  Design and construction of CAD/CAD, CAD/RMS, and RMS/RMS interfaces and applications should comply with all technical elements set forth in Chapters 4, 5, and 6.

6.7.2  The intent of this language is to emphasize the importance of a seamless flow of data among data subsystems. This will enable appropriate utilization of data assets throughout the organization and into the entire public safety ecosystem. This environment will enhance data accuracy and drive the ability to leverage data resources for data driven decisions, comprehensive situational awareness, and essential communications to all stakeholders in the community. In short, unlocking data assets from proprietary systems and structures will provide the data environment that can support effective management.

(6.7.3  6.7.4  6.7.5  6.7.6  6.7.7  6.7.8  6.7.9  6.7.10  6.7.11  all go into great detail on the CAD data exchange elements)
NFPA/NIST Fire Data Workshop

Today and Tomorrow’s Fire Data
Collecting, analyzing, and using fire experience data to reduce the nation’s fire problem
March 26-27, 2014

Action Items

Section A. Action Items to Address Data Needs and Gaps

1) Address inconsistencies among different data analyses (USFA, NFPA, CPSC) and work toward resolution of different types of statistical approaches used and assumptions made

2) Reconcile level of detail desired against other goals of fire data (NFIRS)

3) Address reasons for underreporting of fires and undetermined fire causes

4) Reduce the time for an accurate and complete data set to reach end users

5) Gather information on how NFIRS data are used to inform decisions at the local, state and federal level and develop analysis templates to output data based on specific needs
   a) Local fire departments
   b) Research/policy
   c) etc

6) Identify and link all relevant existing data systems.
   a) Develop standards for data exchange
   b) Leverage the many existing data assets from local governments and provide training/skills to fire service for this
   c) Exploit various databases for elaboration not replacement of NFIRS; coordinate data identification, definition, and linking; avoid duplicative case data and efforts
      i) state and local data systems
      ii) non-redundant wildland fire information from fed and non-fed sources (IRWIN +)
      iii) NFORS data
      iv) Youth Fire Setters Database
      v) Firefighter Injury Database
      vi) Near-Miss data
      vii) ISO data

7) Collect the following data which is not currently being collected in NFIRS
   a) Real time operational data: SITSTAT, RESSTAT
   b) Fire phenomenon related data – fire state at time of first unit arrival
   c) Complex centric data (eg wui event)
   d) Data to enable assessment of financial impact of fire service operations -- money saved
versus loss data

e) Data to support fire department performance measurement
f) Visual data
g) data sets for departments to quantify performance and impact
h) Demographic information (victim, fire starter, etc)
i) In depth fire fighter injury data Develop a model first report of injury form

8) **Encourage use of standards for data collection** such as NFPA 901 and 950
9) Develop **mechanisms to encourage partnerships** between fire departments and academia during data development stage (especially epidemiologists)
10) **Consider special studies** to accomplish specific research goals

**Section B. Action Items to Enhance Data Gathering**

1) Provide broadly accessible access to **lessons learned** (in data gathering)
2) **Take advantage of narratives** for elaboration (not replacement) of NFIRS and codings/classifications as appropriate
3) **Improve the quality** of fire data input (eg. NFIRS)
   a) Identify organizational factors that hinder quality control
   b) Create accountability and incentives to encourage quality recording - Consider EMS model/system and procedures for post-incident (both internal and external) peer review of fire incident data.
   c) Conduct benchmarking exercises with end-users to ensure consistent data entry and data quality issues, esp. for quantifying the impact of proposed changes
   d) Ensure routine/benchmarked data entry tests to check coding accuracy
4) Ensure **fire service considerations** are included in data gathering activities – i.e. develop means to make data entry easy, fun and rewarding
5) **Do usability testing** – develop an NFIRS that is intuitive for fire fighters
6) **Study** the IAFC near miss data gathering process and **other data systems** such as NACS, ICD for possible application to NFIRS data collection
7) **Explore wiki** approaches for data gathering (ie collective/shared data entry)
8) **Conduct an assessment of data entry architecture**
   a) Monitor impact of changes in architecture or entry (eg text searches)
9) Develop **education and training** for fire fighters and administrative personnel on data gathering, its use, and its value
   a) Provide fire phenomenology training to increase accuracy, using principles in NFPA 921
   b) Balance fire science and fire protection engineering concepts in training
10) Promote **allocation of adequate state and local level organizational resources** (personnel and infrastructure) for data (e.g., champions)
11) Develop **strategies to address litigation concerns** regarding incident reporting (NFPA 921, NFPA 1033)
12) **Establish performance standards for technology** to gather data (bring vendors on-board early)

13) Identify **appropriate partners** in data collection, e.g. law enforcement

14) **Automate data collection** as much as is feasible; ensure QA/QC

15) Institutionalize **rewards/recognition** for NFIRS reporting

16) Encourage national organizations to **advocate** (through development of position statements) for the importance of data collection

17) **Outreach to departments not contributing** data to NFIRS

18) Evaluate and **enhance user interfaces**

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Section C. Preparing for the Future of Fire-Related Data (including NFIRS 6.0 and beyond)

1) Create a clear list of **goals/vision** for the future of fire related data

2) Develop a **strategy for long term maintenance and future updates to NFIRS**
   a) shortfalls of NFIRS (deployment scheme, implementation, design, exploiting advancing technology, integrating different datasets, user interface)
   b) Sort short and long term needs
   c) Clarify what can be done before a new version of NFIRS is issued (ie training, data entry issues)
   d) Develop a specific process for development of NFIRS 6.0

3) Methodology should be **peer reviewed**

4) Use relevant **NFPA standards**, guides, and committees

5) **Learn from other communities**

6) **Enhance NFIRS accessibility** (note that there are already plans underway)

7) Incorporate a means to **continuously adapt** data collection to meet changing emerging trends/issues of concern while maintaining a **core set** of data fields for benchmarking over time.

8) Develop strategy for **longevity and continuity** of databases;
   a) Do not lose legacy data with changes

9) **Do not create** a competition between NFIRS and other databases (encourage coordination)

10) **Communicate NFORS plan**

11) Develop a systematic **strategy/design for integration** of databases
   a) Consider IRWIN as a model
   b) Consider connecting NFIRS to appropriate databases such as NEMSIS and wildland databases

12) Establish a **formal process for proposals** with technical justification to change NFIRS and other databases (such as NFORS)

13) Promote the role/importance of **State agencies in** data collection process(NFIC)
14) **Create model regulations** that will improve data collection including injuries (privacy, data security, best practices)

15) **Share best practices**/identify beneficial case studies and databases (e.g., building footprint, Texas Forest Service, California all incident reporting system) beyond NFIRS (share them and use to inform NFIRS development)

16) Consider **streamlining NFIRS modules** in concert with linking to other data streams/databases

17) Establish ways to **demonstrate the value** of all fire related data including NFIRS

18) **Evaluate the optional modules** and voluntary fields