



2009

PERFORMANCE REPORT

Spokane
FIRE DEPARTMENT

Table of Contents

<i>Preface</i>	2
<i>Agency Overview</i>	2
<i>Annual Performance Report</i>	3
Response Performance Objectives	3
Geographic Analysis	6
<i>Response Activity</i>	7
<i>Incident Concentration</i>	9
<i>Conclusion</i>	10
Status towards Department’s Performance Objectives	10
Status of Department’s Performance versus national standards	10
Monitoring of Performance	10
<i>Organizational Structure</i>	11
<i>Facilities</i>	12
<i>Response Resources</i>	13
<i>Policy Statement</i>	14
Emergency Response Functions	14
Response Standards	14
Critical Tasking	15
Alarm Assignments	18
<i>Predictable Consequences</i>	21
Response Performance and Outcomes	21
Dynamics of Fire in Buildings	21
Emergency Medical Event Sequence	23
Factors - People, Tools and Time	24

Preface

The City of Spokane Fire Department is required by RCW Chapter 35.103 to adopt and maintain a written statement or policy that establishes the following:

- The existence of a fire department
- Services that the fire department is required to provide
- The basic organizational structure of the fire department
- The expected number of fire department employees
- Functions that fire department employees are expected to perform

It is further required to establish response performance objectives for the various emergency services it provides. The city must report its performance against these established objectives annually and describe consequences that are predictable for those objectives it is not currently meeting. This document constitutes the required annual report as defined by statute.

Agency Overview

The Spokane Fire Department has existed as a fire protection agency within the State of Washington since 1884. The fire department is a unit of the City of Spokane general government as required of first class cities under Chapter 35.22 RCW. The City of Spokane is the second largest city in the State of Washington, located adjacent to the Idaho border, and has a Washington Survey and Rating Bureau (equivalent to the Insurance Services Office) rating of three.

The Spokane Fire Department's service area is approximately 59 square miles and consists of a mix of urban, suburban, industrial and wildland areas

The primary services provided by the Spokane Fire Department include:

- Fire Suppression
- First Response Basic Life Support (BLS) Emergency Medical Services
- First Response Advanced Life Support (ALS) Emergency Medical Services
- Public Education
- Fire Prevention (Inspection, Fire Protection Engineering Services, Investigations)
- Hazardous materials "Specialist Level" Response
- Special Rescue (Marine, Technical, and USAR)

Annual Performance Report

Response Performance Objectives

The following describes the adopted response time performance objectives established by the Spokane Fire Department and its performance during the evaluation period. The evaluation period is from January 1, 2009, through December 31, 2009, and includes evaluation of only potentially life-threatening emergency responses (11,480 total incidents).

1) Turnout time

The Spokane Fire Department has adopted a turnout time standard of ninety (90) seconds 90% of the time.

Actual department performance for the review period:

The Spokane Fire Department met the turnout time objective **61%** of the time. The Fire Department turnout time was 135 seconds, 90% of the time.

Total incidents – 27,296

2006	2007	2008	2009
66%	60%	61%	61%

2) Response time for arrival of the first arriving engine company at a fire suppression Incident

The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the first arriving fire engine, 90% of the time.

Actual department performance for the review period:

The Spokane Fire Department met the response time objective **87.1%** of the time. The Fire Department's response time for the first arriving fire engine to fire suppression incidents was eight minutes and forty nine seconds, 90% of the time.

Total fire suppression incidents – 1,666

2006	2007	2008	2009
92%	90.5%	90.6%	87.1%

3) Response time for arrival of the full first alarm assignment at a structure fire incident.

The Spokane Fire Department has adopted a response time objective of eleven (11) minutes for the arrival of the full first alarm assignment at structure fire incidents, 90% of the time.

Total structure fire incidents - 257

Actual department performance for the review period:

The Spokane Fire Department met the response time objective **78%** of the time. The Fire Department's response time for the first full alarm assignment to a structure fire was thirteen minutes and thirty nine seconds, 90% of the time.

2006	2007	2008	2009
76%	79%	83%	78%

4) Response time for the first fire department medical unit at an emergency medical (EMS) incident

The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the arrival of the first fire department unit at life-threatening emergency medical incidents, 90% of the time.

Total priority EMS incidents – 9,516

Actual department performance for the review period:

The Spokane Fire Department met the response time objective **94.7%** of the time. The Fire Department's response time for the first arriving fire department unit responding to a life-threatening emergency medical incident was seven minutes and five seconds, 90% of the time.

2006	2007	2008	2009
97.5%	96.3%	94.8%	94.7%

5) Response time for the first fire department advanced life support medical unit at a priority emergency medical (EMS) incident

The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the arrival of the first fire department advanced life support unit at life-threatening emergency medical incidents, 90% of the time.

Total priority EMS incidents – 9,516

Actual department performance for the review period

The Spokane Fire Department met the response time objective **91.5%** of the time. The Fire Department's response time for the first arriving fire department advanced life support unit responding to a life-threatening emergency medical incident was eight minutes and six seconds, 90% of the time.

2006	2007	2008	2009
92.4%	91.5%	94.4%	91.5%

6) Response time for arrival of the first fire department unit at a technical rescue incident

The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the arrival of the first fire department unit at a technical rescue incident, 90% of the time.

Total technical rescue incidents – 9

Actual department performance for the review period:

The Spokane Fire Department met the response time objective **95.6%** of the time. The Fire Department's response time for the first unit to arrive at a technical rescue incident was six minutes and seventeen seconds, 90% of the time.

2006	2007	2008	2009
100%	96%	100%	95.6%

7) Response time for arrival of the first fire department unit at a marine technical rescue incident.

The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the arrival of the first fire department unit at a marine technical rescue incident, 90% of the time.

Total marine rescue incidents – 7

Actual department performance for the review period:

The Spokane Fire Department met the response time objective **73%** of the time. The Fire Department's response time for the first arriving unit at a marine rescue incident was eleven minutes and thirty three seconds, 90% of the time.

2006	2007	2008	2009
88%	65%	41%	73%

8) Response time for arrival of the first fire department unit at a hazardous materials incident.

The Spokane Fire Department has adopted a response time objective of nine (9) minutes for the arrival of **the** first fire department unit at a hazardous materials incident, 90% of the time.

Total hazardous materials incidents – 42

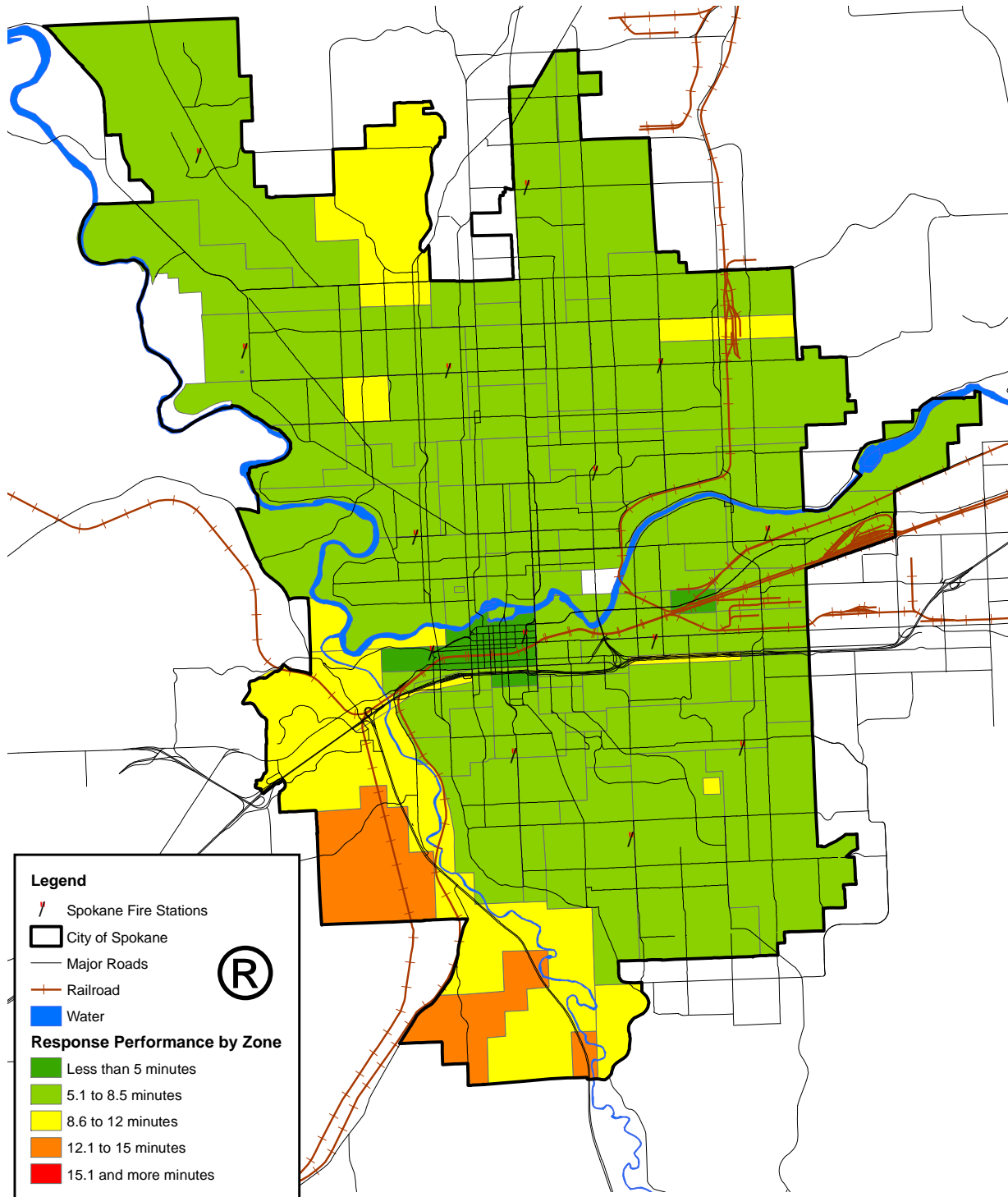
Actual department performance for the review period:

The Spokane Fire Department met the response time objective **96%** of the time. The Fire Department's response time for the first arriving unit at a hazardous materials incident was eight minutes and seventeen seconds, 90% of the time.

2006	2007	2008	2009
100%	92%	92%	96%

Geographic Analysis

The following map shows the city and response time performance at the 90th percentile for priority incidents within specific geographic regions. Response service is uniformly provided throughout the majority of the service area with the significant exception of the south-southwest portion of the city west of the river.



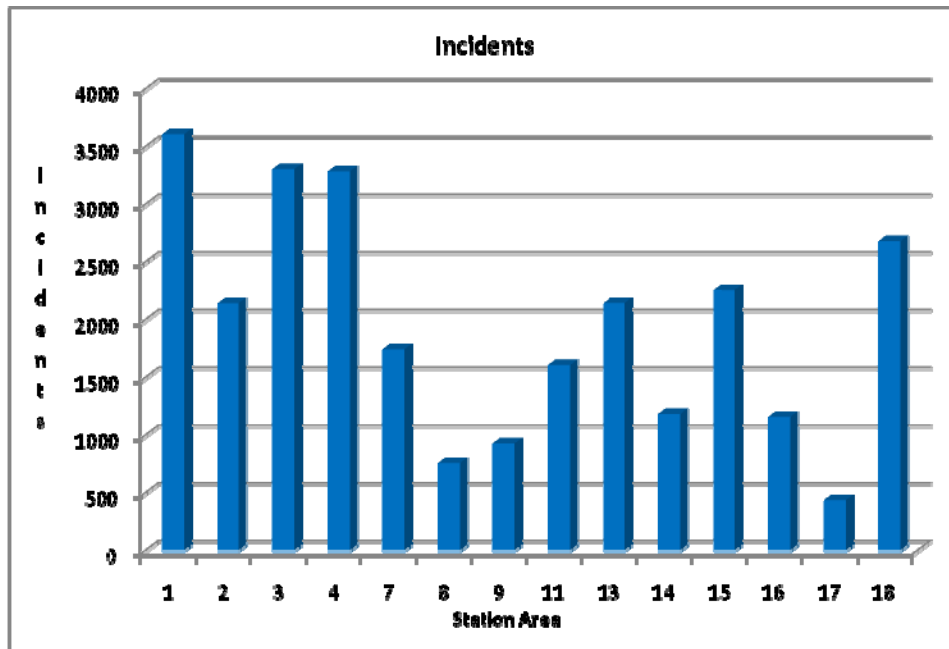
Response Activity

Total fire department responses in 2009 were as follows:

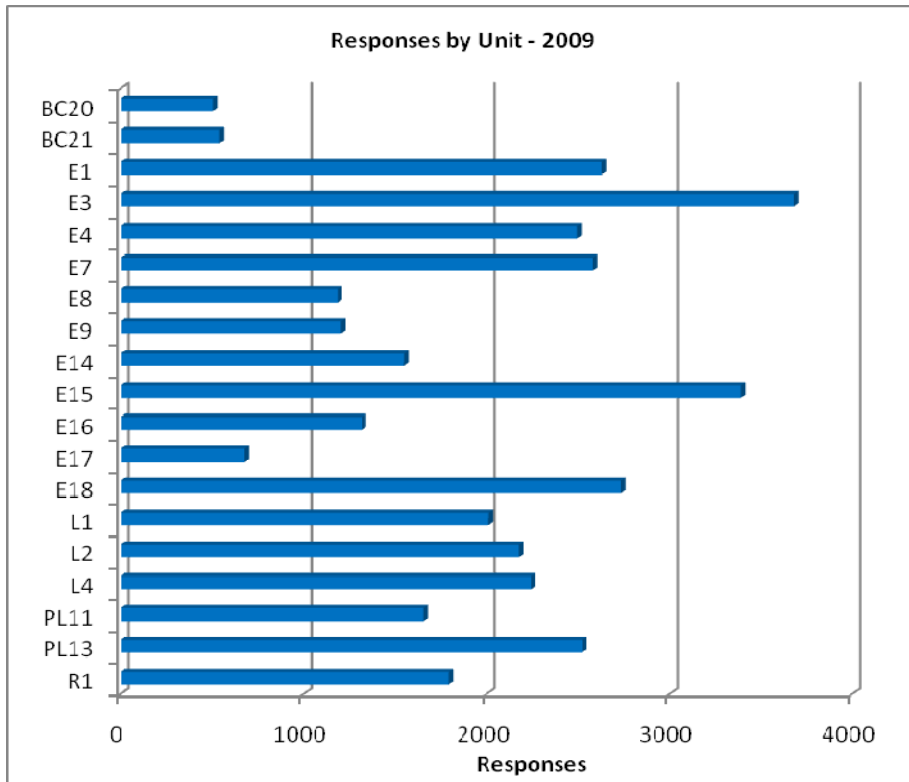
Incident Type at Time of Dispatch

Structure fire	370
Wildland fire	172
Vehicle fire	172
Other fire	1027
EMS non-priority	11626
EMS priority	9516
Motor vehicle accident	1983
Rescue	44
Fire alarm activation	1706
Hazardous materials	294
Public service	386
TOTAL	27296

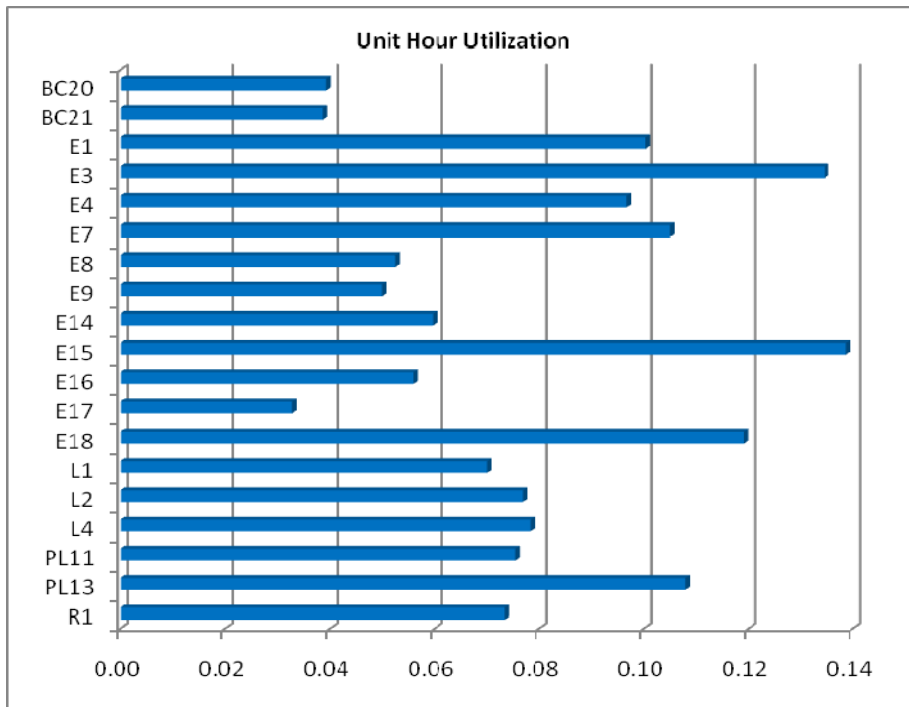
Responses during 2009 broken down by fire station service area are shown in the following chart.



Responses by unit during 2009 are shown in the following chart. Workload varied considerably between units.

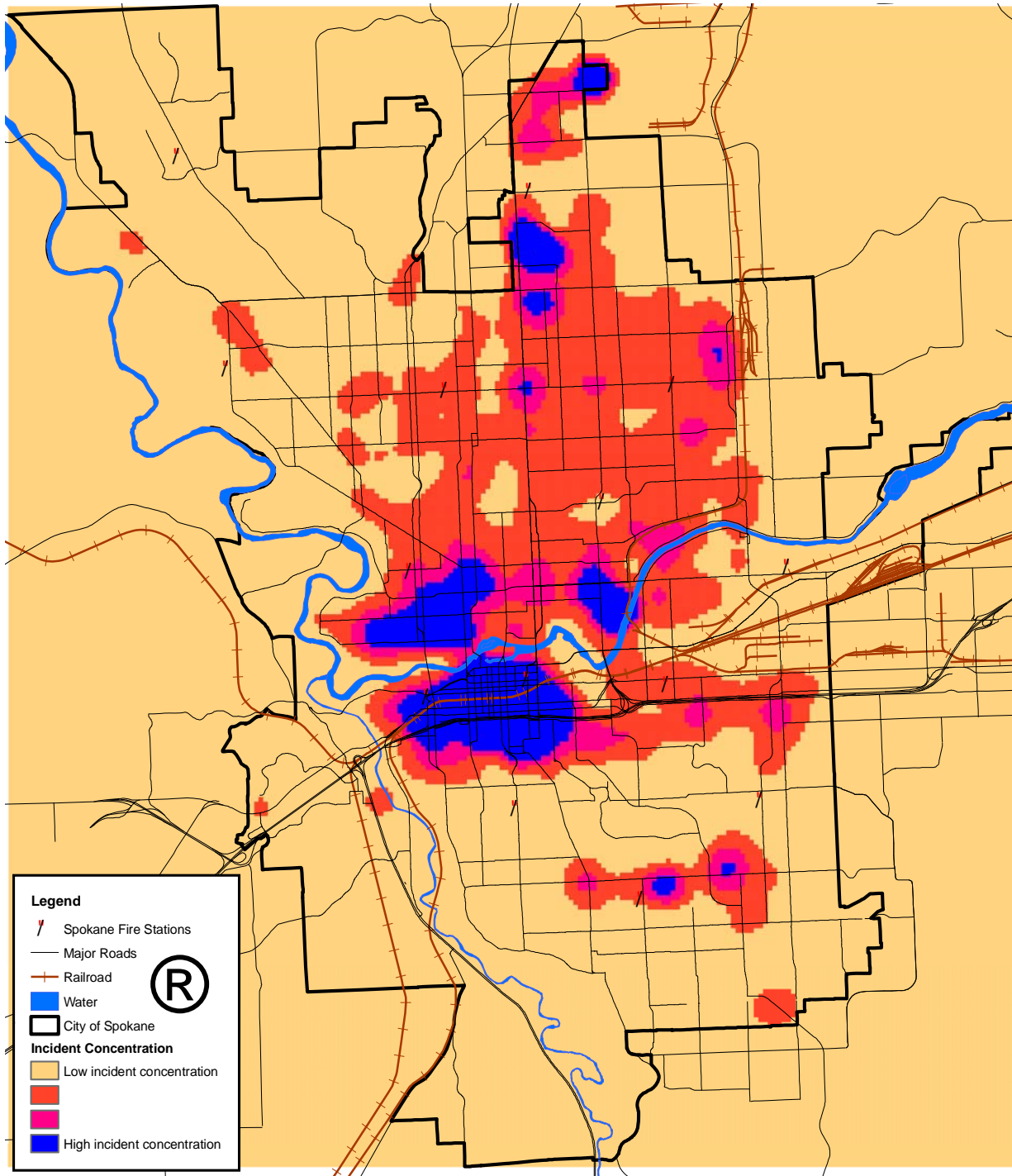


The time committed to responses by each unit is illustrated below. Unit hour utilization represents the amount of a unit's available time it was committed on responses.



Incident Concentration

Response activity tends to be greatest in areas of higher population density. The City of Spokane incident concentration for 2009 follows this trend as shown in the following map.



Conclusion

Status towards Department’s Performance Objectives

The Spokane Fire Department’s adopted performance objectives are being met with three exceptions.

- Turnout time (Actual - 135 seconds, 90% of the time. Target - 90 seconds, 90% of the time)
- Arrival of the first arriving engine company at a fire suppression incident (Actual – 8:49, 90% of the time. Target – 8:30, 90% of the time)
- Arrival of the full first alarm assignment on a structure fire (Actual – 13:39, 90% of the time. Target - 11:00, 90% of the time)
- Arrival of first unit at a marine rescue (Actual – 11:33, 90% of the time. Target – 8:30, 90% of the time)

Status of Department’s Performance versus national standards

The National Fire Protection Association (NFPA) is a non-profit organization that, as a part of its mission, develops standards that are utilized by the fire service. Unless adopted by federal, state, or local law, NFPA standards are voluntary and therefore are not mandated on individual agencies. They act as a guide or best practice.

The NFPA Standard that is utilized by career fire departments for evaluation of response capabilities is NFPA 1710, “Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments.” This standard contains numerous performance objectives for staffing and service delivery times.

The Department’s turnout time, fire, and emergency medical service response time performance objectives are not the same as those outlined in NFPA 1710. The Department’s performance objectives, in most cases, include longer times than those in 1710. A comparison is shown in the following table. All times are measured at the 90th percentile.

Performance Element	Spokane Objective	Spokane Actual	NFPA 1710 Objective
Turnout Time	90 seconds	135 seconds	Fire - 80 seconds EMS – 60 seconds
First unit arrival on a fire incident	8 min 30 sec	8 min 49 sec	5 minutes
Full first alarm assignment at a structure fire	11 minutes	13 min 39 sec	9 minutes
First unit at an emergency medical incident	8 min 30 sec	7 min 5 sec	5 minutes
First ALS unit at an emergency medical incident	8 min 30 sec	8 min 6 sec	9 minutes

Given the current resources and funding levels, the Department would not be able to achieve NFPA 1710 standard compliance for staffing or services delivery performance objectives except for the first advanced life support unit arrival at an emergency medical incident.

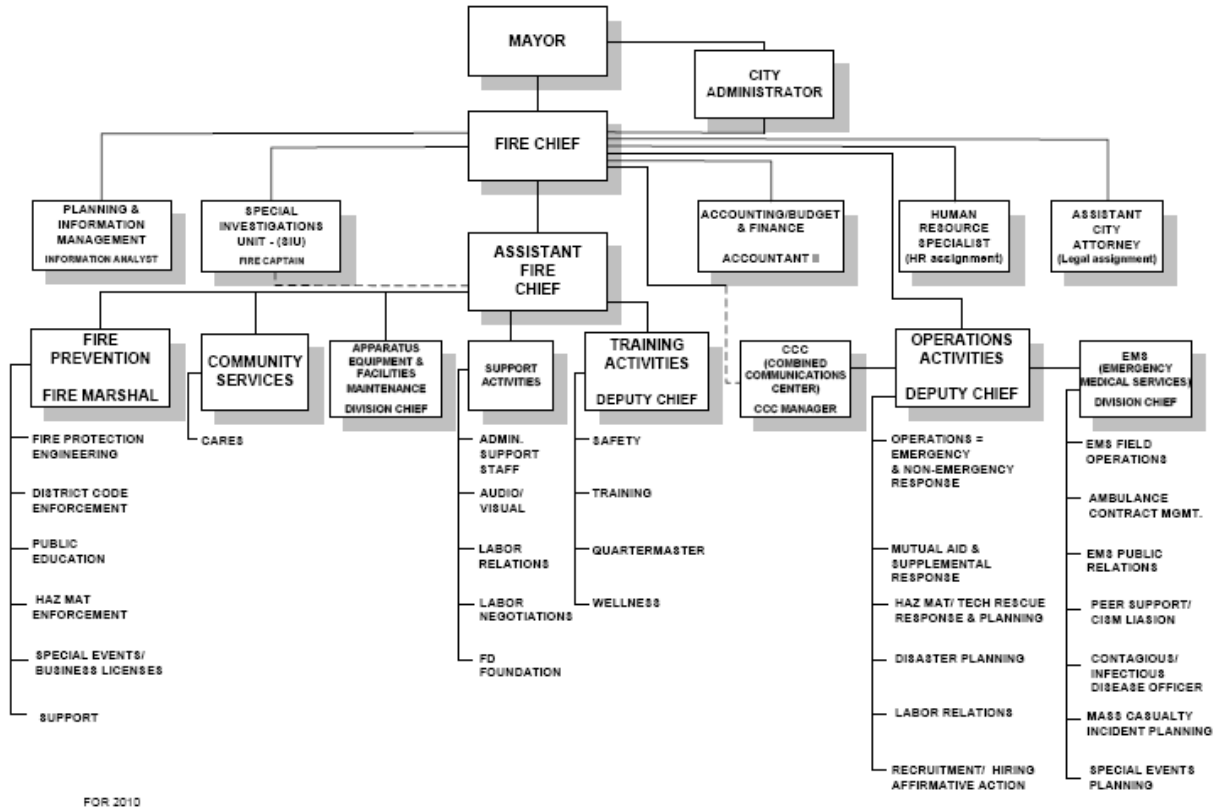
Monitoring of Performance

The Department routinely monitors its performance in relation to performance objectives. Utilizing computer modeling and analysis, the department regularly evaluates modifications to apparatus and personnel deployment to assess possible service delivery improvements. The Department is committed to providing the best service possible to the community, with the resources provided.

Organizational Structure

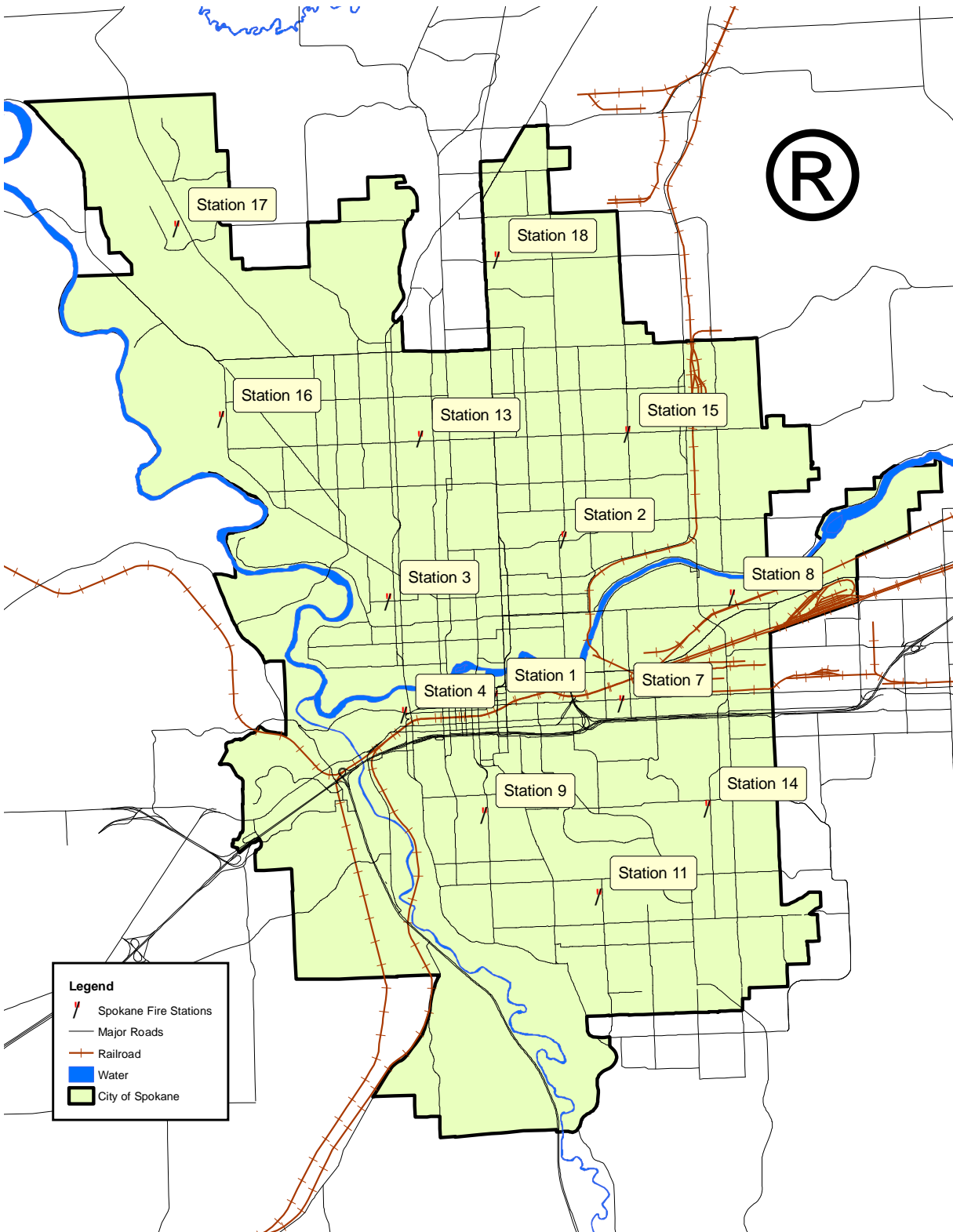
The Spokane Fire Department operates under a hierarchical chain of command. The chain of command, or organizational chart, and authorized staffing are described in the following chart.

SPOKANE FIRE DEPARTMENT ORGANIZATIONAL STRUCTURE



Facilities

The Spokane Fire Department provides emergency response service from 14 locations. The following map shows these sites in relation to the city boundaries.



Response Resources

The table below lists each station along with the apparatus and personnel assigned to them, type of unit, and level of emergency medical service capability. In total, the SFD provides no less than 58 on-duty response personnel. "X" indicates the unit is cross-staffed by personnel as needed.

Station	Year	Apparatus	Unit #	Class	Staffing	ALS
1	2009	PIERCE PUMPER	E1	Structural engine	3	Yes
	1993	SIMON DUPEX AERIAL	L1	Ladder	4	
	2001	PIERCE RESCUE	R1	Rescue	2	
	2001	KENWORTH RESCUE	Haz Mat	Hazardous Materials Unit	X	
	2004	FORD F550 4X4	HAZ-1	Decontamination unit	X	
	2007	CHEV 4X4 SUBURBAN	BC1	Battalion Chief	1	
2	2005	PIERCE PLATFORM	L2	Ladder	4	
	2002	FORD F350 4X4	R2	Rescue	X	
3	2009	PIERCE PUMPER	E3	Structural engine	4	Yes
4	2009	PIERCE PUMPER	E4	Structural engine	3	Yes
	2004	PIERCE AERIAL	L4	Ladder	4	
	2000	INTERNATIONAL TRACTOR/TRAILER	SUSAR	USAR	X	
	1987	KENWORTH RESCUE	R4	Rescue	X	
7	2001	PIERCE PUMPER	E7	Structural engine	3	Yes
	2004	FORD F550 4X4	B7	Brush engine	X	
	1992	CENTRAL STATES PUMPER	E51	Reserve structural engine		
8	2000	PIERCE PUMPER	E8	Structural engine	3	
	1991	CENTRAL STATES PUMPER	E54	Reserve structural engine		
	2004	FORD F550 4X4	B8	Brush engine	X	
9	2000	PIERCE PUMPER	E9	Structural engine	3	
	1991	CENTRAL STATES PUMPER	E55	Reserve structural engine		
	2004	FORD F550 4X4	B9	Brush engine	X	
11	1993	PIERCE PUMPER LADDER	PL11	Ladder-Structural engine combination	4	Yes
	1999	FORD F350 4X4	M52	Reserve medic unit		
	2003	FORD F550 4X4	B11	Brush engine	X	
13	1992	PIERCE PUMPER LADDER	PL13	Ladder-Structural engine combination	4	Yes
	2002	FORD F350 4X4	M51	Reserve medic unit		
	2009	CHEV F2500 4 X 4 PU	BC2	Battalion Chief	1	
14	2000	PIERCE PUMPER	E14	Structural engine	3	
	2004	FORD F550 4X4	B14	Brush engine	X	
15	2009	PIERCE PUMPER	E15	Structural engine	3	Yes
	2003	FORD F550 4X4	B15	Brush engine	X	
16	2000	PIERCE PUMPER	E16	Structural engine	3	
	1991	FORD F350 4X4	R16	Rescue	X	
	2004	FORD F550 4X4	B16	Brush engine	X	
	1991	CENTRAL STATES PUMPER	E52	Reserve structural engine		
17	1999	CENTRAL STATES PUMPER (Freightliner)	E17	Structural engine	3	
	2003	FORD F550 4X4	B17	Brush engine	X	
	1991	CENTRAL STATES PUMPER	E53	Reserve structural engine		
18	2000	PIERCE PUMPER	E18	Structural engine	3	Yes
	1978	AMERICAN LAFRANCE AERIAL	L51	Reserve ladder		

Policy Statement

Emergency Response Functions

The primary emergency response functions performed by the Spokane Fire Department include the following:

- 1) Suppression of fires in buildings, vehicles, natural vegetation, and other property
- 2) Emergency medical response at both the basic life support and advanced life support level
- 3) Technical rescue and extrication (USAR Type III)
- 4) Marine rescue
- 5) Hazardous materials emergency response and control (Type I)

Response Standards

There are several component parts to response standards for which objectives are established. The Spokane Fire Department has established the following response time objectives for its services.

- 1) **Turnout time** – the period of time from initial dispatch to initiation of travel towards the incident.
The Spokane Fire Department has adopted a turnout time standard of ninety (90) seconds, 90% of the time.
- 2) **Response time for the first arriving engine company at a fire suppression incident** – the period from notification of fire department response personnel of the incident to the arrival of the first unit at the scene of the incident.
The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the first arriving fire engine, 90% of the time.
- 3) **Response time for full first alarm assignment at a structure fire incident** - the period of time from notification of fire department response personnel of the incident to the arrival of all of the first alarm units at the scene of the incident.
The Spokane Fire Department has adopted a response time objective of eleven (11) minutes for the arrival of the full first alarm assignment at structure fire incidents, 90% of the time.
- 4) **Response time for the first fire department medical unit at an emergency medical (EMS) incident** – the period from notification of fire department response personnel of the EMS incident to the arrival of the first fire department unit at the scene of the incident.
The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the arrival of the first fire department unit at life-threatening emergency medical incidents, 90% of the time.
- 5) **Response time for the first fire department advanced life support medical unit at a priority emergency medical (EMS) incident** – the period from notification of fire department response personnel of the EMS incident to the arrival of the first fire department advanced life support unit at the scene of the incident.
The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the arrival of the first fire department advanced life support unit at life-threatening emergency medical incidents, 90% of the time.



- 6) Response time for arrival of the first fire department unit at a technical rescue incident** – the period from notification of fire department response personnel of the technical rescue incident to the arrival of the first fire department unit.

The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the arrival of the first fire department unit at a technical rescue incident, 90% of the time.

- 7) Response time for arrival of the first fire department unit at a marine technical rescue incident** – the period from notification of fire department response personnel of the marine rescue incident to the arrival of the first fire department unit.

The Spokane Fire Department has adopted a response time objective of eight minutes and thirty seconds (8:30) for the arrival of the first fire department unit, 90% of the time.

- 8) Response time for arrival of first fire department unit at a hazardous materials incident** – the period from notification of fire department response personnel of the hazardous materials incident to the arrival of the first fire department unit.

The Spokane Fire Department has adopted a response time objective of nine (9) minutes for the arrival of the first fire department unit, 90% of the time.

Critical Tasking

Critical tasks are those activities that must be conducted in a timely manner by firefighters at emergency incidents in order to control the situation, stop loss, and to perform necessary tasks required for a medical emergency. The Spokane Fire Department is responsible for assuring that responding companies are capable of performing all of the described tasks in a prompt, efficient, and safe manner.

Fires - Critical tasking for fire operations is the minimum number of personnel to perform the tasks required to effectively control a fire in the listed risk category. Major fires (beyond first alarm) will require additional personnel and apparatus.

Emergency Medical – Critical tasking for emergency medical incidents is the minimum number of personnel to perform the tasks required to support the identified strategy based on the department’s adopted medical protocol.

Low Rise Residential Structure Fire (Structure under 55 feet in height)

Task	Number of Personnel
Command/Safety	3
Pump Operations	1
Attack Line	2
Search and Rescue	2
Ventilation	2
RIT	3
Other (hydrant and back up line)	3
Total	16

High Rise Residential Structure Fire (Structure over 55 feet in height)

Task	Number of Personnel
Command/Safety	3
Pump Operations	2
Attack Line	4
Search and Rescue	4
Ventilation	4
RIT	4
Other (hydrant and back up line)	4
Total	25

Moderate Risk Commercial Structure Fire

Task	Number of Personnel
Command/Safety	3
Pump Operations	2
Attack Line	4
Search and Rescue	4
Ventilation	4
RIT	2
Other (back up line)	4
Total	23

High Risk Commercial Structure Fire

Task	Number of Personnel
Command/Safety	3
Pump Operations	2
Attack Line	4
Search and Rescue	4
Ventilation	4
RIT	4
Other (back up line)	4
Total	25

Grass/Brush Fire (Not threatening structures)

Task	Number of Personnel
Command/Safety	1
Pump Operations	
Attack Line	2
Other	
Total	3

Vehicle Fire (Not threatening structures)

Task	Number of Personnel
Command/Safety	1
Pump Operations	1
Attack Line	1
Other	
Total	3

Emergency Medical (Non-life threatening)

Task	Number of Personnel
Patient Management	
Patient Care	2
Documentation	1
Total	3

Motor Vehicle Accident (With patient extrication)

Task	Number of Personnel	
	Surface street	Freeway
Scene Management	1	1
Patient Care	3	3
Extrication	4	4
Fire Protection	3	3
Documentation	1	1
Other (safety)	1	1
Total	13	13

Motor Vehicle Accident (No patient extrication)

Task	Number of Personnel	
	Surface street	Freeway
Scene Management	1	1
Patient Care	2	2
Extrication		
Fire Protection		
Documentation		
Other		
Total	3	3

Hazardous Materials

Task	Number of Personnel
Command/Safety	4
Entry Team	2
Backup Team	2
Decontamination	4
Research	1
Support	6
Other (medical)	1
Total	20

Technical Rescue

Task	Number of Personnel
Command/Safety	3
Operations	14
Patient Management	3
Documentation	1
Total	21

Marine

Task	Number of Personnel
Command/Safety	3
Operations	10
Patient Management	3
Documentation	1
Total	17

Alarm Assignments

In order to ensure sufficient personnel and apparatus are dispatched to an emergency event, the following first alarm response assignments have been established. "Total Staffing Needed" is the number identified in the Critical Tasking analysis above.

Low Rise Residential Fire (Structure under 55 feet in height)

Unit Type	Number of Units	Total Personnel
Engine	3	9-11
Senior Ladder	1	4
Rescue	1	2
Squad		
Battalion Chief	2	2
Total Staffing Provided		17-19
Total Staffing Needed		16

High Rise Residential Fire (Structure over 55 feet in height)

Unit Type	Number of Units	Total Personnel
Engine	4	12-14
Senior Ladder	2	8
Rescue	1	2
Squad		
Battalion Chief	2	2
Total Staffing Provided		24-26
Total Staffing Needed		25

Moderate Risk Commercial Fire

Unit Type	Number of Units	Total Personnel
Engine	4	12-14
Senior Ladder	2	8
Rescue	1	2
Squad		
Battalion Chief	2	2
Total Staffing Provided		24-26
Total Staffing Needed		23

High Risk Commercial Fire

Unit Type	Number of Units	Total Personnel
Engine	4	12-14
Senior Ladder	2	8
Rescue	1	2
Squad		
Battalion Chief	2	2
Total Staffing Provided		24-26
Total Staffing Needed		25

Grass/Brush Fire (Not threatening structures)

Unit Type	Number of Units	Total Personnel
Engine	1	3-4
Senior Ladder		
Rescue		
Squad		
Battalion Chief		
Total Staffing Provided		3-4
Total Staffing Needed		3

Vehicle Fire (Not threatening structures)

Unit Type	Number of Units	Total Personnel
Engine	1	3-4
Senior Ladder		
Rescue		
Squad		
Battalion Chief		
Total Staffing Provided		3-4
Total Staffing Needed		3

Emergency Medical (Non-life threatening)

Unit Type	Number of Units	Total Personnel
Engine	1	3-4
Senior Ladder		
Rescue		
Squad		
Battalion Chief		
Total Staffing Provided		3-4
Total Staffing Needed		3

Emergency Medical (Life threatening)

Unit Type	Number of Units	Total Personnel
Engine	2	6-8
Senior Ladder		
Rescue		
Squad		
Battalion Chief		
Total Staffing Provided		6-8
Total Staffing Needed		6

Motor Vehicle Accident (With patient extrication)

Unit Type	Number of Units		Total Personnel	
	Surface street	Freeway	Surface street	Freeway
Engine	1-2	1-2	6-8	6-8
Senior Ladder	1	1	4	4
Rescue	1	1	2	2
Squad				
Battalion Chief	2	2	2	2
Total Staffing Provided			14-16	14-16
Total Staffing Needed			13	13

Motor Vehicle Accident (No patient extrication)

Unit Type	Number of Units		Total Personnel	
	Surface street	Freeway	Surface street	Freeway
Engine	1	1	3-4	3-4
Senior Ladder				
Rescue				
Squad				
Battalion Chief				
Total Staffing Provided			3-4	3-4
Total Staffing Needed			3	3

Hazardous Materials

Unit Type	Number of Units	Total Personnel
Engine	3	9-10
Senior Ladder	1	4
Rescue	1	2
Squad		
Hazardous materials unit	2	4
Battalion Chief	2	2
Total Staffing Provided		20-21
Total Staffing Needed		20

Technical Rescue

Unit Type	Number of Units	Total Personnel
Engine	3	9-10
Senior Ladder	2	6
Rescue	1	2
Squad (tech rescue unit)	1	2
Battalion Chief	2	2
Total Staffing Provided		20-21
Total Staffing Needed		21

Marine Rescue

Unit Type	Number of Units	Total Personnel
Engine	1	3
Senior Ladder	2	4
Squad (marine rescue unit)	1	6
Rescue	1	2
Battalion Chief	1	2
Total Staffing Provided		17
Total Staffing Needed		17

Predictable Consequences

The following describes the sequence of events involved with a fire in a structure and with cardiac arrest, a significant medical emergency. These explain the importance of response time in creating an effective outcome to an emergency and the results if response is delayed.

Response Performance and Outcomes

The ultimate goal of any emergency service delivery system is to provide sufficient resources (personnel, apparatus, and equipment) to the scene of an emergency in time to take effective action to minimize the impacts of the emergency. This need applies to fires, medical emergencies, and any other emergency situation to which the fire department responds.

Dynamics of Fire in Buildings

Most fires within buildings develop in a predictable fashion, unless influenced by highly flammable material or liquids. Ignition, or the beginning of a fire, starts the sequence of events. It may take some minutes or even hours from the time of ignition until flame is visible. This smoldering stage is very dangerous, especially during times when people are sleeping, since large amounts of highly toxic smoke may be generated during early phases.

Once flames do appear, the sequence develops rapidly. Combustible material adjacent to the flame heats and ignites which in turn heats and ignites other adjacent materials if sufficient oxygen is present. As the objects burn, heated gases accumulate at the ceiling of the room. Some of the gases are flammable and are highly toxic.

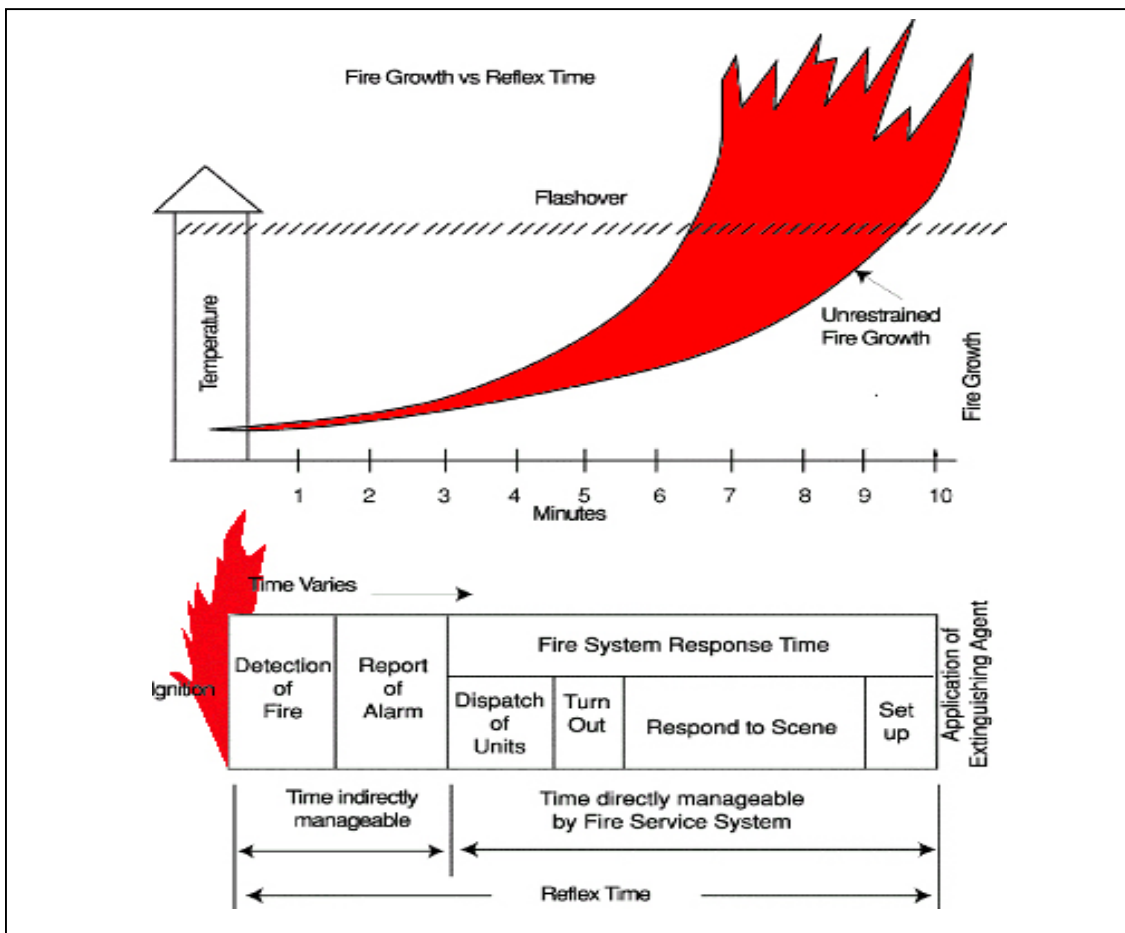
The spread of the fire continues quickly. Soon the flammable gases at the ceiling reach ignition temperature. At that point, an event termed “flashover” takes place; the gases ignite, which in turn ignites everything in the room. Once flashover occurs, damage caused by the fire is significant and the environment within the room can no longer support human life.

Flashover usually happens about five to eight minutes from the appearance of flame in typically furnished and ventilated buildings. Since flashover has such a dramatic influence on the outcome of a fire event, the goal of any fire agency is to apply water to a fire before flashover takes place.

Perhaps as important as preventing flashover is the need to control a fire before it does damage to the structural framing of a building. Materials used to construct buildings today are often less fire resistive than the heavy structural skeletons of older frame buildings. Roof trusses and floor joists are commonly made with lighter materials more easily weakened by the effects of fire. “Light weight” roof trusses can fail after five to seven minutes of direct flame impingement. Plywood I-beam joists can fail after as little as three minutes of flame contact. This creates a very dangerous environment for firefighters.

In addition, the contents of buildings today have a much greater potential for heat and smoke production than in the past. The widespread use of plastics in furnishings and other building contents rapidly accelerates fire spread and increases the amount of water needed to effectively control a fire. All of these factors make the need for early application of water essential to a successful fire outcome.

A number of things must happen quickly to make it possible to achieve fire suppression prior to flashover. The following figure illustrates the sequence of events.



Source: Commission on Fire Accreditation, International

The reflex time continuum consists of six steps, beginning with ignition and concluding with the application of (usually) water. The time required for each of the six components varies. The policies and practices of the fire department directly influence four of the steps, but two are only indirectly manageable.

The six parts of the continuum are:

1. **Detection:** The detection of a fire may occur immediately if someone happens to be present or if an automatic fire detection or fire suppression system is functioning. Otherwise, detection may be delayed, sometimes for a considerable period.
2. **Report:** Today most fires are reported by telephone to the 9-1-1 center. Call takers must quickly elicit accurate information about the nature and location of the fire from persons who are apt to be excited. A citizen well trained in how to report emergencies can reduce the time required for this phase.
3. **Dispatch:** The dispatcher must identify the correct fire units, subsequently dispatch them to the emergency, and continue to update information about the emergency while the units respond. This step offers a number of technological opportunities to speed the process including computer aided dispatch and global positioning systems.
4. **Turnout:** Firefighters must don firefighting protective clothing, assemble on the response vehicle, and begin travel to the fire. Good training and proper fire station design can minimize the time required for this step.
5. **Travel:** This is potentially the longest phase of the continuum. The distance between the fire station and the location of the emergency influences reflex time the most. The quality and connectivity of streets, traffic, driver training, geography, and environmental conditions are also factors.

- Set up: Once firefighters arrive on the scene of a fire emergency, fire apparatus are positioned, breathing apparatus donned, hose lines stretched out, additional equipment assembled, and certain preliminary tasks are performed (such as ventilation) before entry is made into the structure and water is applied to the fire.

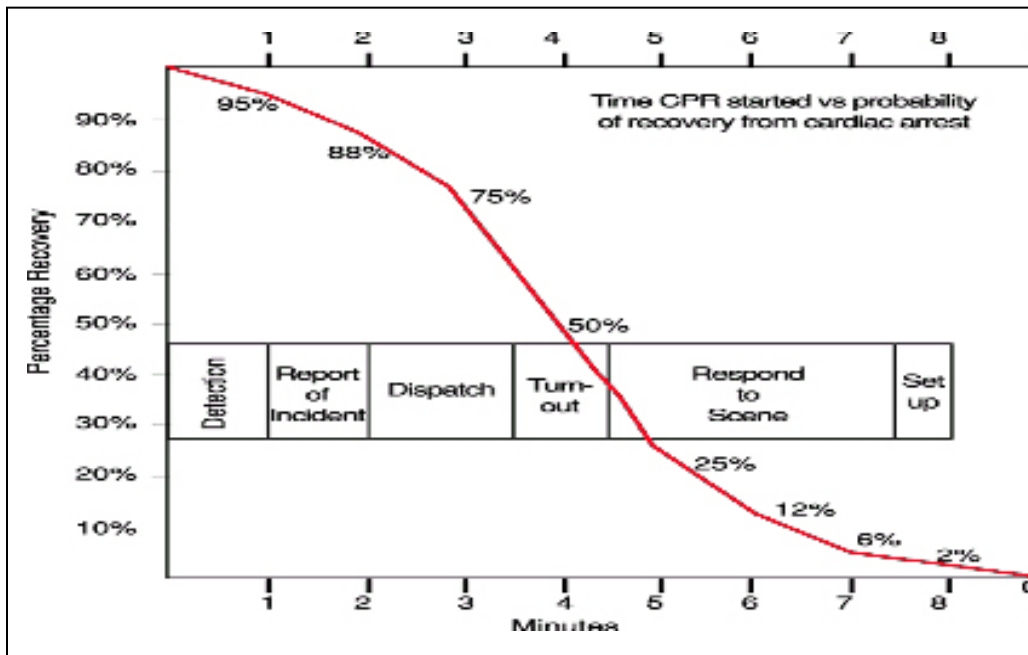
As is apparent by this description of the sequence of events, application of water in time to prevent flashover is a serious challenge for any fire department. It is reasonable though, to use the continuum as a tool in designing the emergency response system.

Emergency Medical Event Sequence

Cardiac arrest is generally used as the prototypical life-threatening medical event. A victim of cardiac arrest has mere minutes in which to receive definitive lifesaving care if there is to be any hope for resuscitation.

Heart attack survival chances fall by seven to ten percent for every minute between collapse and defibrillation. Consequently, American Heart Association guidelines now recommend the administration of cardiac defibrillation accompanied by effective cardio pulmonary resuscitation (CPR) as quickly as possible following cardiac arrest.

As with fires, the sequence of events that leads to emergency cardiac care can be visually shown, as in the following figure.



Source: American Heart Association

The probability of recovery from cardiac arrest drops quickly as time progresses. The stages of medical response are very similar to the components described for a fire response.

Research stresses the importance of rapid cardiac defibrillation and administration of certain drugs as a means of improving the opportunity for successful resuscitation and survival. An Oregon fire department studied the effect of time on cardiac arrest resuscitation and found that nearly all of their “saves” were within 1.5 miles of a fire station, underscoring the importance of quick response.

Factors - People, Tools and Time

Time matters a great deal in the achievement of an effective outcome to an emergency event. Time, however, isn't the only factor. Delivering sufficient numbers of properly trained and appropriately equipped personnel within the critical time period completes the equation.

For medical emergencies, this will vary based on the nature of the emergency. Most medical emergencies are not as time critical as structure fires. However, for serious trauma, cardiac arrest, or conditions that may lead to cardiac arrest, response time can be very critical.

Equally critical is delivering a sufficient complement of personnel to the scene to perform all concurrent tasks required to deliver quality emergency care. For a cardiac arrest, this can be up to six personnel: two to perform CPR, two to set up and operate advanced medical equipment, one to record the actions taken by emergency care workers, and one to direct and provide advanced patient care. Thus, for a medical emergency the real test of performance is the time it takes to provide the personnel and equipment needed to deal effectively with the patient's condition, not necessarily the time it takes for the first person to arrive.

Fire emergencies are even more resource critical. Again, the true test of performance is the time it takes to deliver sufficient personnel to initiate application of water on the fire. This is the only practical method to reverse the continuing internal temperature increases and ultimately prevent flashover. The arrival of one person with a portable radio does not provide fire intervention capability and should not be counted as "arrival" by the fire department.

Industry standards and worker safety regulations require that at least four personnel must be on scene to conduct interior firefighting operations. The initial arrival of effective resources should be marked as the point in time when at least four personnel, properly trained and equipped, have assembled at the fire.

Effective operations at the scene of fire emergencies also depend on the arrival of sufficient trained and equipped personnel to perform all of the duties and tasks required to control a fire event. Tasks that must be performed can be broken down into two key components: life safety and fire flow. Life safety tasks are based on the number of building occupants, their location, status, and ability to take self-preservation action. Life safety tasks involve the search, rescue, and evacuation of victims. The fire flow component involves delivering sufficient quantities of water to extinguish the fire and creating an environment within the building that allows entry by firefighters.

The number and types of tasks needing simultaneous action will dictate the minimum number of firefighters required to combat different types of fires. In the absence of adequate personnel to perform concurrent action, the command officer must prioritize the tasks, completing some in chronological order rather than at the same time, reducing overall fire emergency effectiveness.

These tasks include:

- | | | |
|-------------|--------------|-------------------|
| command | scene safety | search and rescue |
| fire attack | water supply | pump operation |
| ventilation | back-up | |

The following chart illustrates the fire ground staffing recommendations of the Commission on Fire Accreditation, International.

The following definitions apply to the chart:

Low Risk – Fires involving small sheds and other outbuildings, larger vehicles and similar. Characterized by sustained attack fire flows typically less than 250 gallons per minute.

Moderate Risk – Fires involving single-family dwellings and equivalently sized commercial office properties. Sustained attack fire flows range between 250 gallons per minute to 1,000 gallons per minute.

High Risk – Fires involving larger commercial properties with sustained attack fire flows between 1,000 gallons per minute and 2,500 gallons per minute

Maximum Risk – Fires in buildings with unusual hazards such as high-rise buildings, hazardous materials facilities, very large buildings, and high life risk properties (nursing homes, hospitals, etc.). Though they may not require large sustained attack fire flows, they do require more personnel to perform tasks required for effective control.

Minimum Firefighting Personnel Needed Based Upon Level of Risk

Task	Maximum Risk	High Risk	Moderate Risk	Low Risk
Attack Line	4	4	2	2
Search and Rescue	4	2	2	
Ventilation	4	2	2	
Back-Up Line/Rapid Intervention	8	6	4	2
Pump Operator	1	1	1	1
Water Supply	1	1	1	
Utilities Support	1	1	1	
Command/Safety	2	2	2	1#
Forcible Entry	*			
Salvage	*			
Overhaul	*			
Communication	1*			
Operations Section Chief	1			
Logistics	1			
Planning	1*			
Staging	1*			
Rehabilitation	1			
Division/Group Supervisors	2*			
High Rise Evacuation	10*			
Stairwell Support	10*			
Totals:	53	19	15	6

Can often be handled by the first due officer.

* At maximum and high-risk fires, additional personnel may be needed.

See the definitions on the previous page