



Homeland
Security



Homeland
Security

**Basic Annual Report
Information from NFIRS:**

A National Perspective

December 6, 2007



Homeland
Security

What is an Annual Report?

“A document that summarizes the results of operations and financial status of a company for the past year and outlines plans for the future.”

“A report card.”

“An annual performance review, without a raise.”



Homeland
Security

Annual Reports in the Fire Service

- **No standard format**
- **Captures the essence of a multi-tasking, complex operation**
- **Varying Audiences**
- **Each report is unique**



- **Annual Report (*Fire in the United States*) at the National level:**
 - Presents overview of the size and scope of the U.S. fire problem and its components
 - Provides detailed information on the components
 - Seeks to mitigate the fire problem by understanding it
- **The overall USFA format may not apply, but the components of the report are useful for other Annual Reports**
- **Commonalities in analysis and presentation**



Major Analysis Areas

- **Fires**
- **Civilian and firefighter deaths**
- **Civilian and firefighter injuries**
- **Dollar loss (property loss + contents loss)**

Today's focus: Fires



Homeland
Security

In the Beginning....

As you prepare your Annual Report:

- **Decide focus**
- **Identify audience**
- **Determine data needs**
- **Determine appropriate analysis tools**
- **Determine appropriate data presentation**



- **Non-NFIRS related data:**
 - Outreach (public education and other)
 - Data on inspections
 - Arson and arson investigations

- **NFIRS related data:**
 - Overall run distributions; fires only (which excludes mutual aid)
 - Dollar loss (missing values)
 - Multiple entry data elements (e.g., human factors contributing to ignition, etc.)
 - Complex analytic issues (e.g., combining data from multiple elements, etc.)



Homeland
Security

Analytic Topics Not Addressed Today

continued

- **Trend analysis - comparison of percentage change indicators**
- **Statistical significance**
- **Computation of Rates**



Topics to Consider

- **NFIRS “unknown” codes (U, UU, UUU) and missing data (blanks or null values)**
- **Data interpretation and presentation - is it more effective to present the data in a graph or table?**
- **Confined fires**
- **Mutual aid**
- **NFIRS version 5.0 vs. 4.1**



Homeland
Security

**What is it that we
want to know?**

**For the fire portion of a typical
Annual Report:**

- Types of fires
- When fires occur
- Where fires occur
- How much loss
- Cause of fire



With the audience identified and the focus of the report established:

- **Choose analysis tools**
- **Determine NFIRS data elements to use**



- **Software (e.g., Excel, SAS, SQL Server)**
- **NFIRS 5.0 Complete Reference Guide:**
<http://www.nfirs.fema.gov/documentation/reference/>
- **NFIRS Training Courses:**
<http://www.usfa.dhs.gov/fireservice/nfirs/training/index.shtm>
- **Fire Data Analysis Handbook, Second Edition, January 2004:**
<http://www.usfa.dhs.gov/downloads/pdf/publications/fa-266.pdf>

NFIRS 5.0 Complete Reference Guide:

[http://
www.nfirs.fema.gov/
documentation/
reference/](http://www.nfirs.fema.gov/documentation/reference/)

National Fire Incident Reporting System 5.0 Complete Reference Guide

January 2006



FEMA

U.S. Fire Administration
National Fire Data Center

NFIRS Training Courses:

[http://www.usfa.dhs.gov/
fire-service/nfirs/training/
index.shtm](http://www.usfa.dhs.gov/fire-service/nfirs/training/index.shtm)



National Emergency Training Center

2007-2008

Training Catalog

Catalog of Courses for the
U.S. Fire Administration's National Fire Academy



FEMA

Fire Data Analysis Handbook, Second Edition, January 2004:

<http://www.usfa.dhs.gov/downloads/pdf/publications/fa-266.pdf>

Fire Data Analysis Handbook

Second Edition

FA-266/January 2004



FEMA



Determine Which NFIRS Data Elements to Use

- **Data element(s) appropriate for the information presented**
- **Decide which specific NFIRS codes apply**
- **If NFIRS 4.1 is used, be aware of the differences from NFIRS 5.0**
- **Exclude mutual aid incidents (i.e., where AID \neq 3 and AID \neq 4) to avoid double counting fires**



Data Interpretation and Presentation

- **Tables**
- **Graphs**
 - Appropriate scales
 - Bar
 - Histogram
 - Line
 - Pie
- **Source**
- **Appropriate Titling**
- **Proper Labeling**



From the NFIRS basic module

- Version = 5.0
- Exclude mutual aid incidents
(i.e., where AID \neq 3 and AID \neq 4)
- Incident type (INC_TYPE) 100, 111-173

Note: When analyzing only version 5.0 data, exclude incident type 110 (4.1 conversion only)



Homeland
Security

What types of fires occur?

Structure

Vehicle

Outside

Other



How to Define Types of Fires Using NFIRS

■ General incident types

- Structures

○ Incident type: 111-123

- Vehicles

○ Incident type: 130-139

- Outside

○ Incident type: 140-162, 164-173 (note, excludes 163)

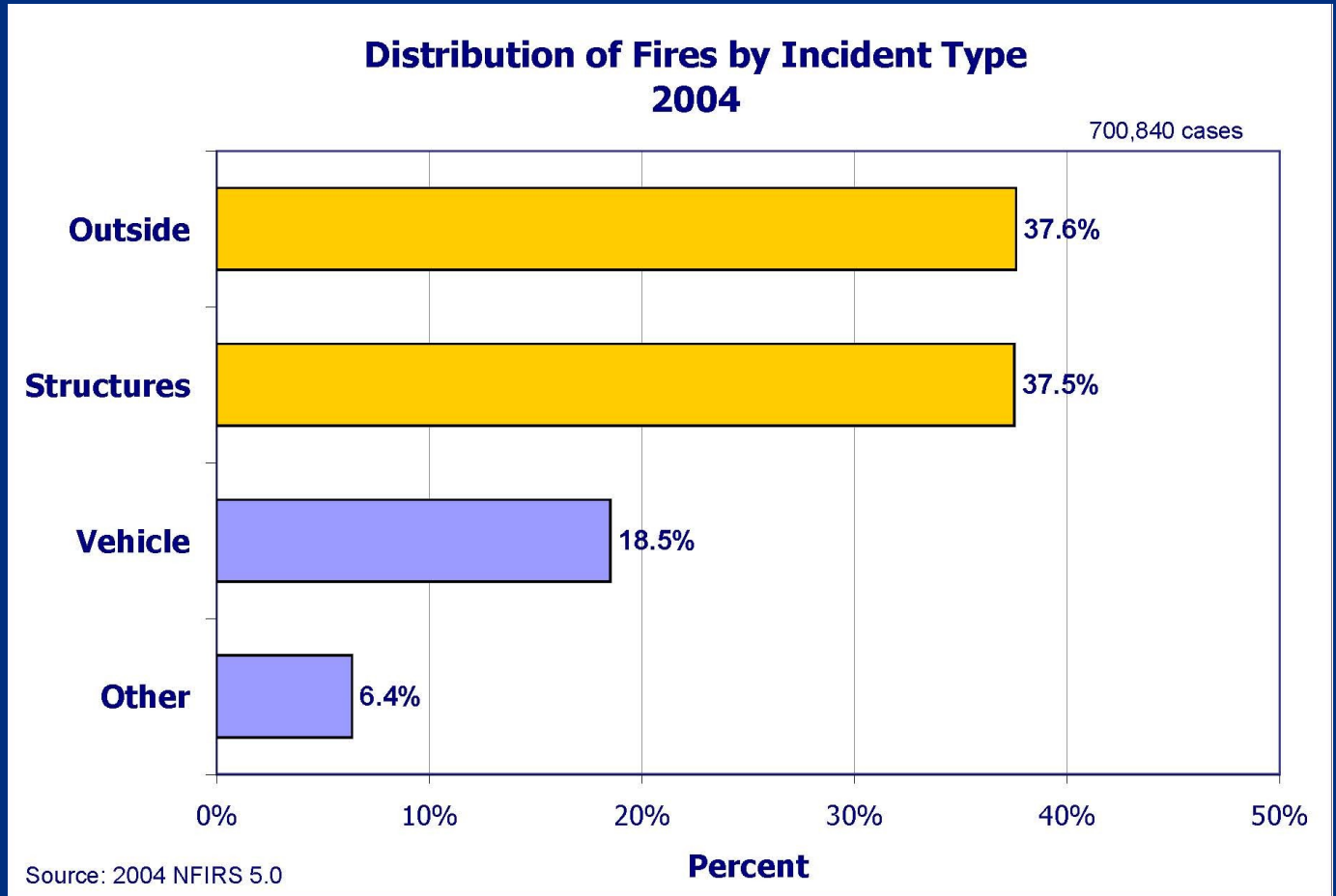
- Other

○ Incident type: 100-109, 163 (outside gas/vapor combustion/explosion)



Examples: Distribution of Fires by General Incident Type

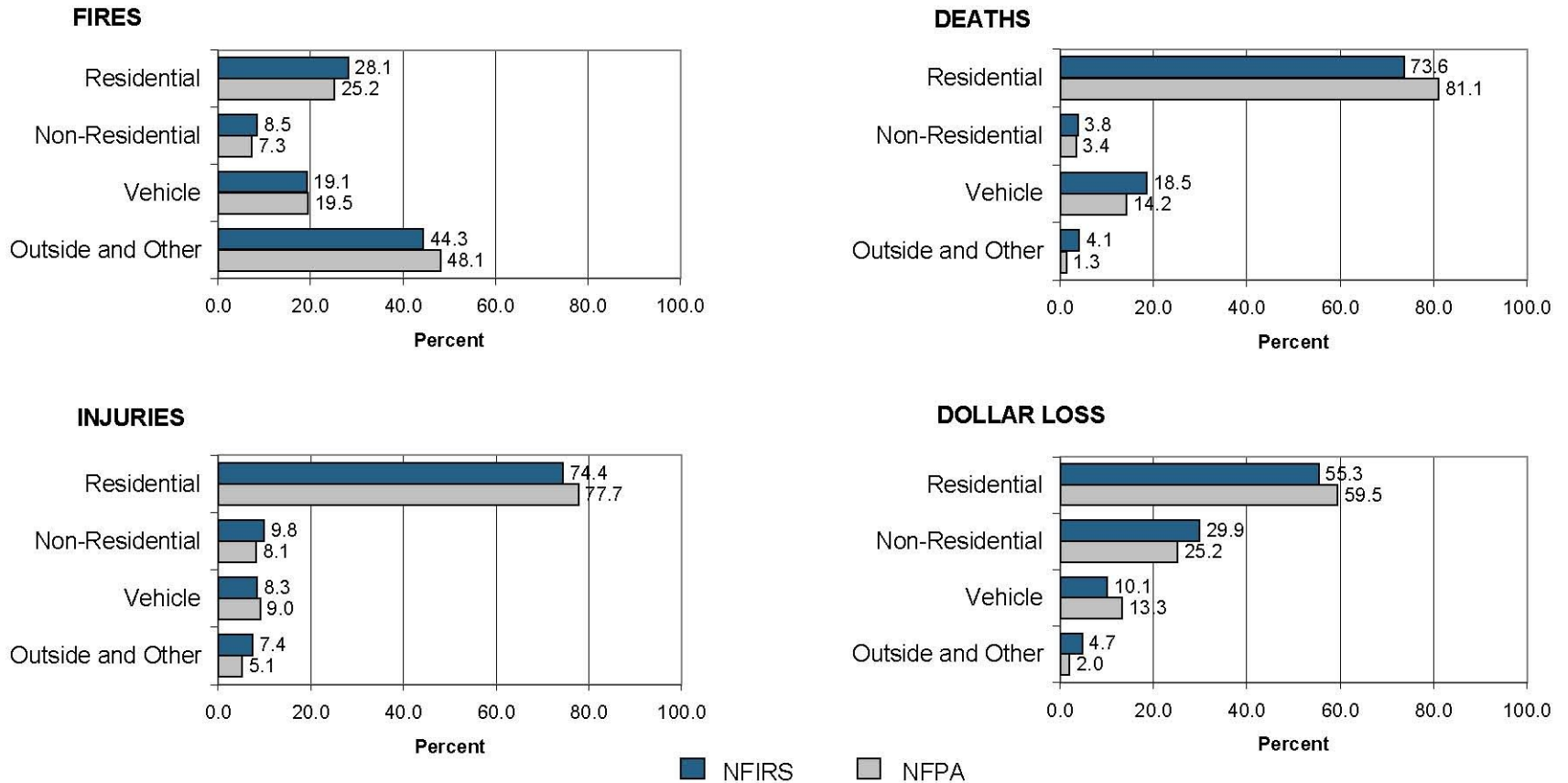
Graphically:





Homeland

Figure 3: Comparison of NFIRS Data with NFPA Estimates by General Property Type (3-year average)



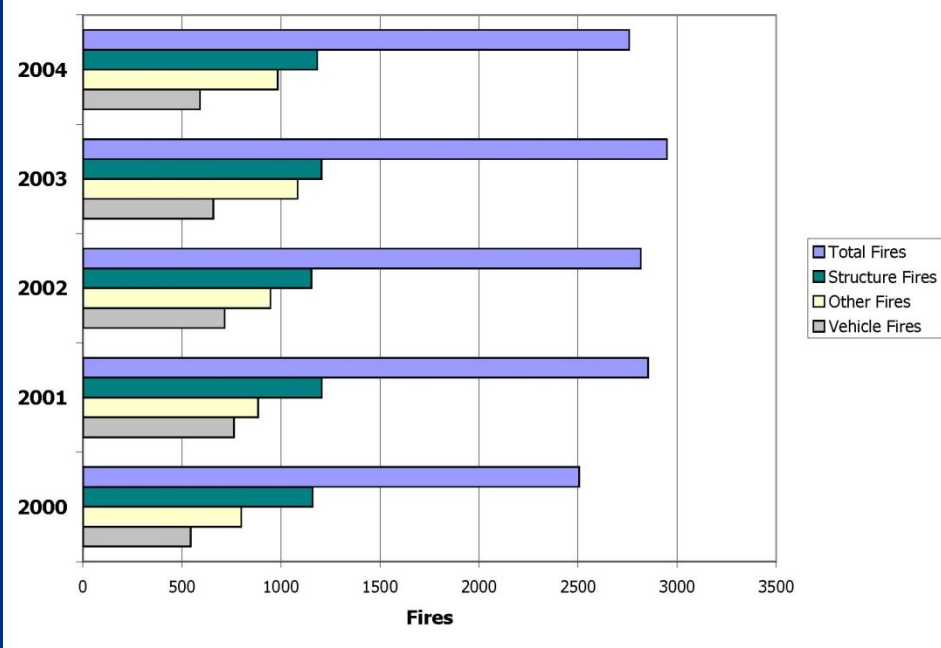
Sources: 2002-2004 NFIRS 5.0
2002-2004 NFPA

Or, use a table:

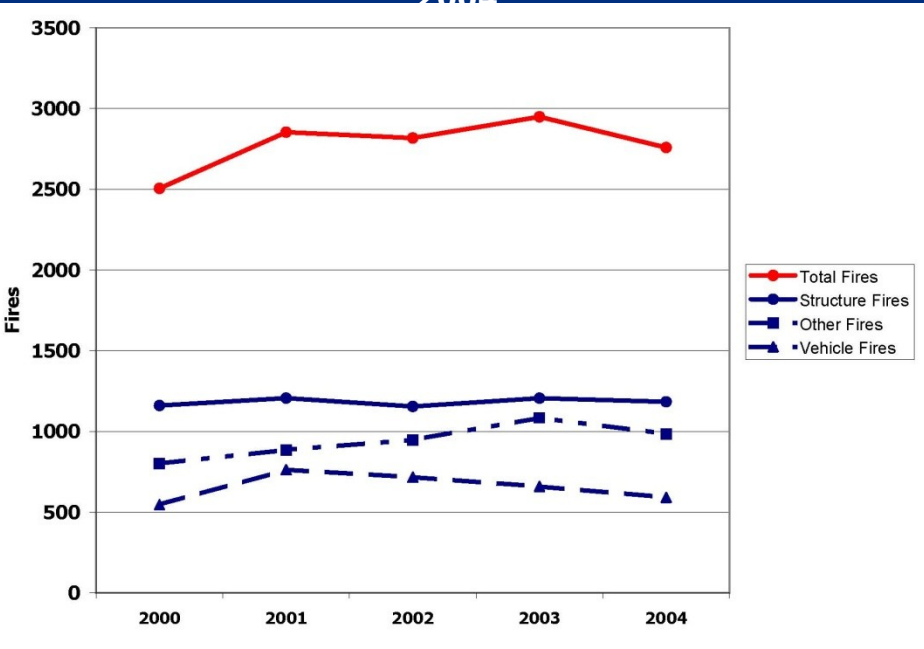
Year	Total Fires	Structure Fires	Vehicle Fires	Other Fires
2004	2,758	1,183	591	984
2003	2,949	1,205	658	1,086
2002	2,817	1,154	716	947
2001	2,853	1,206	762	885
2000	2,505	1,160	545	800

Total Fires and Fires by Major Incident Type 2000-2004

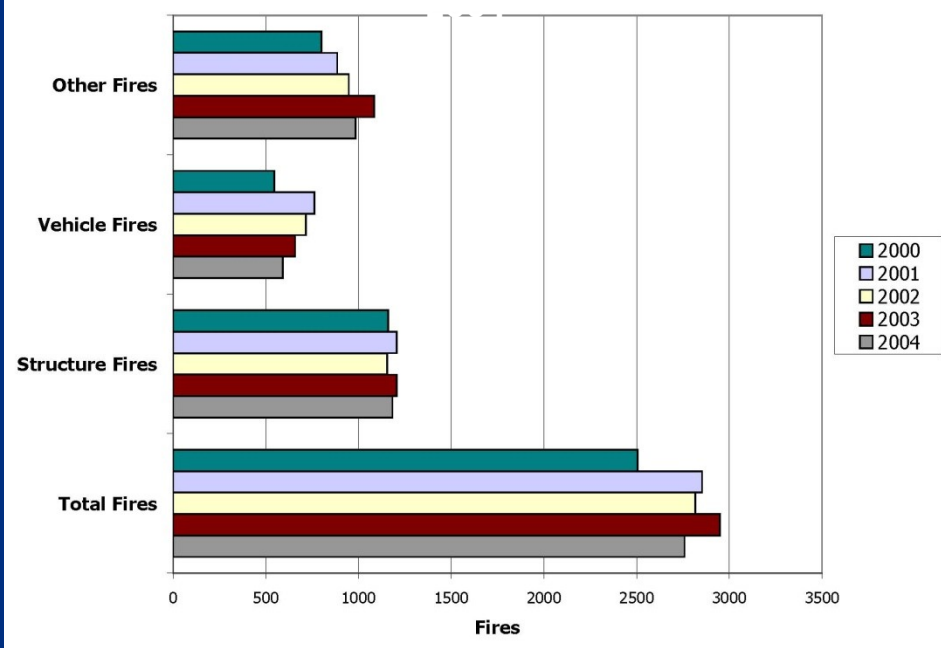
Year	Total Fires	Structure Fires	Vehicle Fires	Other Fires
2004	2,758	1,183	591	984
2003	2,949	1,205	658	1,086
2002	2,817	1,154	716	947
2001	2,853	1,206	762	885
2000	2,505	1,160	545	800



Total Fires and Fires by Major Incident Type 2000-2004



Total Fires and Fires by Major Incident Type 2000-2004





Homeland
Security

Temporal Analyses: When Do Fires Occur?

Month/Season

Day of Week

Year

Time of Day

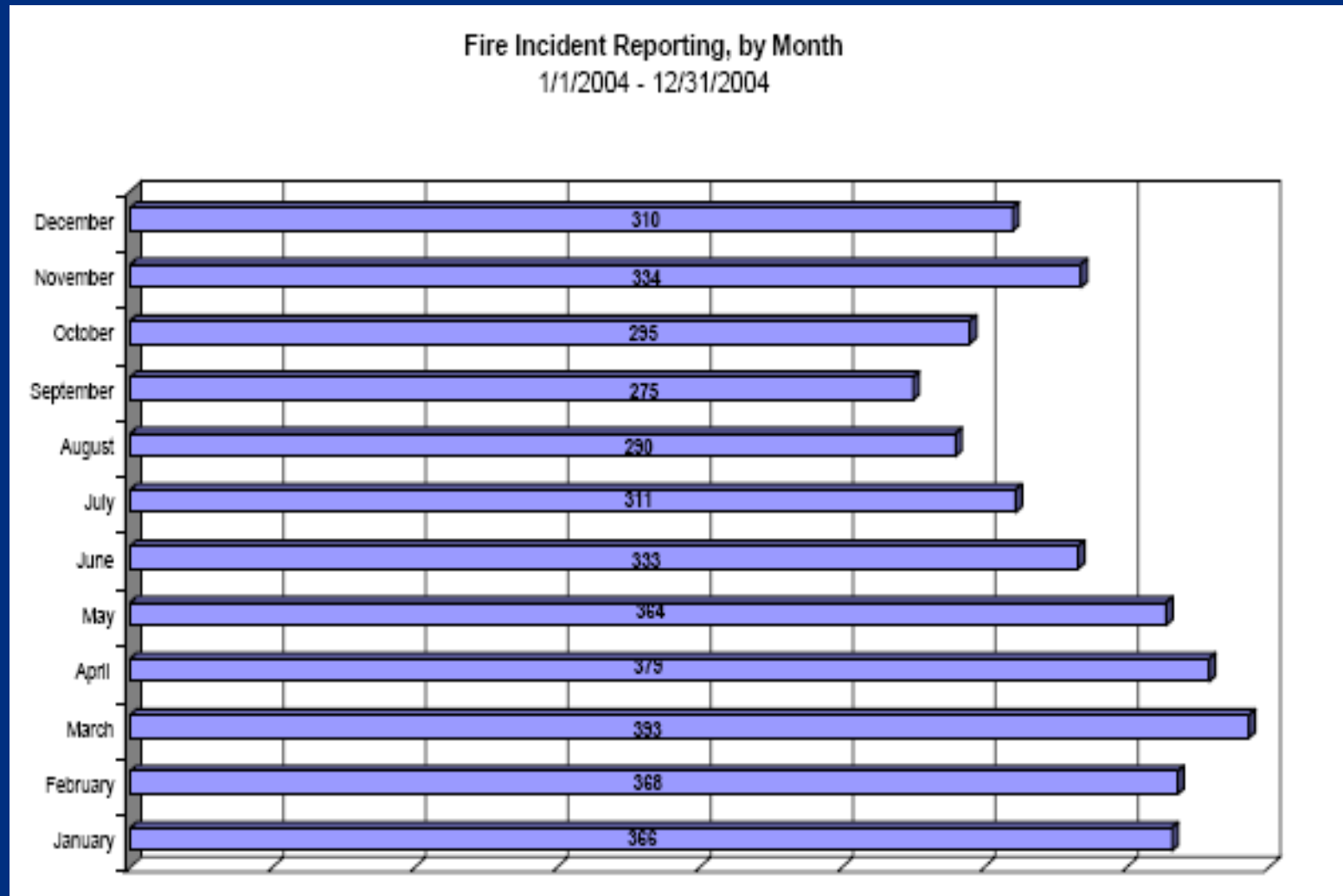


How to Define When Fires Occur Using NFIRS

- **From the NFIRS basic module**
 - Version = 5.0
 - Exclude mutual aid incidents (i.e., where AID \neq 3 and AID \neq 4)
 - Define fires (based on INC_TYPE)
 - Incident date (INC_DATE)
 - Alarm time (ALARM)
- **Month:** Characters 1-2 of the incident date field
- **Day:** Characters 3-4 of the incident date field
- **Year:** Characters 5-8 of the incident date field
- **Time:** Characters 9-12 of the alarm time field

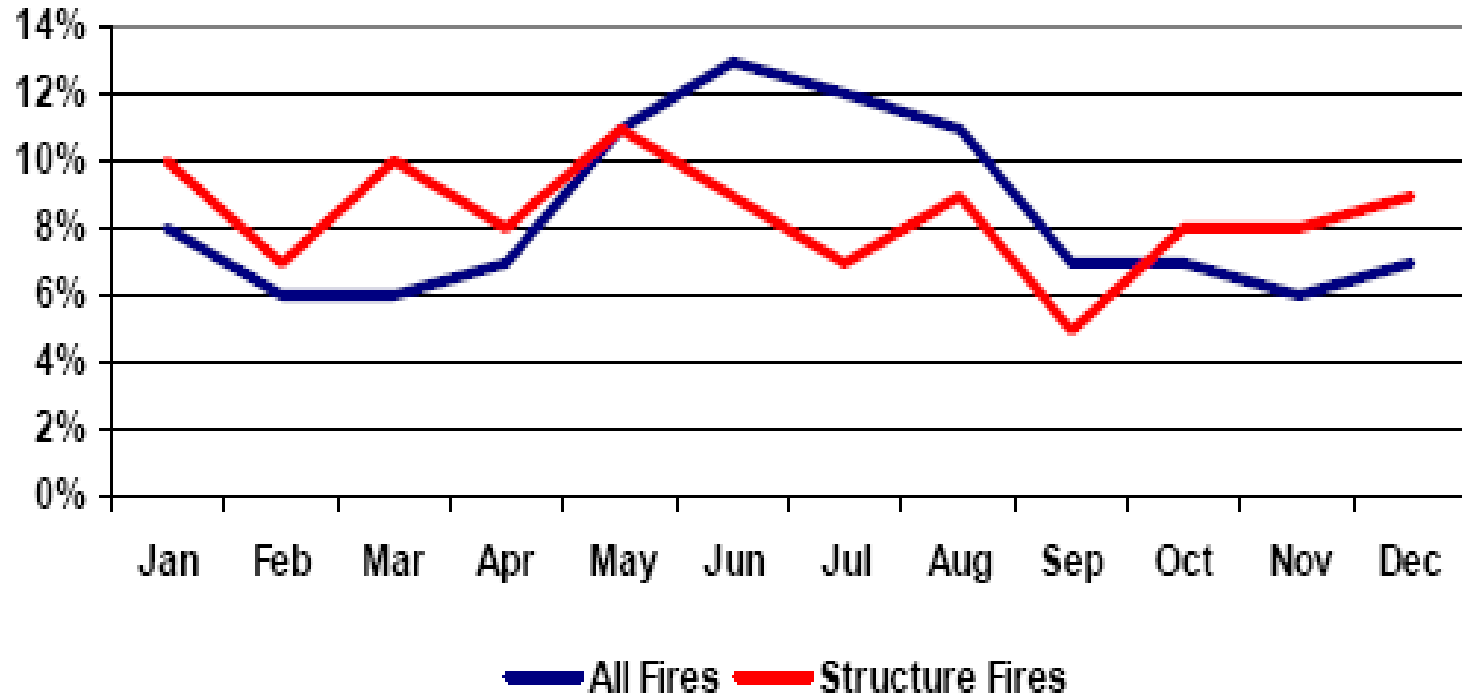


Examples: When Fires Occur



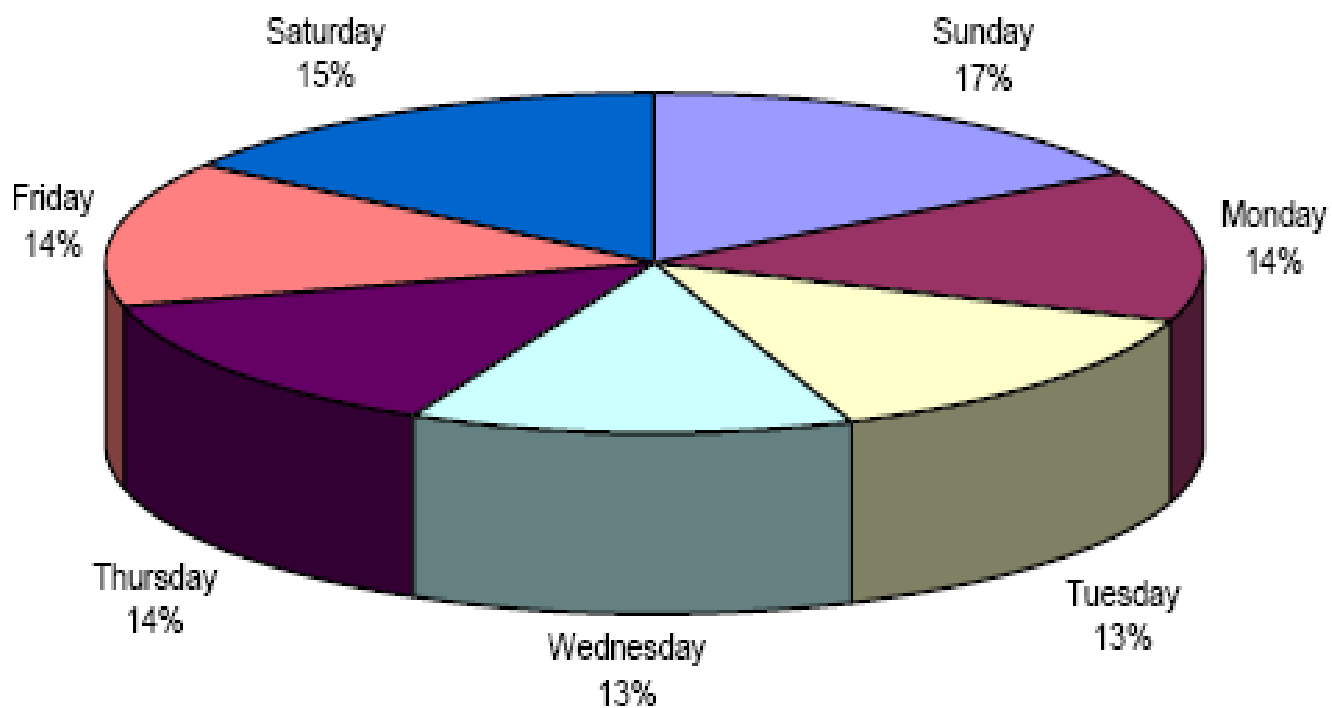


Residential Structure Fires by Month

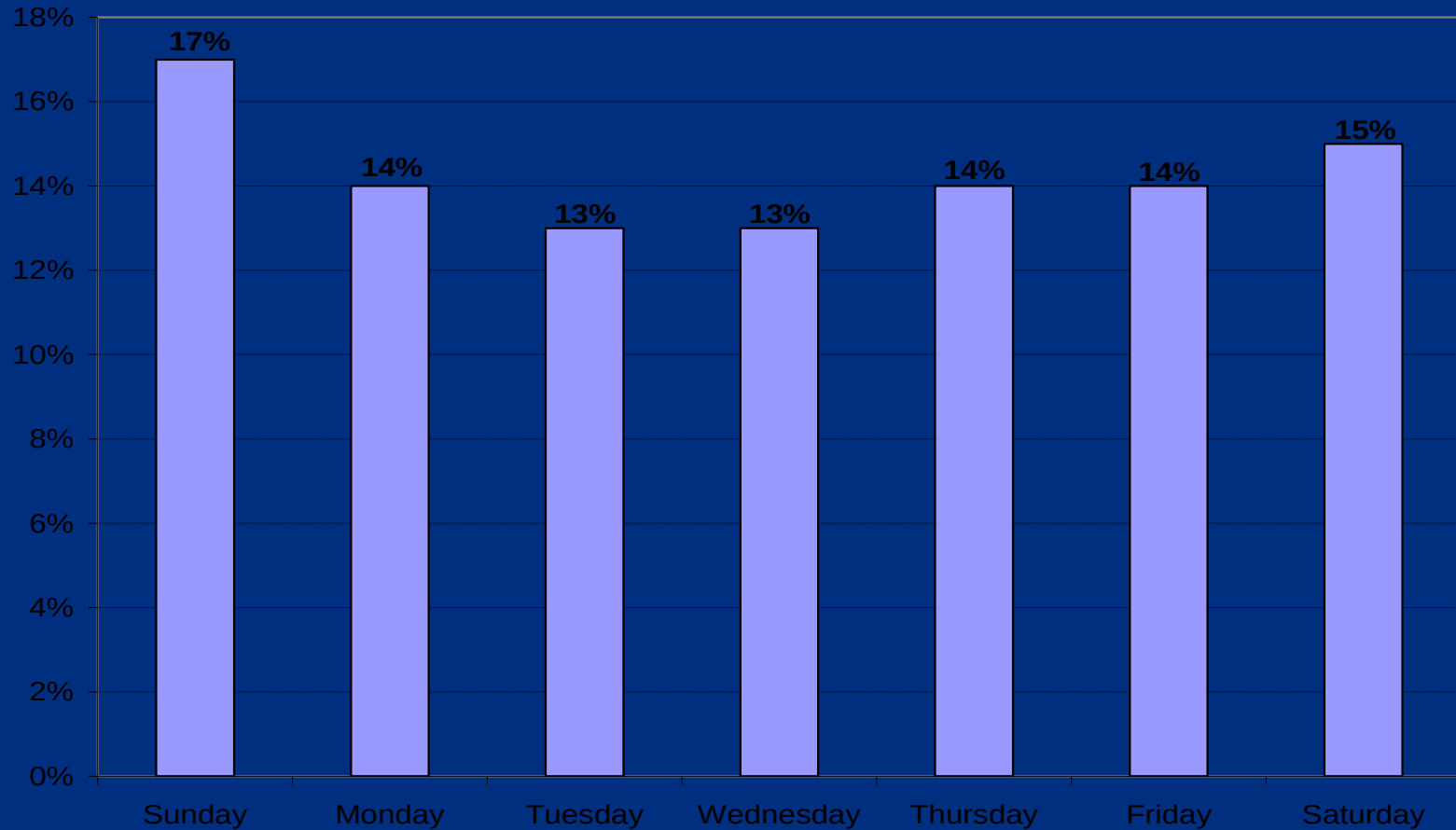


Fire Incident Reporting, by Day of the Week

1/1/2004 - 12/31/2004

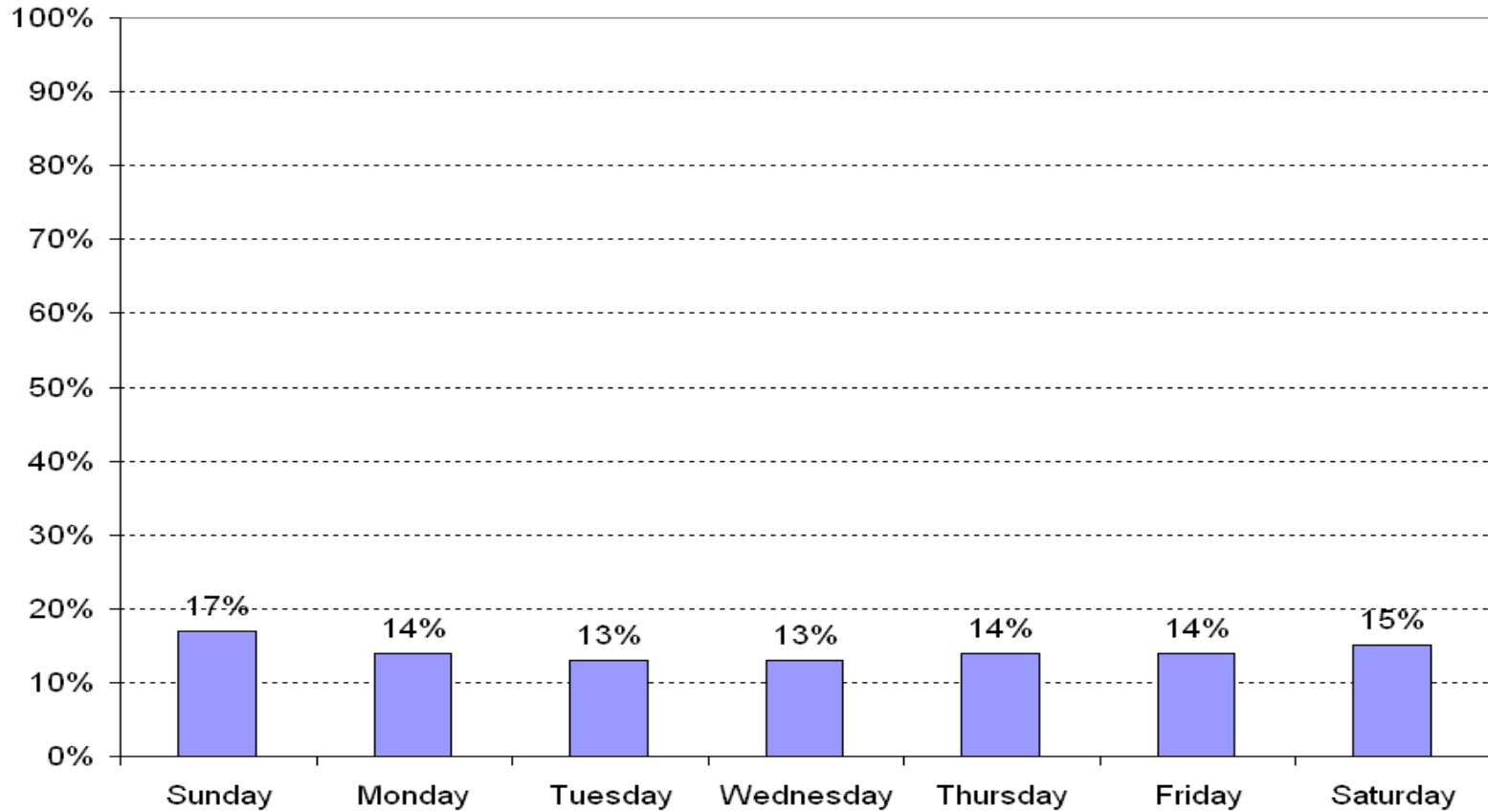


Fire Incident Reporting by Day of the Week 2004

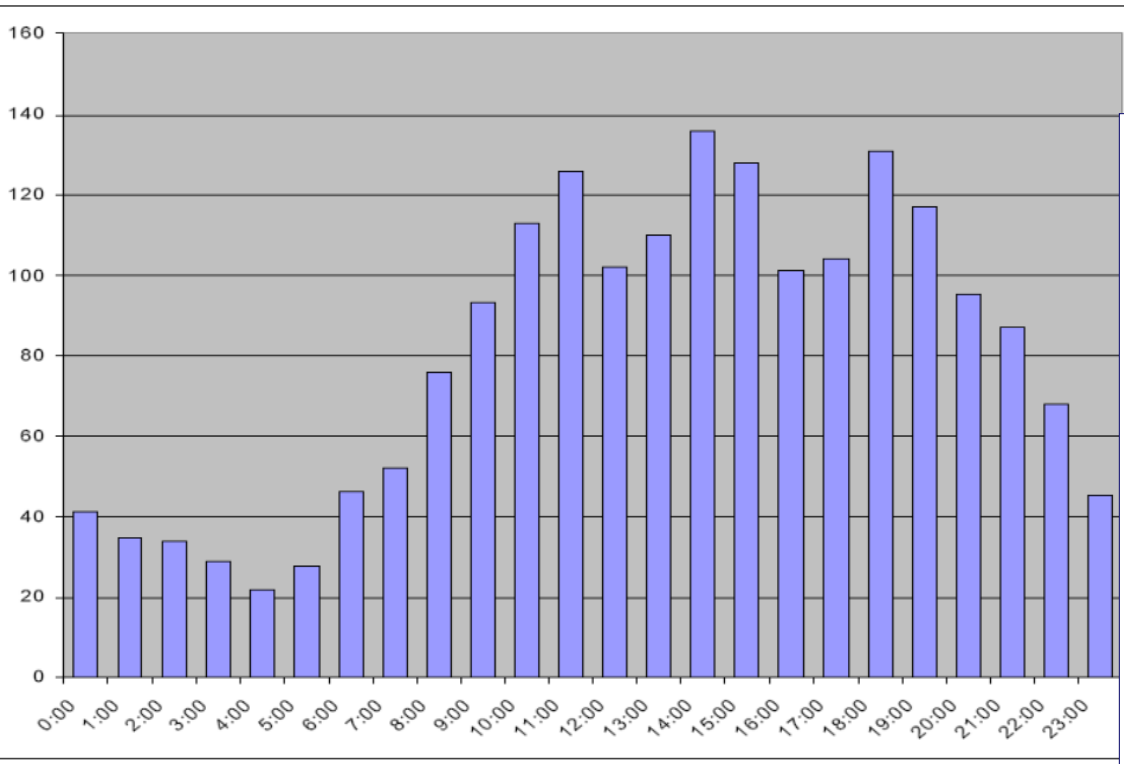


Source: 2004 (etc...)

Fire Incident Reporting by Day of the Week 2004

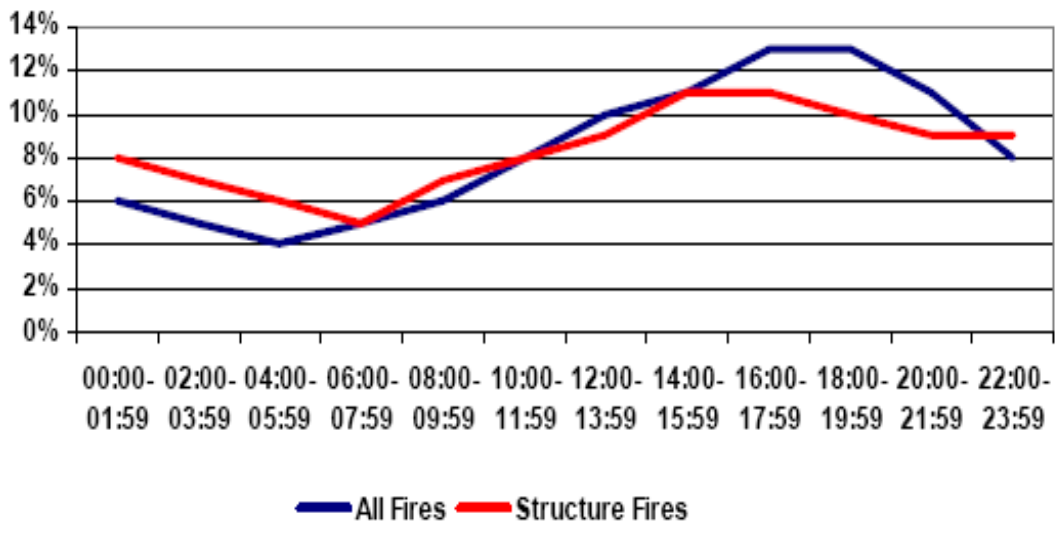


Source: 2004 (etc...)



A.M.		P.M.	
12 AM - 00:59	41	12 PM - 12:59	102
01:00 - 01:59	35	13:00 - 13:59	110
02:00 - 02:59	34	14:00 - 14:59	136
03:00 - 03:59	29	15:00 - 15:59	128
04:00 - 04:59	22	16:00 - 16:59	101
05:00 - 05:59	28	17:00 - 17:59	104
06:00 - 06:59	46	18:00 - 18:59	131
07:00 - 07:59	52	19:00 - 19:59	117
08:00 - 08:59	76	20:00 - 20:59	95
09:00 - 09:59	93	21:00 - 21:59	87
10:00 - 10:59	113	22:00 - 22:59	68
11:00 - 11:59	126	23:00 - 23:59	45

Residential Structure Fires by Time of Day

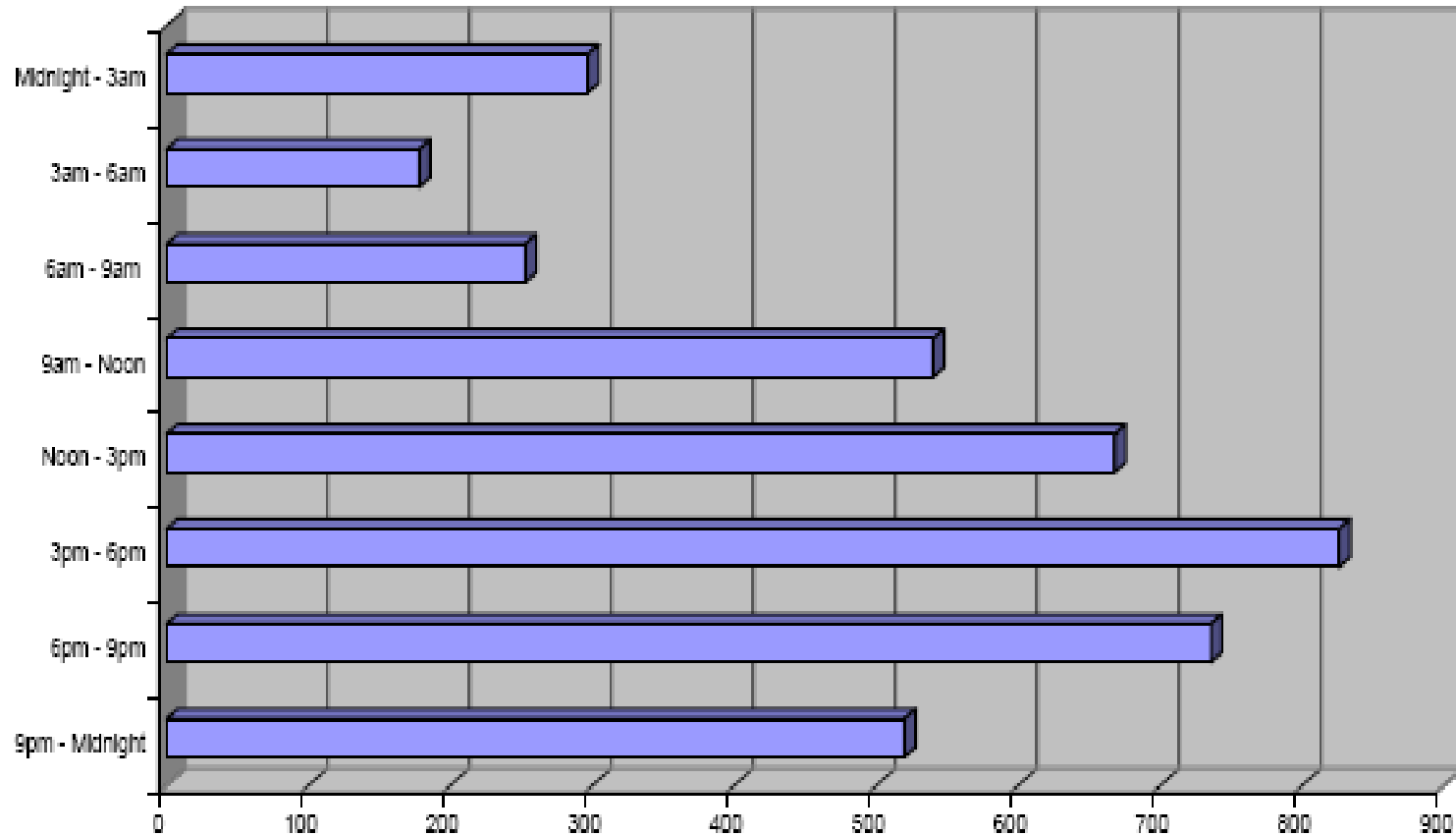


TOTAL RUNS CALCULATED: 1919



Homeland Security

Fire Incident Reporting, by Hour of the Day
1/1/2004 - 12/31/2004





Homeland
Security

Where do fires occur?

Property Use

Area of Fire Origin

Geographic Location



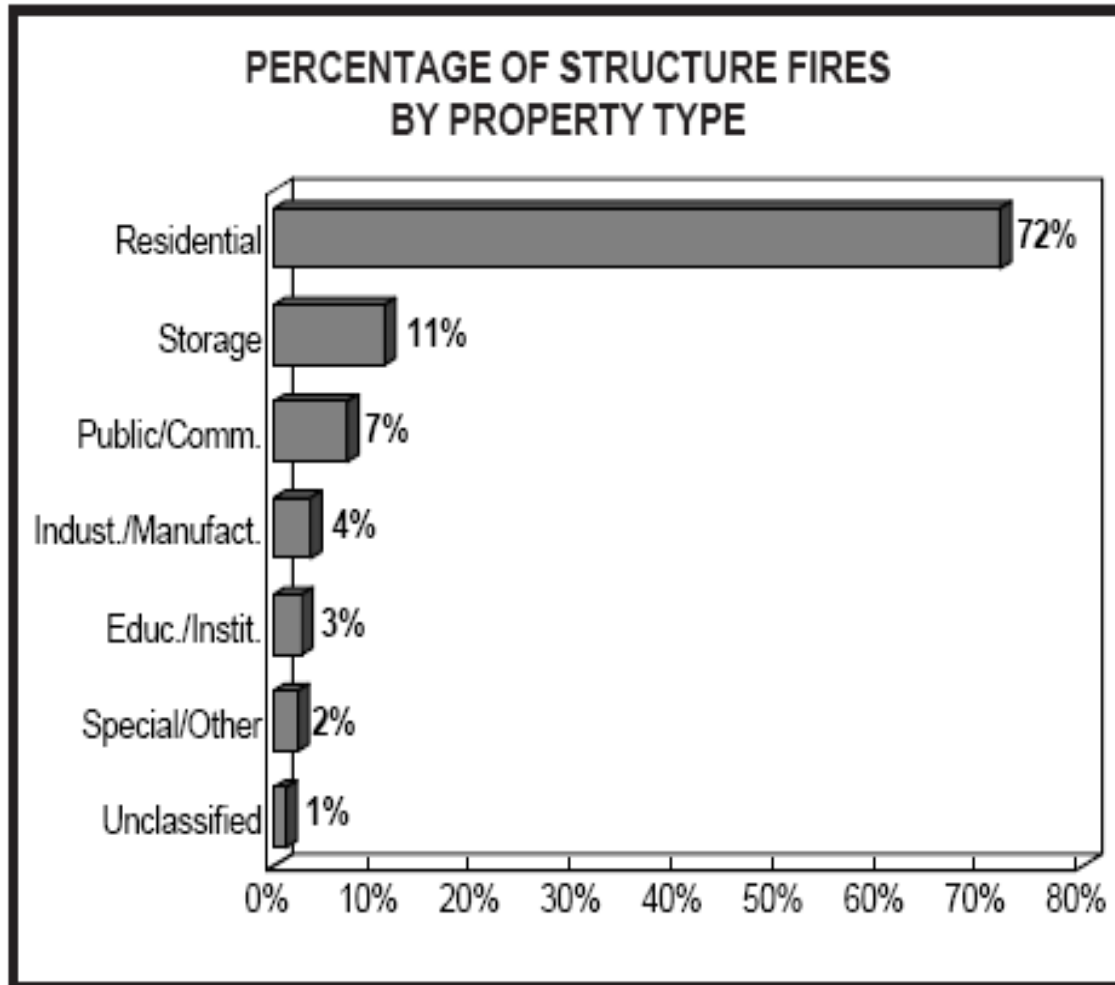
- **From the NFIRS basic module**
 - Version = 5.0
 - Exclude mutual aid incidents (i.e., where AID \neq 3 and AID \neq 4)
 - Define fires (based on INC_TYPE)
 - Property use (PROP_USE)
 - State (STATE)
- **From the NFIRS header module**
 - County (FD_FIP_CTY)
- **From the NFIRS fire module**
 - Area of fire origin (AREA_ORIG)



- **Assembly**
-PROP_USE: 100-199
- **Educational**
-PROP_USE: 200-299
- **Health Care, Detention and Correction**
-PROP_USE: 300-399
- **Residential**
-PROP_USE: 400-499
- **Mercantile, Business**
-PROP_USE: 500-599
- **Industry**
-PROP_USE: 600-699
- **Manufacturing**
-PROP_USE: 700
- **Storage**
-PROP_USE: 800-899
- **Outside or Special Property**
-PROP_USE: 900-999
- **Property Use, Other**
-PROP_USE: 000
- **None**
-PROP_USE: NNN
- **Undetermined**
-PROP_USE: UUU
- **Null or Missing Values**
-PROP_USE: blank



Examples: Where Fires Occur Property Types





Ho
Se

Structure Fires by Property Type 2001 - 2005

	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>% Increase (Decrease) 2004-2005</u>
Residential	3,912	4,698	4,858	4,973	5,043	1%
Educational/ Institutional	183	245	216	202	195	(3%)
Public Assembly/ Commercial	409	454	433	443	512	16%
Industrial/ Manufacturing	271	253	261	257	256	(<1%)
Storage	771	799	847	822	769	(6%)
Special/Other	170	220	234	199	167	(16%)
Unclassified	84	91	102	80	84	5%
TOTAL	5,800	6,760	6,951	6,976	7,026	1%



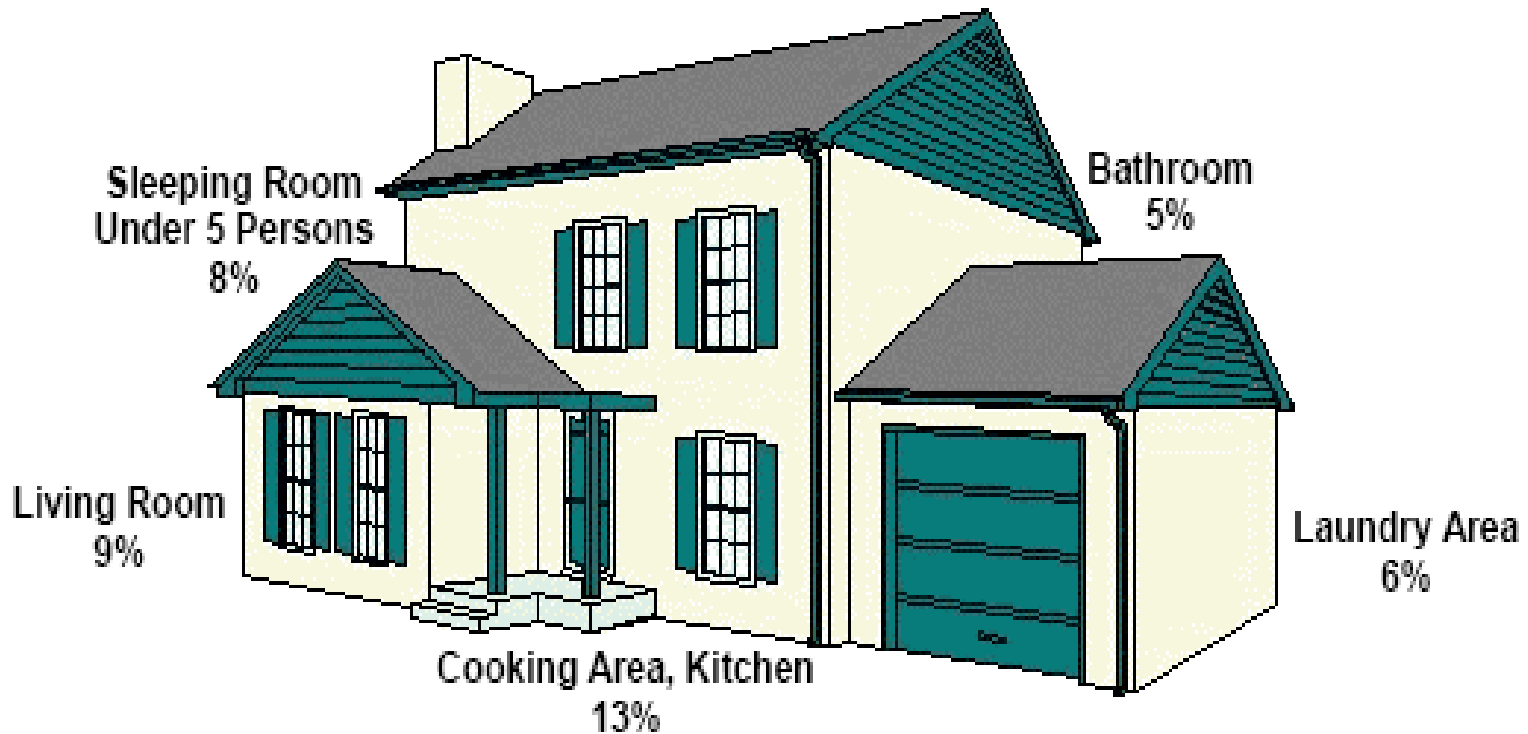
Area of Fire Origin

- **Means of Egress**
-AREA_ORIG: 01-09
- **Assembly or Sales Areas**
-AREA_ORIG: 10-17
- **Function Areas**
-AREA_ORIG: 20-28
- **Technical Processing Areas**
-AREA_ORIG: 30-38
- **Storage Areas**
-AREA_ORIG: 40-47
- **Service Areas**
-AREA_ORIG: 50-58
- **Service or Equipment Areas**
-AREA_ORIG: 60-68
- **Structural Areas**
-AREA_ORIG: 70-78
- **Transportation, Vehicle Areas**
-AREA_ORIG: 80-86
- **Outside Areas**
-AREA_ORIG: 90-98
- **Area of Fire Origin, Other**
-AREA_ORIG: 00
- **Undetermined**
-AREA_ORIG: UU



Examples: Where Fires Occur Area of Fire Origin

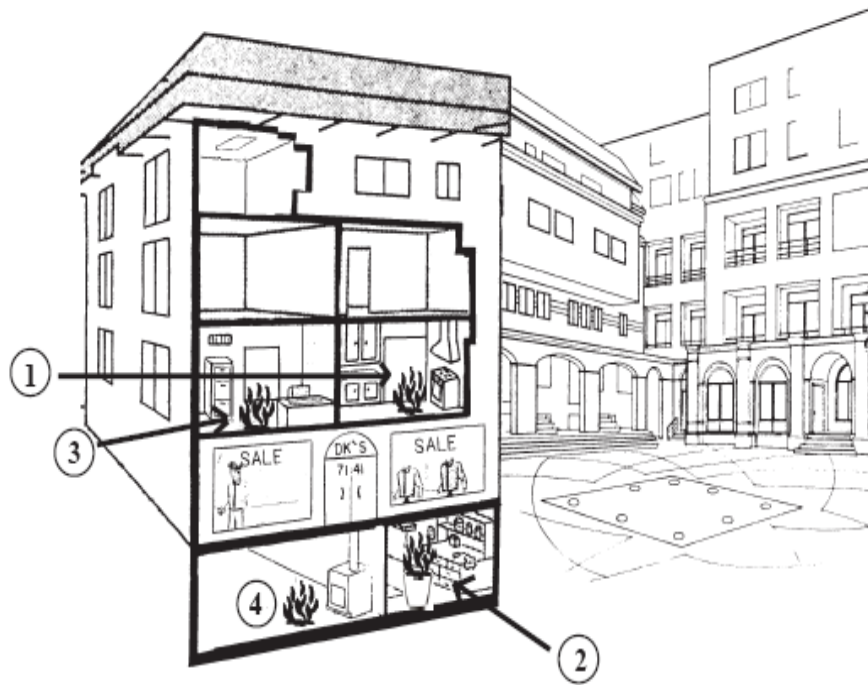
Top Five Area of Fire Origin





STORE AND OFFICE PROPERTY

(Retail Shopping, Business Offices, Service Stations)

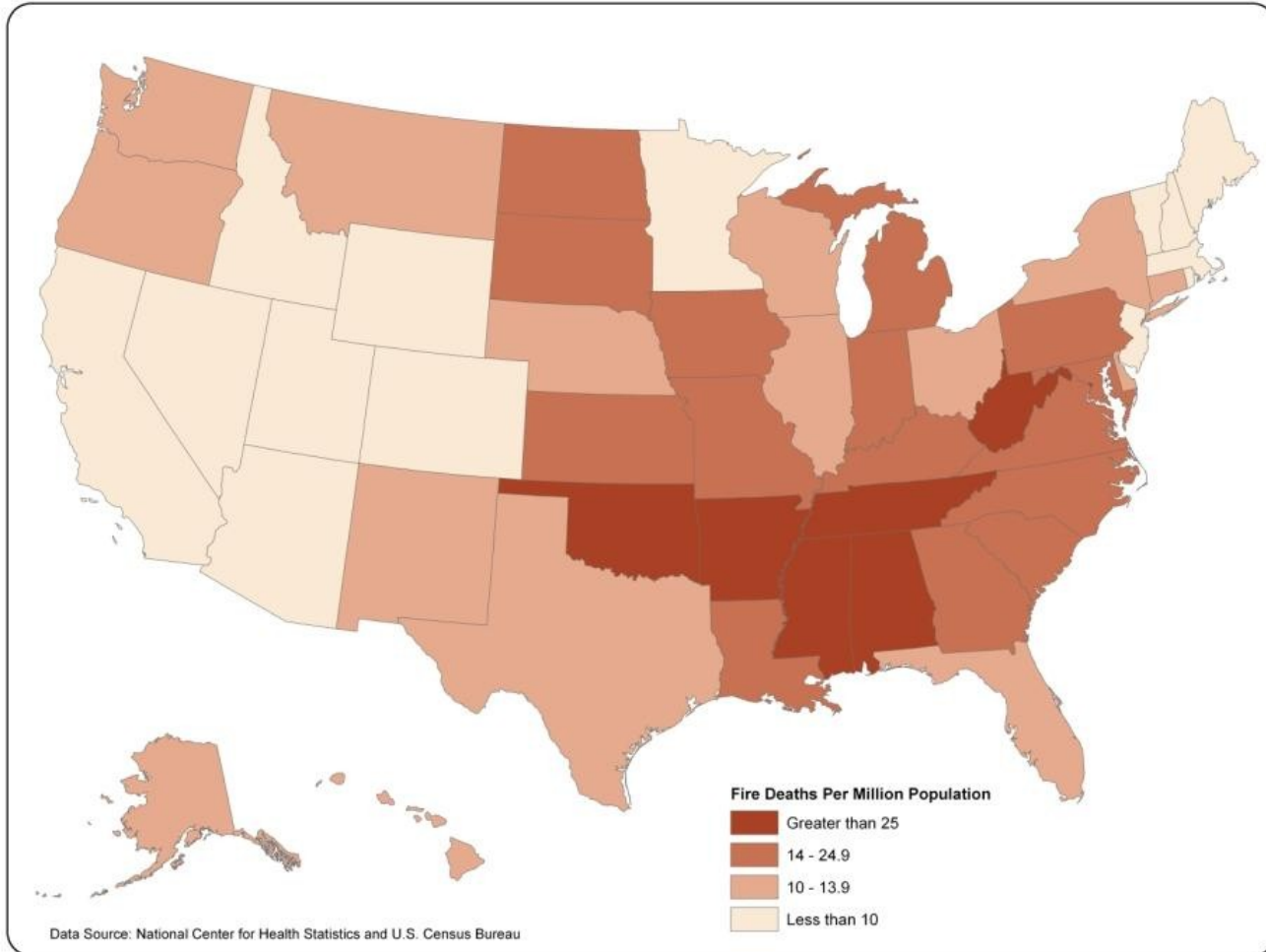


AREA OF FIRE ORIGIN

1. Kitchen/Cooking Area	14%
2. Trash Chute/Container	9%
3. Office	6%
4. Heating Room/Area	5%
Other Areas of Fire Origin	66%



Example: Where Fires Occur Geographic Location (Spatial Analyses)





Homeland
Security

How Much Loss Occurs?

Deaths

Injuries

Contents Loss

Property Loss

Fire Spread



How to Define Losses Using NFIRS

- **From the NFIRS basic module**
 - Version = 5.0
 - Exclude mutual aid incidents (i.e., where AID \neq 3 and AID \neq 4)
 - Define fires (based on INC_TYPE)
 - Deaths (OTH_DEATH)
 - Injuries (OTH_INJ)
 - Total dollar loss = Contents loss (CONT_LOSS) + Property loss (PROP_LOSS)
- **From the NFIRS structure fire module**
 - Fire Spread (FIRE_SPRD)



- **Confined fires, by definition, are confined to the object of origin (FIRE_SPRD=1)**
 - Confined Fires = INC_TYPE 113 to 118
- **Abbreviated reporting may limit the number of confined fires with fire spread entries**
- **Confined fires with no (or NULL) fire spread entries then need to be counted in with FIRE_SPRD=1**



Examples: Fire Spread

**Table 2. Dollar Loss per Clothes Dryer Fire by Fire Spread
[Residential Buildings, 3-year Average (2002-2004)]**

Measure	Flame Spread Confined to:				
	Confined to object of origin	Confined to room of origin	Confined to floor of origin	Confined to building of origin	Beyond building of origin
Clothes Dryer Loss per fire	\$2,420	\$4,742	\$28,971	\$63,822	\$65,665
Percent of Fires	61.8%	26.5%	3.8%	7.4%	.5%

Source: NFIRS 5.0 data only; Loss per fire is computed for only those fires where loss information was provided.



What causes the fire?

- At USFA, fire cause for structures is **determined** by information gathered from several data fields from different NFIRS modules.
 - Cause is mutually exclusive - one and only one cause is assigned to each incident
 - The cause hierarchy is designed for structure fires, but currently is applied to all fires.
 - Separate cause hierarchies are under development for vehicles and outside/other fires.
- What does this mean for you?**



How to Define Cause Using NFIRS

- **Option: Implement USFA cause methodology**
- **Option: Cause-related fields from the NFIRS fire module**
 - Cause of ignition (CAUSE_IGN)
 - Equipment involved in ignition (EQUIP_INV)
 - Factors contributing to ignition (FACT_IGN_1, FACT_IGN_2)
 - Human factors contributing to ignition (HUM_FACT1, ... , HUM_FACT8)
 - Heat source (HEAT_SOURC)

None of these NFIRS variables individually defines fire cause



- **Cause is a complex chain of events**
- **Hierarchy of definitions**
 - Assign fire to highest category – if it does not fit in the top category, then consider the second; if not that one, then the third, etc.
- **Three level process**
 - Priority cause – Initial hierarchy, 34 categories
 - Cause – 34 priority groupings condensed into 16 major groups.
 - General Cause – 16 causes condensed into 7 general causes



Cause Hierarchy Components

- **Primary Variables Used**
 - Cause of ignition (CAUSE_IGN)
 - Equipment involved in ignition (EQUIP_INV)
 - Factors contributing to ignition (FACT_IGN_1, FACT_IGN_2)
 - Heat source (HEAT_SOURC)
 - Human factors contributing to ignition (HUM_FACT1, ... , HUM_FACT8)
 - Area of Origin (AREA_ORIG)

- **Secondary Variables**
 - Age, Equipment power source (EQ_POWER), Mobile property involved (MOB_INVOL)



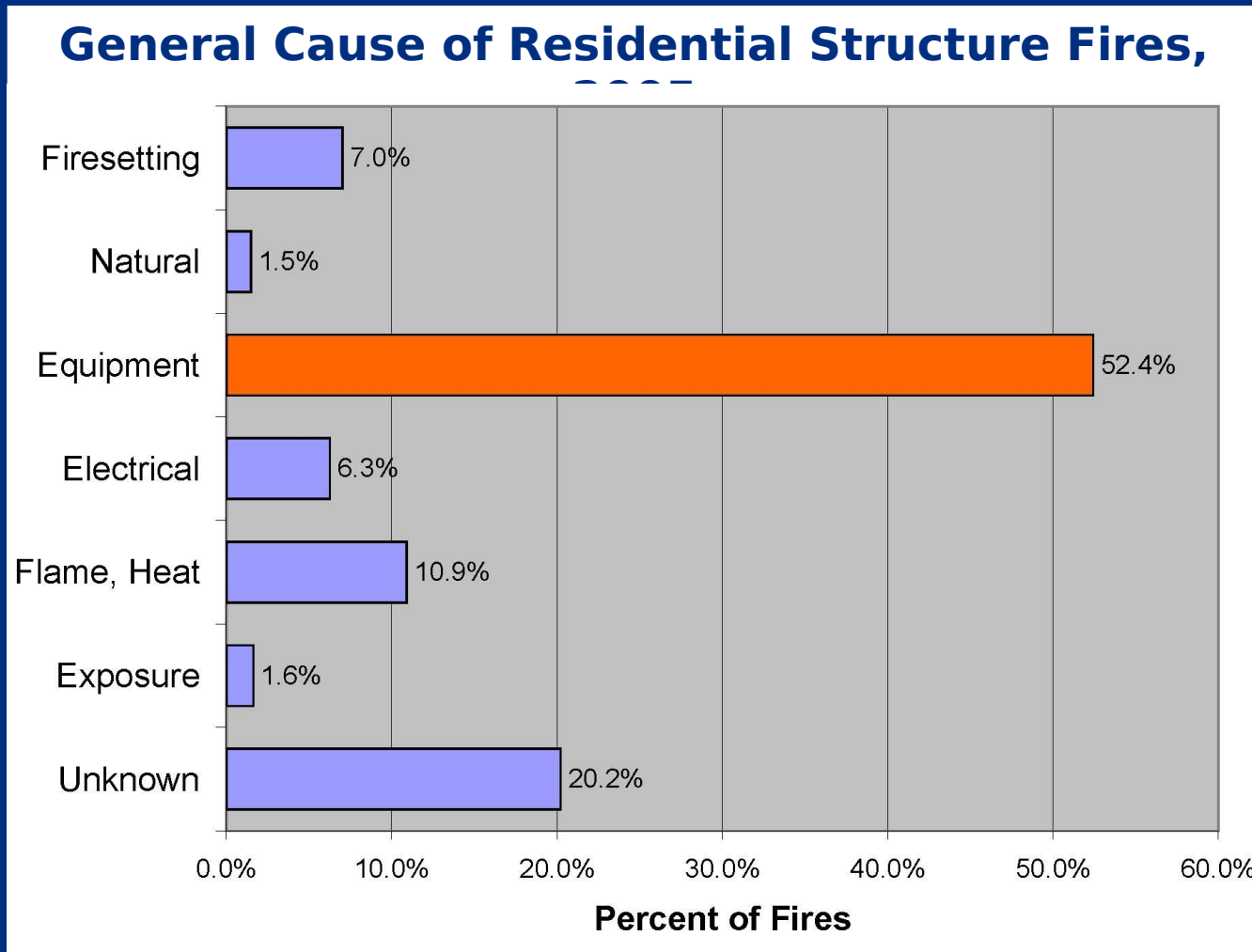
Hierarchy Matrix

- **Cause Category Methodology Matrix:**
http://www.nfirs.fema.gov/jsps/nfirsdownload.jsp?url=/_download/50causematrix01012004.xls

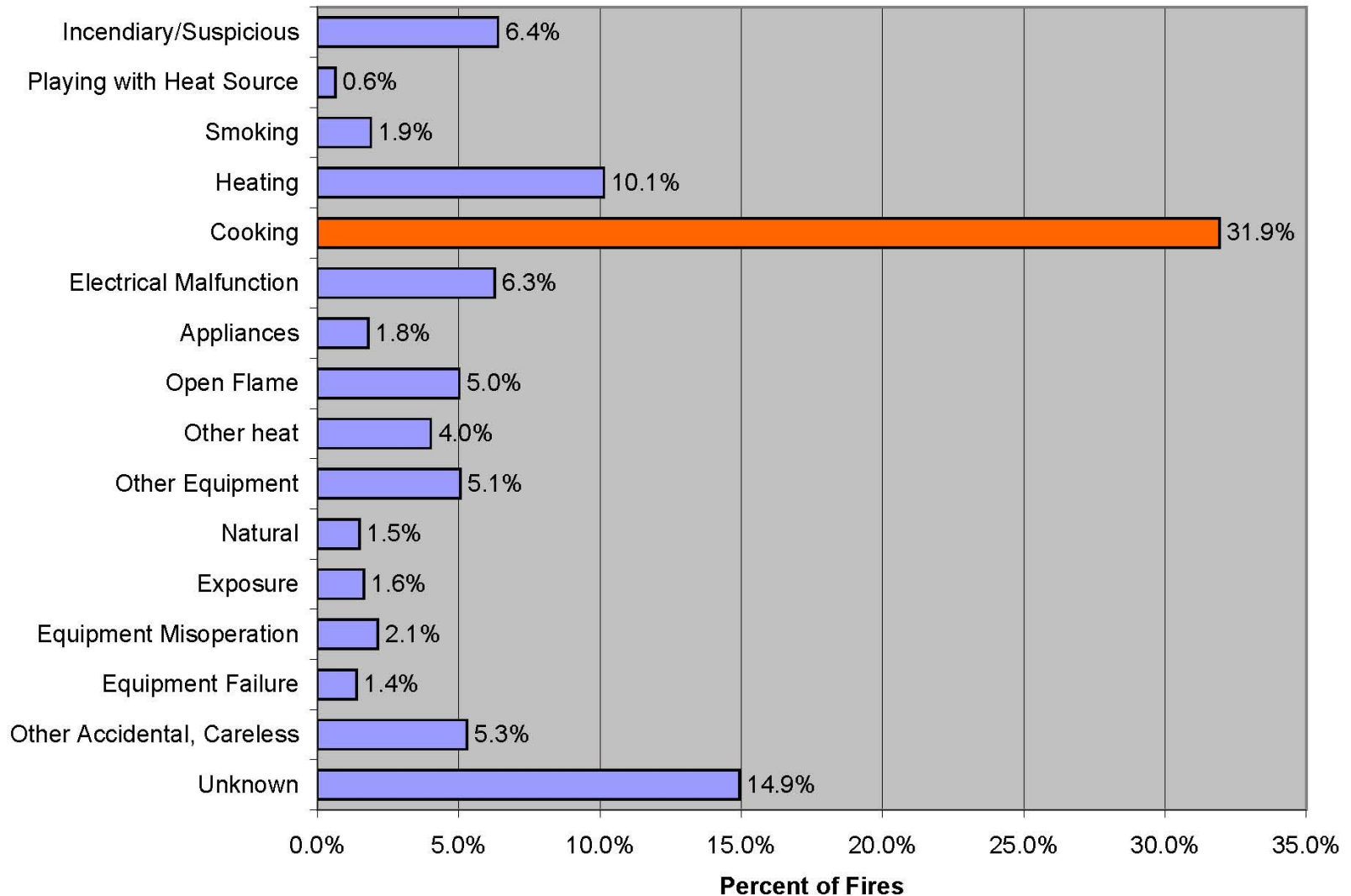
Code	Priority Cause Description	Code	Cause Description	Code	General Cause Description
04	Incendiary	01	Incendiary/Suspicious	01	Firesetting
04	Suspicious				
05	Children Playing	02	Playing with Heat Source		
05	Children Playing				
05	Children Playing				
36	Other Playing				
06	Natural	11	Natural	02	Natural
06	Natural 2				
11	Heating	04	Heating	03	Equipment
12	Cooking	05	Cooking		
13	Air Conditioning	07	Appliances		
15	Appliances				
16	Special Equip.	10	Other Equipment		
16	Special Equip.				
17	Processing Equip.				
19	Service Equip.				
20	Vehicle, Engine				
25	Unclassified fuel powered equip.				
25	Unclassified equip. w/ other or unknown fuel source				
22	Equipment Operation Deficiency	14	Equipment Misoperation		
23	Equipment Failure, Malfunction	15	Equipment Failure		
14	Electrical Dist.	06	Electrical Malfunction	04	Electrical
26	Unclassified elec malfunction				
07	Fireworks	09	Other heat	05	Flame, Heat
08	Explosives				
09	Smoking	03	Smoking		
18	Torches	08	Open Flame		
27	Matches, Candles				
28	Open fire				
31	Ember, rekindle				
29	Other open flame, spark	09	Other heat		
30	Friction, hot material				
32	Other hot object				
03	Exposure	12	Exposure	06	Exposure
33	Exposure 2				
24	Other Unintentional	16	Other Accidental, Careless	07	Unknown
21	Heat Source or Product Misuse				
34	Unknown 1	13	Unknown		
35	Unknown 2				
37	Trash, rubbish				



Examples: Fire Cause



Cause of Residential Structure Fires, 2005



Source: 2005 NFIRS 5.0 Data

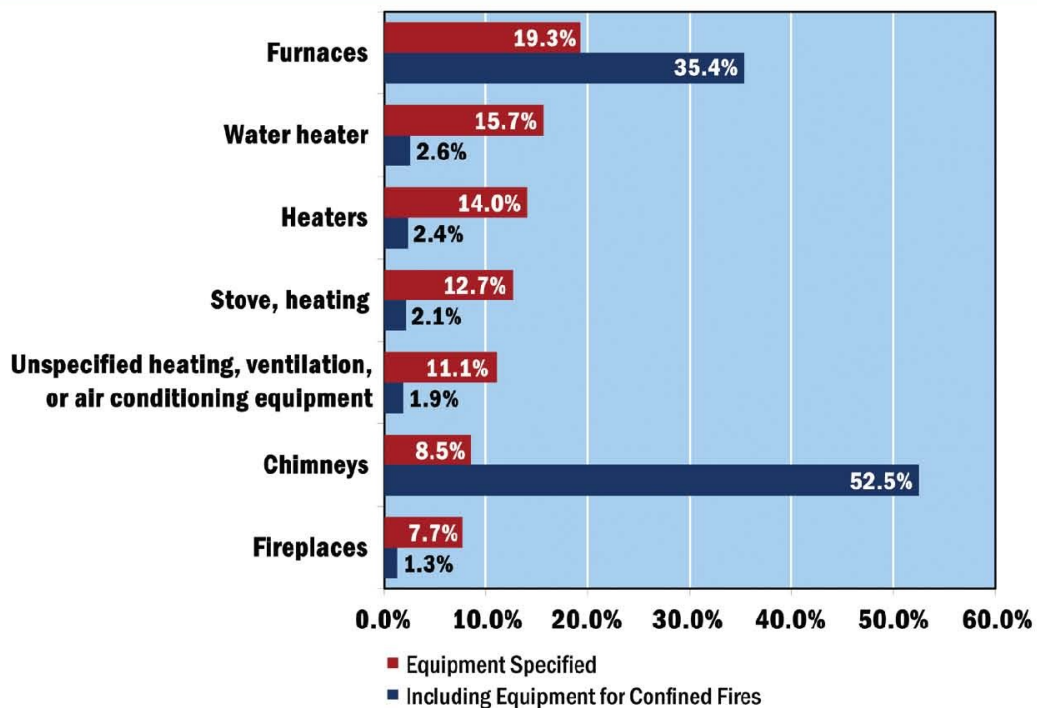


Homeland Security

HEATING FIRES IN RESIDENTIAL PROPERTIES ONLY

<u>Equipment</u>	<u>No. of Fire Incidents</u>	<u>% of Total</u>	<u>Dollar Loss</u>	<u>% of Total</u>
Fireplace/Chimney	240	62%	\$1,472,550	47%
Fixed Heating Units	65	17%	762,925	24%
Central Heating Units	61	16%	169,200	5%
Water Heaters	12	3%	208,000	7%
Portable Heaters	9	2%	464,000	15%
Other	3	1%	40,080	1%
Total	390	100%	\$3,116,755	100%

Figure 4: Leading Equipment Involved in Ignition of Residential Building Heating Fires
(residential buildings, 3-year average (2002-2004) NFIRS 5.0 data)



Note: Adjustments were made for heating stoves: NFIRS 5.0 data on item first ignited (cooking materials) suggested the equipment involved in ignition was a cooking stove. These 558 incidents were excluded from this analysis.

Source: 2002-2004 NFIRS 5.0 data



A Last Word: NFIRS Unknown Values and Missing Data

- **Unreported data**
- **Data reported as “unknown” or “undetermined”**
- **Adjusting for unknown data - adjusted percentages computed using only those incidents for which data were provided**



- **Decide focus**
- **Identify audience**
- **Determine data needs**
- **Determine appropriate analysis tools**
- **Determine appropriate data presentation**
- **Write clearly, keep focused**



Homeland
Security

Contact Information

Patricia Frazier, Director

Center for Data Analysis
and Special Studies
TriData, a Division of
System Planning
Corporation
(703) 351-8300
pfrazier@sysplan.com
www.sysplan.com

Gayle Kelch, Statistician

National Fire Data Center
U.S. Fire Administration
Federal Emergency
Management Agency
Department of Homeland
Security
(301) 447-1154
gayle.kelch@dhs.gov
www.usfa.fema.gov