STANDARD OF COVERAGE FOR EMERGENCY RESPONSE

JUNE 2010

Spokane
FIRE DEPARTMENT

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Executive Summary

This report updates the original Standards of Coverage and Deployment Plan first developed in 2007. The original study, and this update, focused on the City of Spokane Fire Department's (SFD) ability to achieve a prompt and effective response to emergencies. Detailed analysis of historical response activity was conducted to determine factors contributing to current levels of performance. In addition, population growth and response activity was forecast to identify how workload will likely change in the future. Several conclusions were reached.

1. Population, almost exclusively, drives emergency response activity.
2. Spokane's population has grown steadily and will continue to do so.
3. The City has adopted service level performance objectives. However, these objectives are not in conformance with nationally recognized standards as described in National Fire Protection Association Standard 1710, or with comparable Washington cities.
4. The Fire Department's current response time performance *generally* meets currently adopted performance objectives, but not those described in the national recommended standards.
5. Three primary factors are impacting the department's ability to meet national recommended standards:
    a. Turnout times exceed what reasonably can be achieved.
    b. Travel times are impacted by response unit workload and unit availability.
    c. Geographic areas remain uncovered (SW and NW).
6. Unit availability is impacted by the deployment of advanced life support capable resources. The current emergency medical incident delivery system requires that more apparatus respond to many incidents than would otherwise be required if all units were advanced life support capable.
7. Significant opportunities exist to utilize technology to improve performance without the need to add apparatus and personnel. Many of these initiatives are planned or being implemented.
8. The South and Southwest portion of the city lies a great distance from existing fire stations.

The study concludes with a variety of recommendations to improve fire and emergency services to varying degrees. These include modifications to deployment, response personnel management, use of technology, and others.

Of the recommendations offered, the most significant are:

- Re-evaluate currently adopted response performance objectives to ensure the level of service expected of the fire department is reasonable and appropriate for the community.

- Improve turnout times through crew performance management and technology.
- Invest in "closest-unit" dispatch technology to reduce travel times.
- Install traffic signal pre-emption equipment at all controlled intersections.
- Explore opportunities to better utilize mutual and automatic aid from neighboring fire agencies and the possibility of shared staffing of fire stations.
- Redistribute advanced life support care resources so that all SFD response units can provide this level of care.
- Add at least two peak activity engine companies or consider alternative staffing to increase the number of available units, dynamically deployed during the busiest periods of each day, to improve emergency response times.
- Determine if the cost of additional resources to serve the southwest portion of the city are an appropriate investment from an overall policy perspective.

This report offers the Mayor and City Council of Spokane the tools to make choices on the level of service to be provided by the city's fire department. These choices will be based both on the desires of the community and its ability to pay for services.

Background

The Standards of Coverage and Deployment Planning process accomplishes a number of vital elements benefiting the delivery of fire and life safety services. Originating in the 1960's under the moniker "Fire Department Master Planning," refined by the National Fire Academy, it has evolved to an intensely data driven process for identifying the desired level of performance by a fire agency based on achievable emergency event outcomes. Significant contributions to the planning process have been provided by the United States Fire Administration and the Center for Public Safety Excellence (formerly known as the Commission on Fire Accreditation, International).

The process begins with a comprehensive review of the community served by the fire protection agency. It includes a review of:

- Community demographics
- Nature of fire and life safety risks
- Historic and predicted population and geographic growth
- Historic and predicted land development

This is followed by a thorough assessment of resources available to the fire protection and life safety agency, including:

- Fire stations
- Response apparatus
- Staffing
- Special programs and services

The Standards of Coverage is developed based on the various services provide by the department and the level of risk within the community. It includes:

- Establishment of response performance objectives, usually expressed in both time and resources.
- Determination of tasks that must be performed at various emergency events and the number of personnel needed to achieve them.
- Determination of the number of response resources needed to effectively mitigate an emergency.

Historic fire department performance is evaluated to determine current service levels for various types of response activity. This includes a review of workload and performance on both a geospatial and temporal basis, and in comparison to the Standards of Coverage. It also includes an assessment of workload on existing resources. Any existing performance expectations, such as response time goals, are evaluated to determine the degree to which the department is achieving them.

Finally, recommendations are developed and presented for any opportunities to improve performance (and emergency event outcomes) and/or create efficiencies in the delivery of service. These recommendations can become a plan for improvement should that be desired by the department's governing body, in this case the City of Spokane mayor and city council.

The process uses guidance developed from various professional sources including:

- National Fire Protection Association
- Center for Public Safety Excellence
- United States Fire Administration
- American Heart Association
- International City Management Association

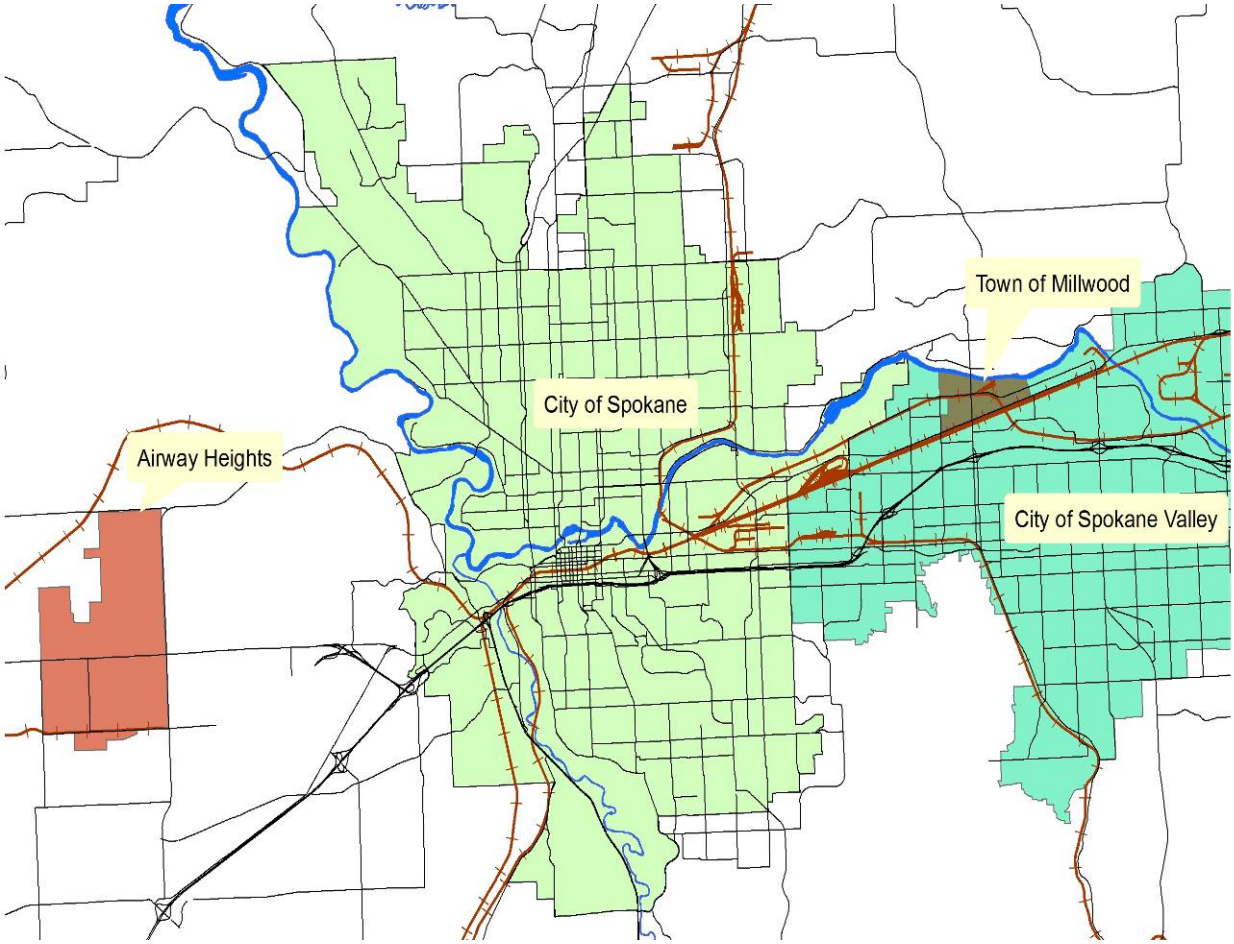
The delivery of effective fire and life safety services is important to creating a positive quality of life within a community. The impact of fire is well established, costing thousands of lives each year, billions of dollars in damage, and representing one of the most significant disruptions to life that can occur to a family, business, or community.

General Community Conditions

Background

The city of Spokane is located in the northeast corner of the state of Washington and is the state's second largest city. The city covers an area of 59 square miles and contains a population of 205,500 residents.

Figure 1. City of Spokane and Surrounds



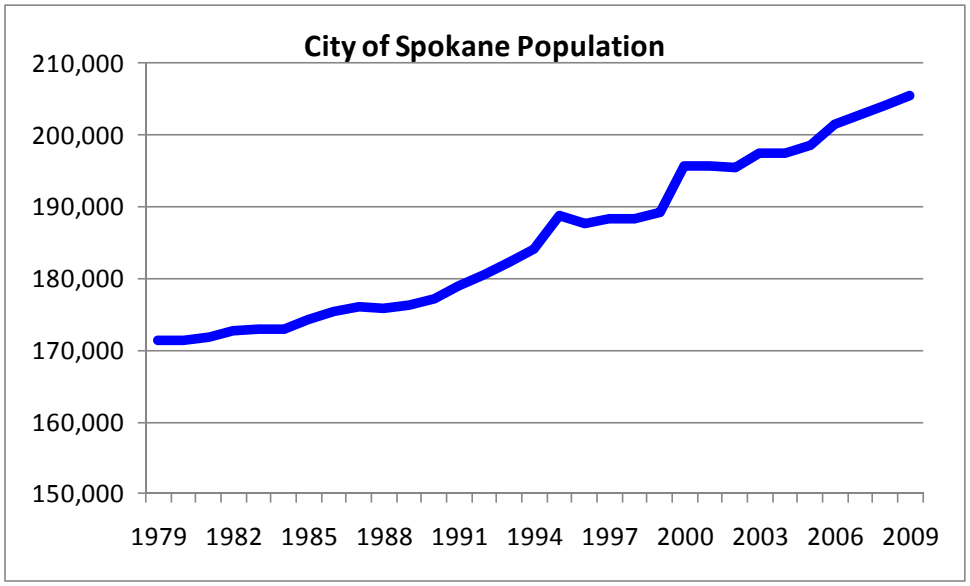
The City of Spokane has a rich history shaped originally by 18th century pioneers. The city was incorporated as "Spokan Falls" in 1881. The city's official name became Spokane in 1891. A major fire destroyed portions of the city in August 1889. During its rebuilding, Spokane replaced old wood buildings with structures of stone and brick.

Spokane experienced periods of rapid growth and periods of population decline during the next century. Its early years saw Spokane's population grow from 350 in 1880 to over 100,000 by 1910. Spokane's commercial and industrial strength blossomed during the World War II years. The community's growth has continued to its current population of 205,500.

Population

The city's population has increased slowly but steadily over the past 30 years, at an annual rate of 0.5 percent. The following chart illustrates population growth over the past 30 years.

Figure 2. Spokane Population, 1979-2009



Population growth between 2009 and 2040 is estimated to be 54,500 within the current and expanded city boundaries.

The age distribution of a community's residents can affect fire department workload. For example, a community with a large percentage of elderly persons would expect significantly higher volumes of emergency medical responses. In this case, however, age distribution of the city's population does not present any unusual conditions. The following table shows the current age demographics.

Figure 3. Age Distribution, City of Spokane

Age	Percentage
Under 5 years	5.8%
5 to 9 years	6.0%
10 to 14 years	6.3%
15 to 19 years	7.5%
20 to 24 years	9.2%
25 to 29 years	7.8%
30 to 34 years	6.9%
35 to 39 years	6.4%
40 to 44 years	6.7%
45 to 49 years	7.1%
50 to 54 years	7.4%
55 to 59 years	5.6%
60 to 64 years	4.0%
65 to 69 years	3.1%
70 to 74 years	3.1%
75 to 79 years	2.5%
80 to 84 years	2.7%
85 years and over	1.9%

Source: Census Bureau 2005 American Community Survey

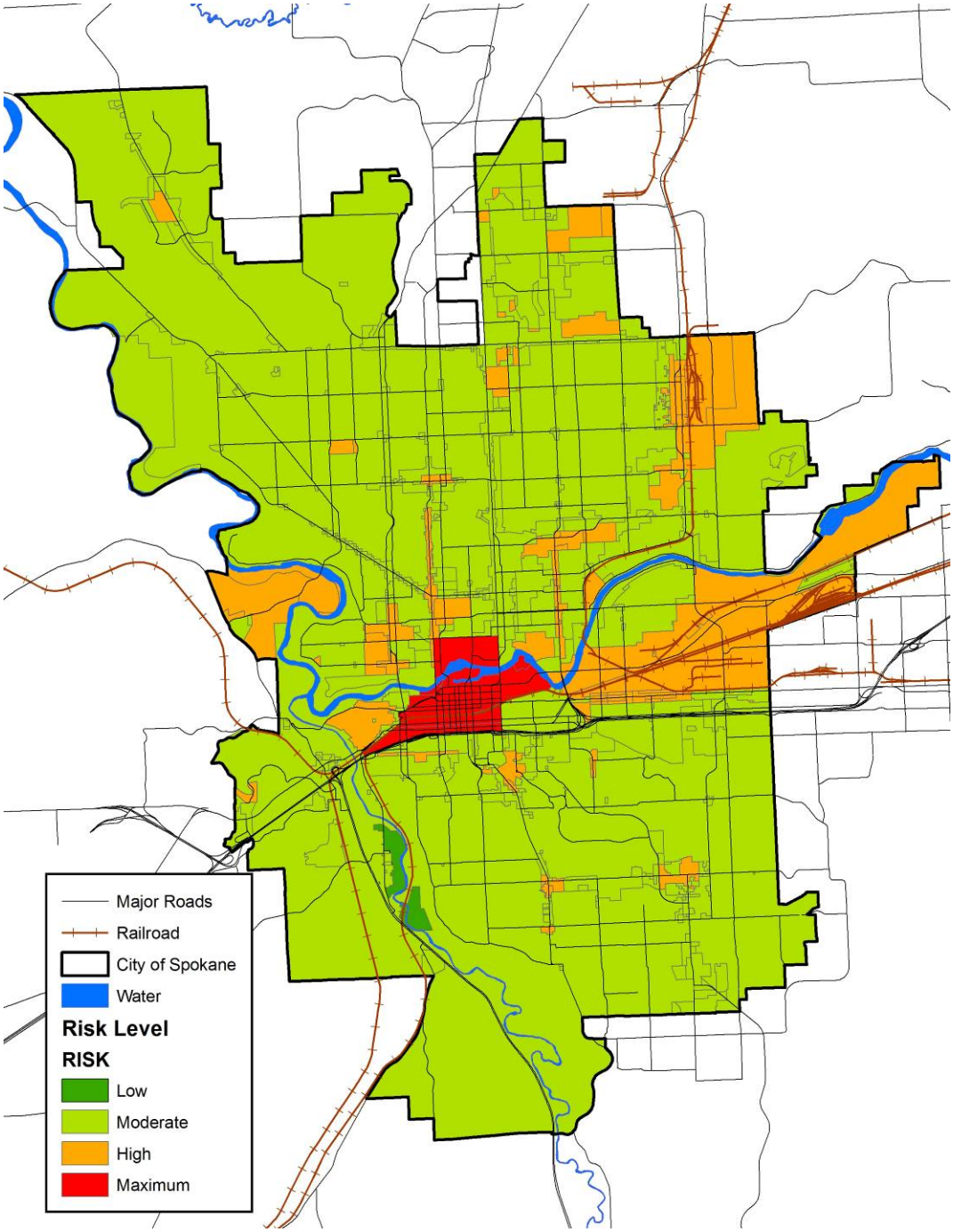
Community Risk

The fire service assesses the relative risk of properties based on a number of factors. Properties with high fire and life risk require greater numbers of personnel and apparatus to effectively mitigate a fire emergency. Staffing and deployment decisions are largely based on the level of risk within geographic sub-areas of a community.

The city's risk assessment has been developed based on potential uses of land within its boundaries. These potential uses are found in the city's development code and zoning designations. The following map translates zoning (potential scale of development within geographic sub-areas) to four categories of relative fire and life risk.

- **Low risk:** Areas zoned and used for agricultural purposes, open space, and other low intensity uses.
- **Moderate risk:** Areas zoned for single family properties, small commercial and office uses and equivalently sized business activities.
- **High risk:** Business districts, high density residential, light industrial, and large mercantile centers.
- **Maximum risk:** High rise buildings typically found in the downtown core.

Figure 4. Zoning to Fire Risk Translation



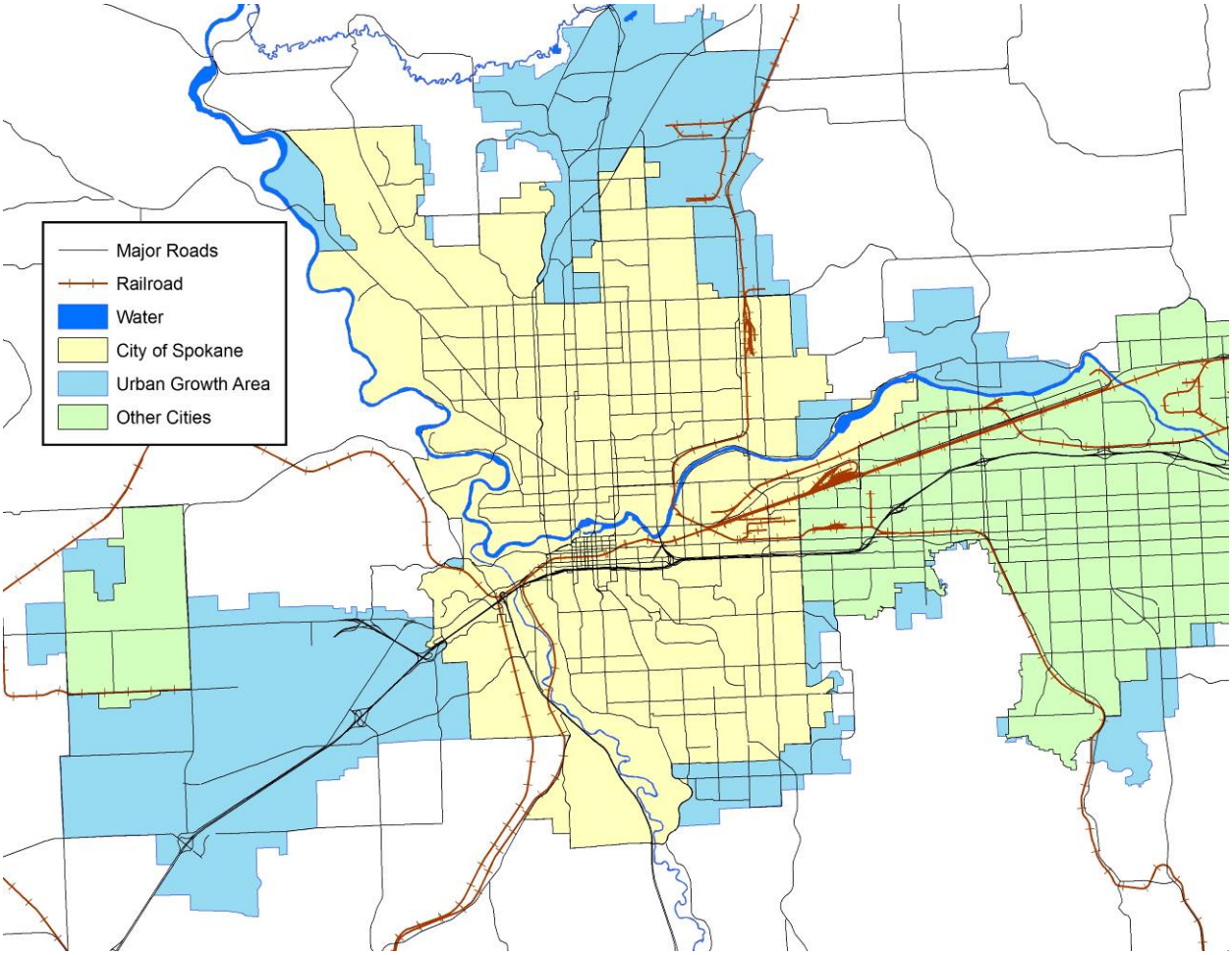
The city contains mostly moderate risk properties. Maximum risk is located on the city's central area. High risk areas include industrial facilities, center and corridor, and high density residential. Moderate risk areas include residential, office, and neighborhood commercial uses.

The city's zoning pattern generally contributes to development of an efficient fire resource deployment configuration. Higher risk properties are concentrated into the city's central region and along major transportation routes rather than scattered throughout, as is found in some communities.

Future Community Growth

Some additional geographic growth may occur around the city, primarily to the north and west. The currently defined urban growth area is shown on the following map. There is no specific timeline for inclusion of these areas inside the city. In-fill development is likely in many areas inside the current city boundaries.

Figure 5. Urban Growth Area (as of 2009)



City of Spokane Fire Department

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) public protection classification of three.

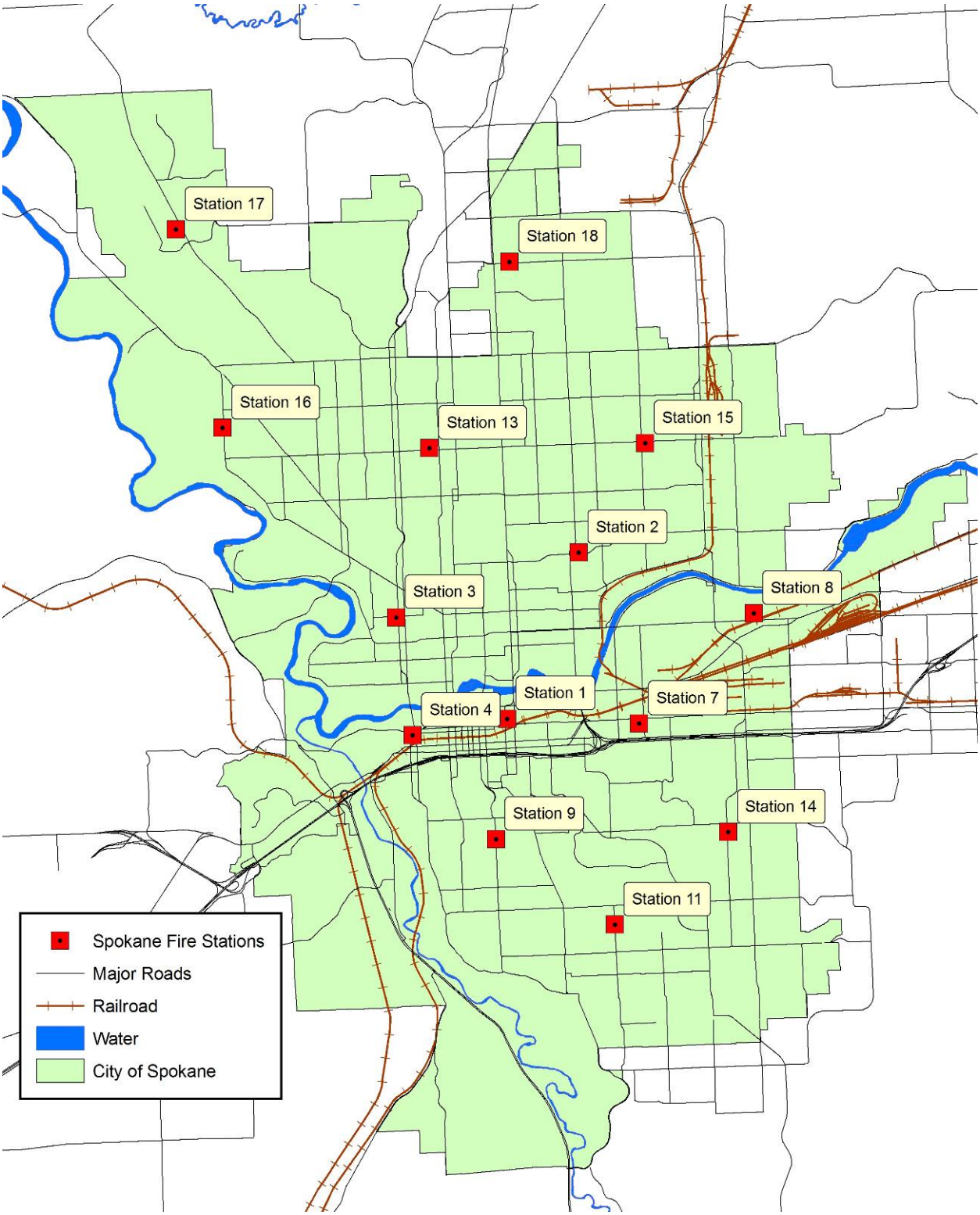
The Spokane Fire Department's service area is approximately 59 square miles and consists of a mix of urban, suburban, industrial, and wildland areas. The primary services provided by the Spokane Fire Department include:

- 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)

Resources

The SFD operates from 14 fire stations located throughout the city. The following map shows their locations.

Figure 6. Fire Station Locations



Fire Stations and In-Service Resources

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

Figure 7. Current Resources and Staffing Levels

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	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	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	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		

SFD employs a total of 324.25 employees, 289 uniformed and 35.25 civilian. The breakdown of personnel by position is shown in the following table. Current staffing is 36.75 personnel fewer than existed in 2004 (33 of which were shift personnel).

Figure 8. Current Staffing

Division	Uniformed	Civilian
Administration		
Fire Chief	1	
Asst. Fire Chief	1	
HR Specialist (Assigned from City Hall)		
Attorney (Assigned from City Hall)		
Accountant II (Assigned from City Hall)		1
Accountant I (Assigned from City Hall)		1
Accounting Clerk (Assigned from City Hall)		1
Admin. Secretary (Payroll)		1
EMS		
Deputy Fire Chief	1	
Physician Medical Director (Contract)		0.5
EMS Officer (Captain)	1	
QA/QI Officer – (Lieutenant)	1	
Operations		
Deputy Fire Chief	1	
Battalion Chief	9	
Captains	17	
Lieutenants	51	
Fire Equipment Operator	72	
Firefighters	115	
Prevention		
Division Chief/Fire Marshal	1	
Asst. Fire Marshal	1	
Deputy Fire Marshal	6	
Fire Protection Engineer		1
Public Education Officer		1
Office Manager		1
Clerk III		2
Fire Investigation		
Fire Captain	1	
Fire Lieutenant	1	
Training		
Deputy Fire Chief	1	
Training Captain	1	
Training Lieutenant	1	
Clerk		1
AV Tech		1
Facilities & Apparatus Maintenance		
Division Chief/Logistics	1	
Fire Apparatus Mechanic Foreperson		1
Fire Apparatus Mechanic		3
Equipment Servicer		1

Division	Uniformed	Civilian
Information Management		
Supervisory Analyst		1
Programmer Analyst		0
Information Analyst		3
Dispatch (CCC)		
Communications Manager (Captain)	1	
Shift Supervisor (Lieutenant)	3	2
Fire Dispatcher	1	12.75
Grand Total	**289**	**35.25**

Workload Evaluation

The SFD responds to a wide variety of calls for service. People, specifically the number of people within a given service area, are the most significant influence on both response volume and type. One hundred percent of emergency medical responses are directly attributable to people. The National Fire Protection Association reports that 70 percent of all fires are the direct result of an act or error on the part of a person. Thus, factors such as the age of the population, population density, and other demographics drive a fire department's workload.

Response Types

During 2009 the SFD responded to 27,296 emergency and non-emergency incidents. The following tables show the distribution and number of responses during this time period by type of response at initial dispatch and the final incident type. The proportion of responses by type is comparable with similar jurisdictions.

Figure 9. Incident Reponses by Type, 2009

Incident Type at Time of Dispatch

Structure fire	370
Wildland fire	172
Vehicle fire	172
Other fire	1027
EMS non-priority	11,626
EMS priority	9516
Motor vehicle accident	1983
Rescue	44
Fire alarm activation	1706
Hazardous materials	294
Public service	386
TOTAL	**27,296**

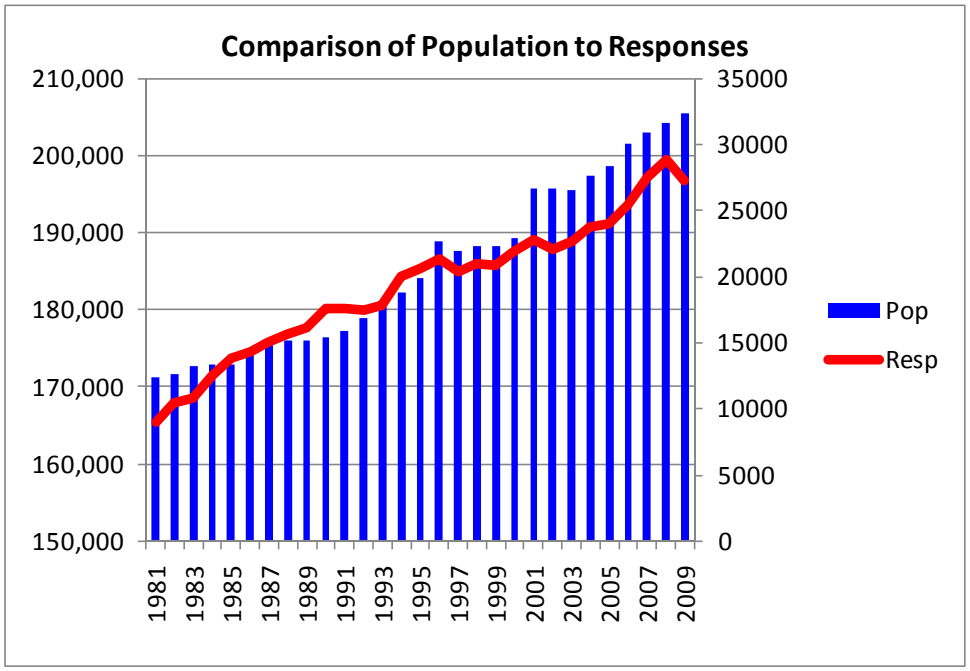
Final Incident Type

Structure fire	257
Wildland fire	118
Vehicle fire	128
Other fire	192
Emergency medical	17079
MVA injury	713
MVA non-injury	528
Rescue	34
Hazardous condition	628
Overpressure rupture	39
Public service	1847
False alarm	1332
Good intent	2347
Severe weather	9
Other	1695
No final type	350
TOTAL	**27,296**

Response History

Response activity has tripled since 1981. This steady growth in workload corresponds very closely to growth in population. The following chart shows both response workload and population growth since 1981.

Figure 10. Number of Responses Compared to Population, 1981 - 2009

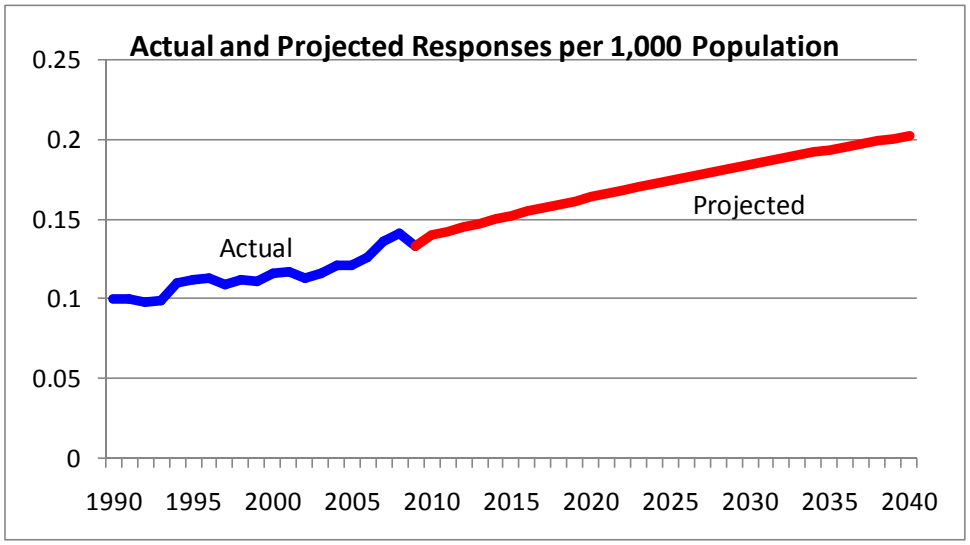


Response Workload Projection

Since a fire department's response workload is largely driven by population, the city's modest future population growth will also mean modest response workload growth. Population growth forecast to occur between 2010 and 2020 is estimated to be 17,500 within the current city boundaries. Population is expected to increase to a total of 260,000 by 2040 within the current city limits and portions of Spokane's urban growth area annexed in the future. It is expected that the urban growth area will be annexed to the city at some time during the next 20 years.

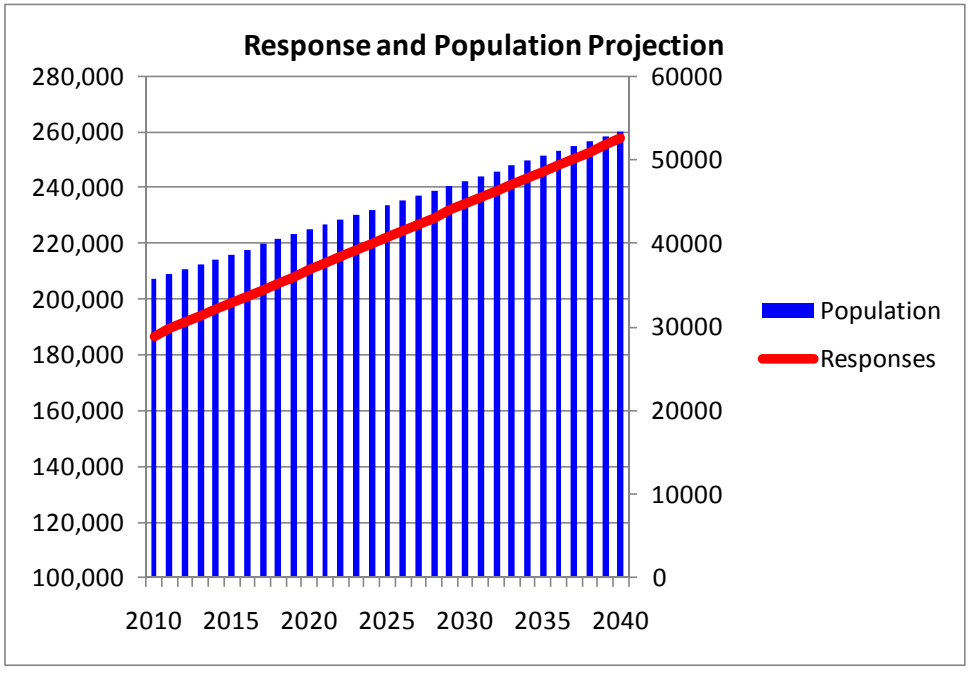
Use of fire department services has increased on a per capita basis over the past years. This is typical, with most of the increase in emergency medical service. The following chart shows historic and projected responses per 1,000 population to the year 2040.

Figure 11. Responses per 1,000 Population, 1990 - 2040



Using the projected demand for services on a per capita basis and the population forecast for current city boundaries and its urban growth area, the following chart shows the forecast response workload for the Spokane Fire Department to the year 2040. Total responses in the year 2040 are projected to be 52,517.

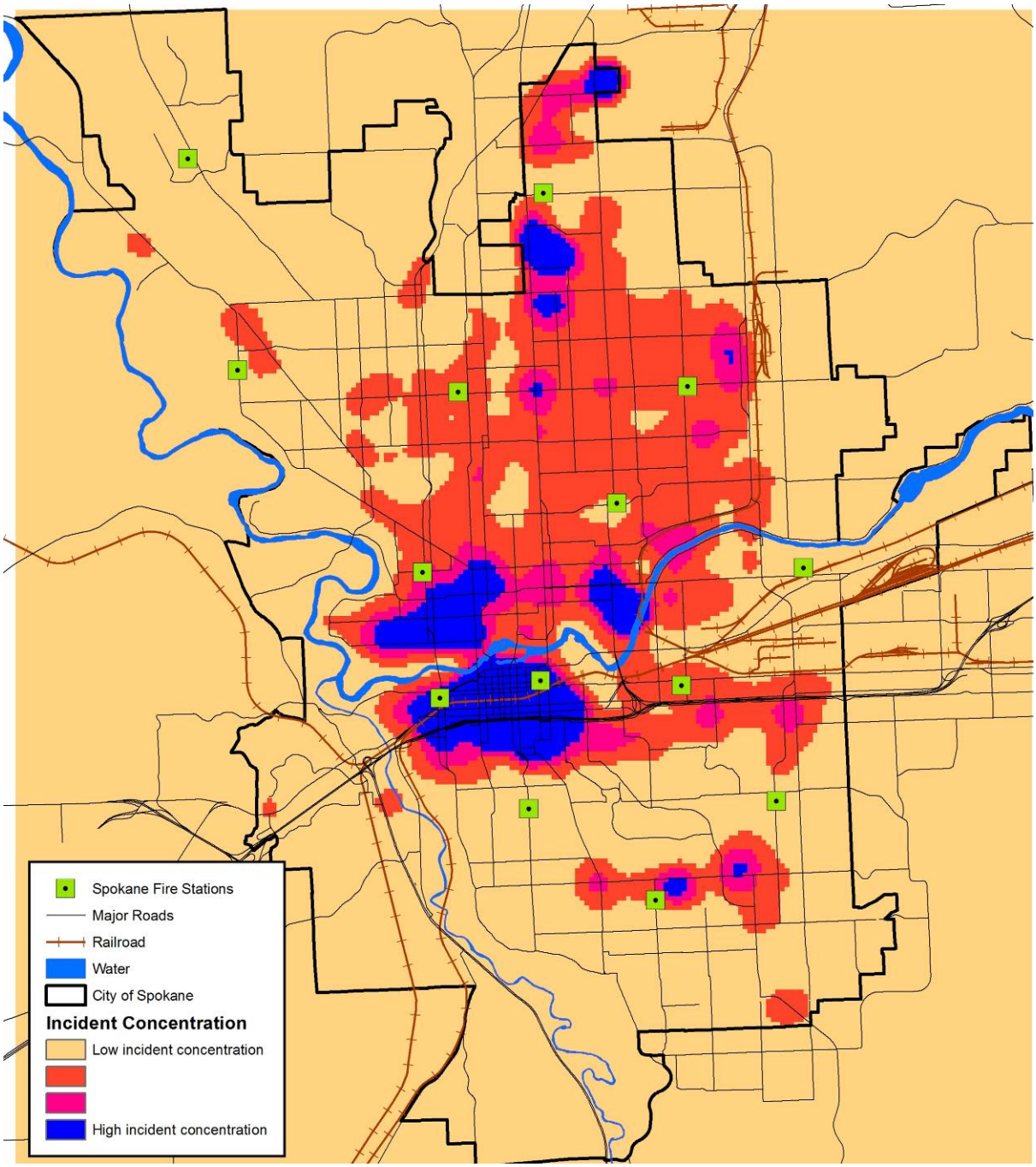
Figure 12. Response and Population Projections, 2010 - 2040



Response Distribution

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

Figure 13. Emergency Incident Concentration, 2009



The following maps show actual locations for fires and emergency medical incidents during 2009. As illustrated in the previous map, responses are more concentrated in areas with higher population density.

Figure 14. Fire Incident Locations, 2009

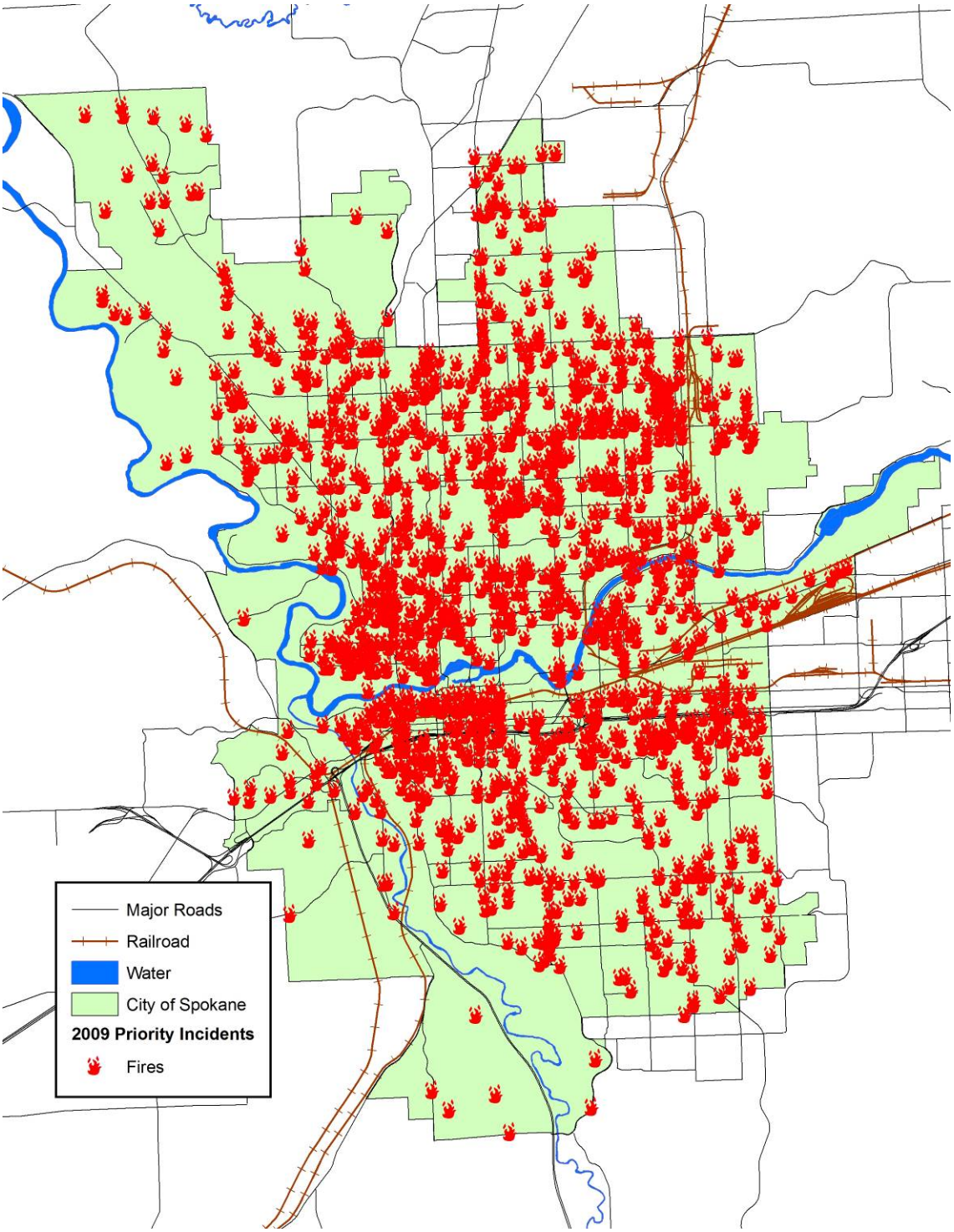
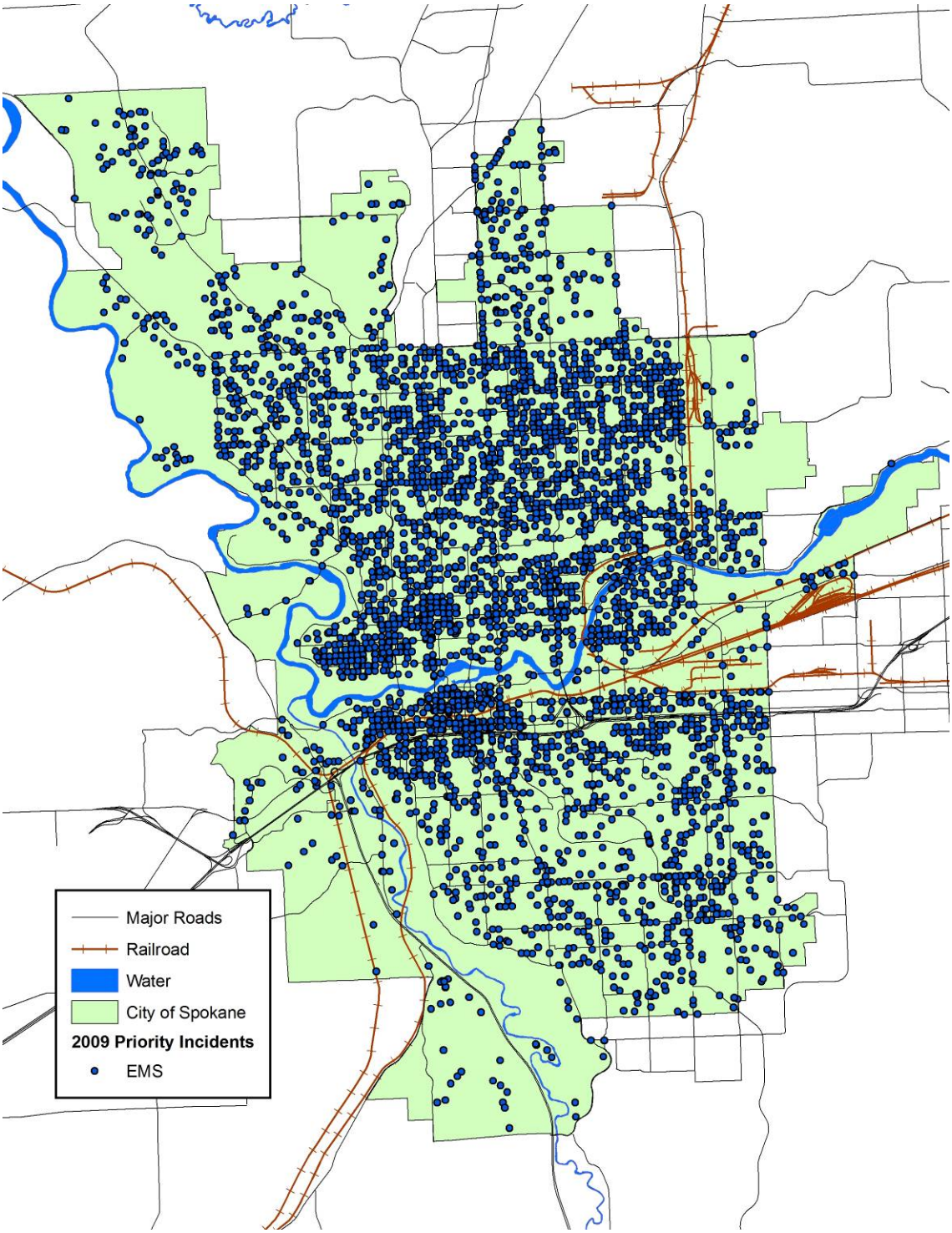


Figure 15. Emergency Medical Incident Locations, 2009

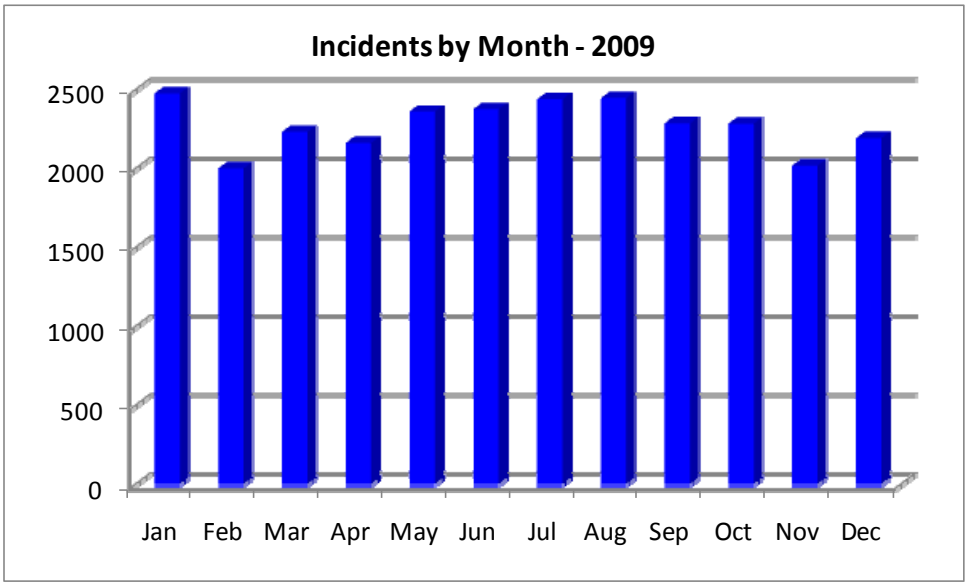


Temporal Analysis

Response activity can be variable over the course of a day, month, or year. Understanding when peak activity occurs can assist in determining the deployment of resources. For example, a department may choose to provide higher staffing levels during peak periods when concurrent responses are frequent. A department may also choose to conduct non-response activities, such as training, during periods of lower activity to avoid response delays.

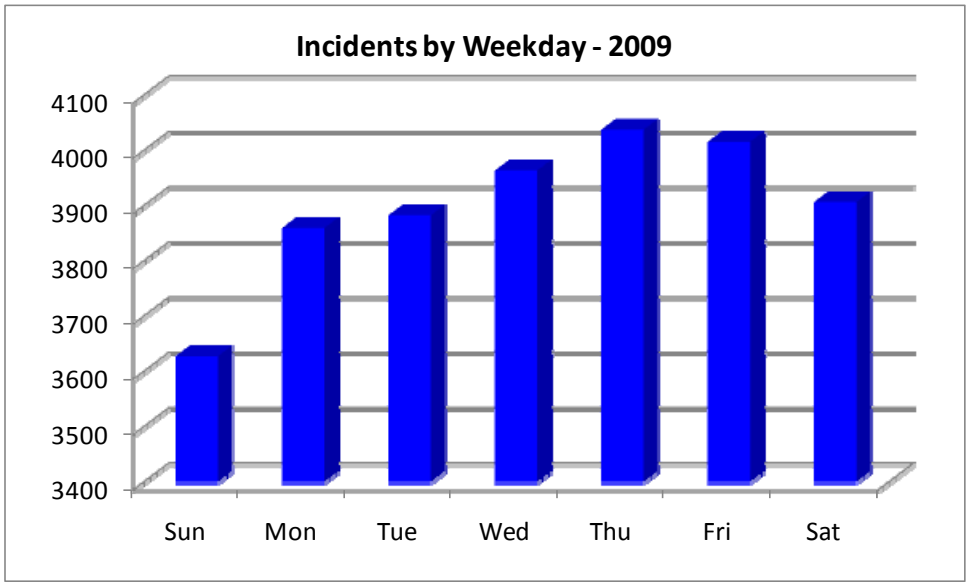
The following charts illustrate the variability of workload for the SFD. The first shows response activity by month for the year 2009. Monthly maximum variation is only 1.7 percent of total responses.

Figure 16. Workload Activity by Month, 2009



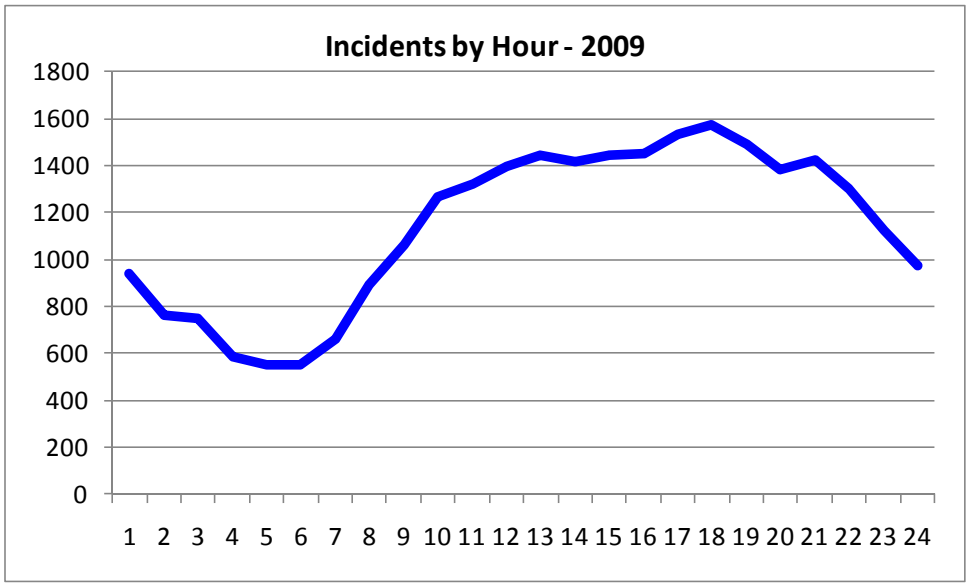
The next chart shows response activity by day of week. Weekday maximum variation is 1.5 percent of total responses.

Figure 17. Workload Activity by Day of Week, 2009



Response activity tends to increase during the daytime and evening hours and decreases during the night. People are more active during the day and evening, creating more opportunity for conditions that result in a fire department response. The Spokane Fire Department's response workload, as shown in the following chart, is at its highest between 12:00 p.m. and 9:00 p.m. and lowest in the predawn hours.

Figure 18. Workload Activity by Hour of Day, 2009

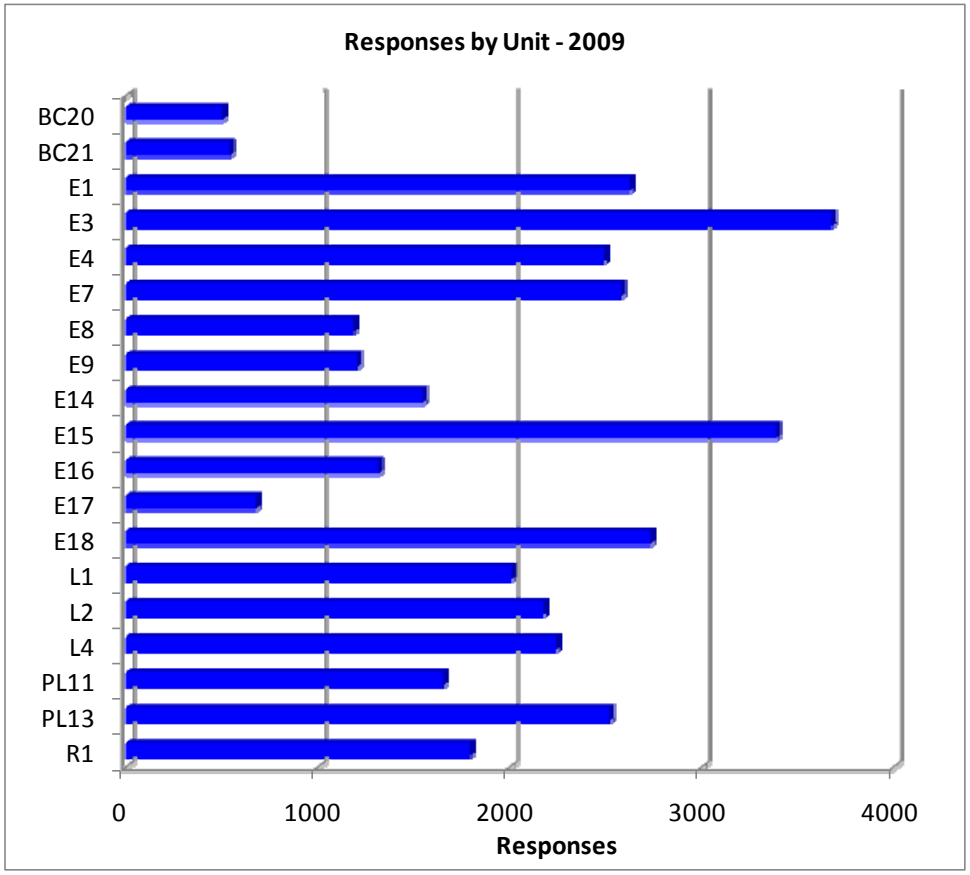


Resource Workload

The workload on emergency response units is a large factor in response time performance. The busier a given unit, the less available it is for the next emergency. If a response unit is unavailable, then a unit from a more distant station must respond, increasing overall response time. A cushion of surplus response capacity above average values must be maintained due to less frequent but very critical times, when atypical demand patterns appear in the system. Multiple medical calls, simultaneous fires, multi-casualty events, or multiple alarm fires are all examples and are not at all uncommon.

The following chart shows response activity by unit. This chart describes total response activity for each unit during 2009. Total unit responses exceed total incidents for the year since many calls for service require more than one unit to respond.

Figure 19. Total Responses by Unit, 2009



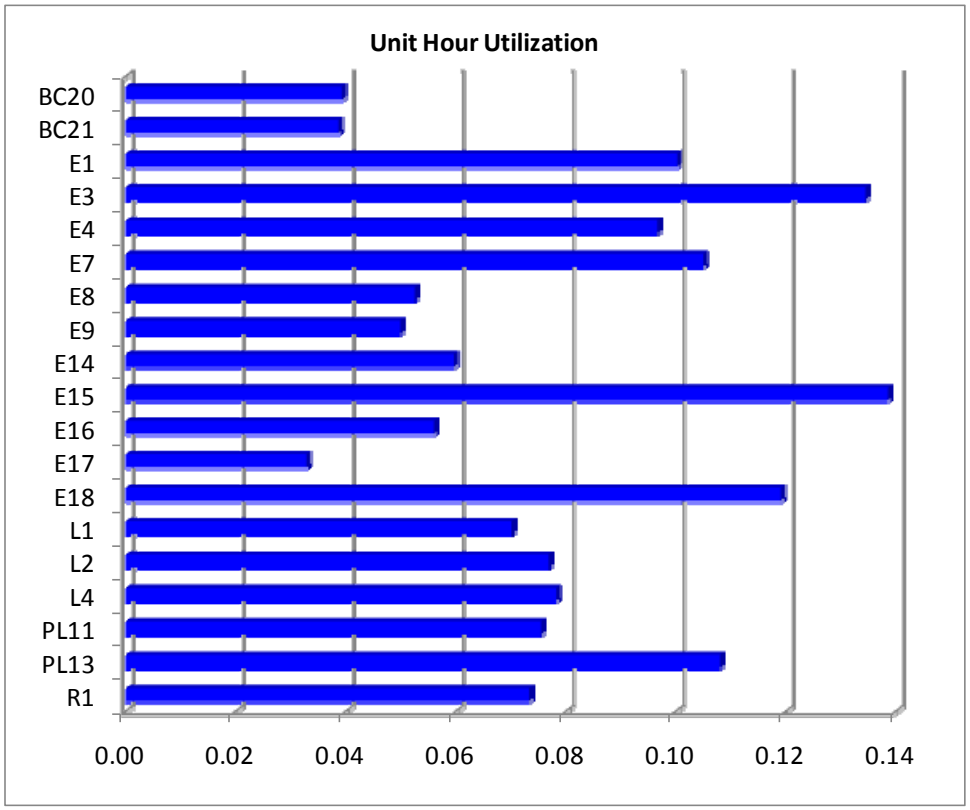
The amount of time a given unit is committed to an incident is also an important workload factor. The following table illustrates the average time each unit was committed to an incident, from initial dispatch until it cleared the scene.

Figure 20. Average Time Committed to an Incident by Unit, 2009

Unit	Average Time Committed (Minutes)
Engine 1	20.1
Ladder 1	18.3
Rescue 1	21.5
Ladder 2	18.6
Engine 3	19.2
Engine 4	20.4
Ladder 4	18.4
Engine 7	21.4
Engine 8	23.3
Engine 9	21.8
Pumper Ladder 11	24.0
Pumper Ladder 13	22.5
Engine 14	20.3
Engine 15	21.5
Engine 16	22.4
Engine 17	25.5
Engine 18	22.9

Unit hour utilization is an important workload indicator. It describes the amount of time a unit is not available for response since it's already committed to an incident. The larger the number, the greater a unit's utilization and the less available it is for assignment to an incident.

Figure 21. Unit Hour Utilization, 2009



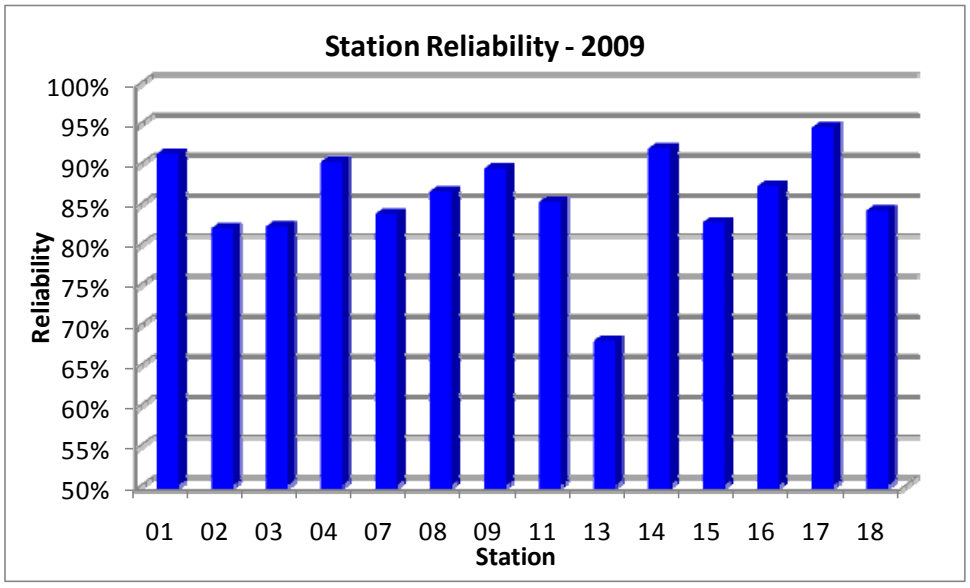
Unit hour utilization is an important statistic to monitor for those fire agencies using percentile based performance standards, as does SFD. In Spokane's case, where performance is measure at the 90th percentile, a unit hour utilization greater than 0.10 means that the response unit will not be able to provide on-time response to at least 90 percent of incidents even if response is its only activity. Incident commitment beyond the 0.10 utilization makes it unavailable for the next response in its first-due area, requiring a response from a more distant unit.

Resource Reliability

Both emergency response workload and other response unit commitments, such as training, will reduce the percentage of time a unit is available to respond to an emergency within its primary service area. Given SFD's 90th percentile response performance objectives, reliability less than 90 percent will make achieving response time objectives difficult if not impossible.

The following chart lists reliability for each station area. This chart evaluates the percentage of incidents to which the primary response unit from each station was available to respond.

Figure 22. Fire Station Response Reliability - 2009



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.

Before discussing the department's current performance, it is important to gain an understanding of the dynamics of fire and medical emergencies.

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 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.

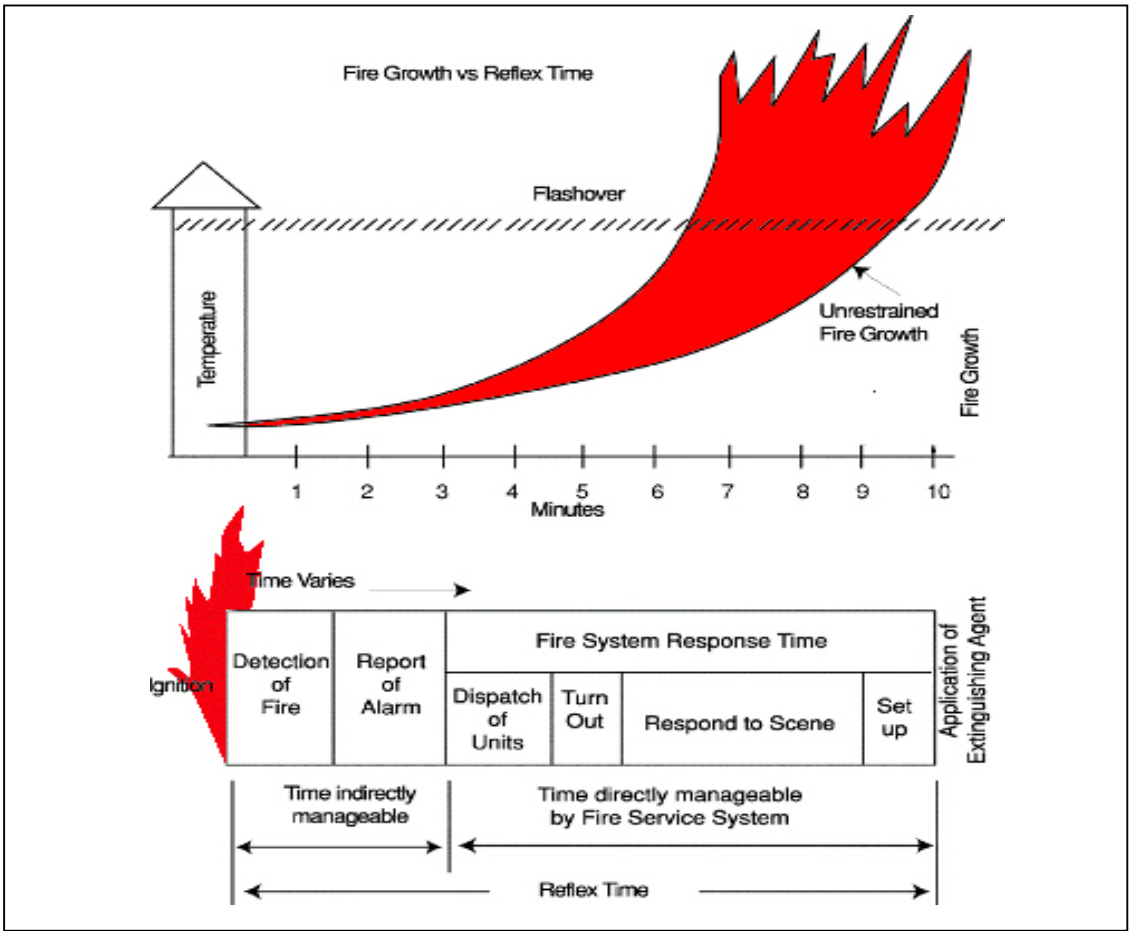
Perhaps as important as preventing flashover is the need to control a fire before it does damage to the structural framing of a building. Materials used to construct buildings today are often less fire resistive than the heavy structural skeletons of older frame buildings. Roof trusses and floor

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.

Figure 23. Fire Growth vs. Reflex Time



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.
6. **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.

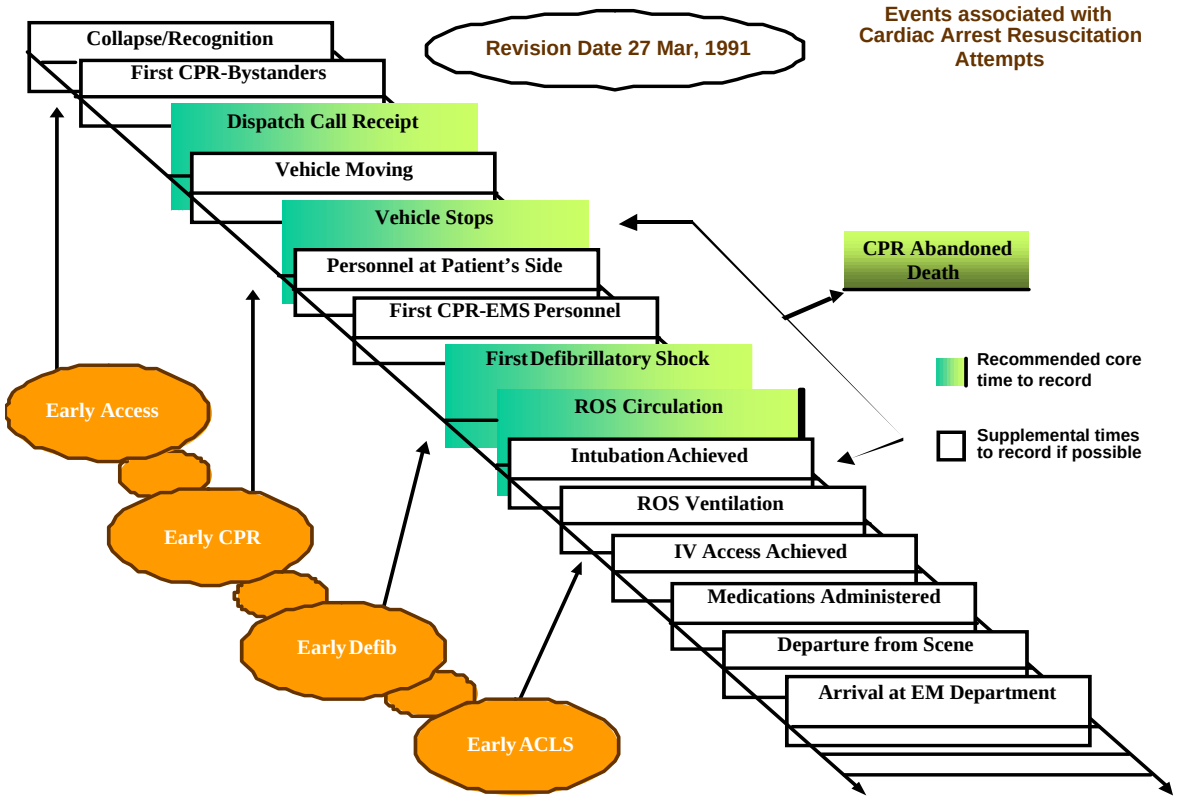
As is apparent by this description of the sequence of events, application of water in time to prevent flashover is a serious challenge for any fire department. It is reasonable, though, to use the continuum as a tool in designing the emergency response system.

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 7 to 10 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.

Figure 24. Cardiac Arrest Event Sequence (Utstein Criterion)



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 actions, the command officer must prioritize the tasks, completing some in chronological order rather than at the same time, reducing overall fire emergency effectiveness.

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 and 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.

Figure 25. 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.

Standards of Coverage

The response objectives listed in the City of Spokane Comprehensive Plan for the Spokane Fire Department are:

1. 11:00 minutes – non-emergency/non-life threatening (90 percent of the time)
2. 8:30 minutes – emergency/potentially life threatening (90 percent of the time)

The SFD has further defined these response performance objectives in its adopted Standards of Coverage (SOC). The SOC describes, in detail, the level of service to be provided by the department and includes:

- **Response standards:** level of service for emergency response based on time to deliver resources
- **Critical tasking:** an evaluation of the tasks that must be performed during the initial stages of an incident in order to provide effective service
- **Alarm assignments:** The number of apparatus and personnel that should be dispatched in order to provide the resources needed to complete tasks within a reasonable time frame

The following section details the Spokane Fire Department's Standards of Coverage.

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 SFD 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 percent 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 8 minutes 30 seconds (8:30) for the first arriving fire engine, 90 percent 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 11 minutes (11:00) for the arrival of the full first alarm assignment at structure fire incidents, 90 percent 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 8 minutes 30 seconds (8:30) for the arrival of the first fire department unit at life-threatening emergency medical incidents, 90 percent 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 8 minutes 30 seconds (8:30) for the arrival of the first fire department advanced life support unit at life-threatening emergency medical incidents, 90 percent 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 8 minutes 30 seconds (8:30) for the arrival of the first fire department unit at a technical rescue incident, 90 percent 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 8 minutes 30 seconds (8:30) for the arrival of the first fire department unit, 90 percent 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 9 minutes (9:00) for the arrival of the first fire department unit, 90 percent 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 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.

Figure 26. Critical Tasking Tables

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**

Emergency Medical (Life threatening)

Task	Number of Personnel
Patient Management	1
Patient Care	2-3
Total	**3-4**

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 Rescue

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.

Figure 27. First Alarm Assignment Tables

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 Structure 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 Structure 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		**3-4**

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		**21-22**
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		**21-22**
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**

Overall Response Performance

The purpose of this section is to compare SFD's current performance with its established response objectives found in the city's Comprehensive Plan and as described in the previous section of this report.

The following lists the adopted response time performance objectives established by the Spokane Fire Department, and its performance during the period between January 1, 2009, and December 31, 2009. Performance during previous years is also listed for illustration purposes. It includes evaluation of only emergency/potentially life-threatening responses (11,480 total incidents). The fire and emergency medical service objectives will be discussed in detail in this section since they involve the vast majority of SFD's total responses.

1. **Turnout time:** The Spokane Fire Department has adopted a turnout time standard of 90 seconds, 90 percent of the time.

   Actual department performance for the review period: The Spokane Fire Department met the turnout time objective **61 percent** of the time. The Fire Department turnout time was 135 seconds (2:15), 90 percent 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 8 minutes 30 seconds (8:30) for the first arriving fire engine, 90 percent of the time.

   Actual department performance for the review period: The Spokane Fire Department met the response time objective **87.1 percent** of the time. The Fire Department's response time for the first arriving fire engine to fire suppression incidents was 8 minutes 49 seconds (8:49), 90 percent of the time.

   Total fire suppression incidents: 1,666

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

   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 11 minutes (11:00) for the arrival of the full first alarm assignment at structure fire incidents, 90 percent 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 percent** of the time. The Fire Department's response time for the first full alarm assignment to a structure fire was 13 minutes 39 seconds (13:39), 90 percent of the time.

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

3. **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 8 minutes 30 seconds (8:30) for the arrival of the first fire department unit at life-threatening emergency medical incidents, 90 percent 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 percent** 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 7 minutes 5 seconds (7:05), 90 percent of the time.

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

4. **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 8 minutes 30 seconds (8:30) for the arrival of the first fire department advanced life support unit at life-threatening emergency medical incidents, 90 percent 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 percent** 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 8 minutes 6 seconds (8:06), 90 percent of the time.

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

5. **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 8 minutes 30 seconds (8:30) for the arrival of the first fire department unit at a technical rescue incident, 90 percent 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 percent** of the time. The Fire Department's response time for the first unit to arrive at a technical rescue incident was 6 minutes 17 seconds (6:17), 90 percent of the time.

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

6. **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 8 minutes 30 seconds (8:30) for the arrival of the first fire department unit at a marine technical rescue incident, 90 percent 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 percent** of the time. The Fire Department's response time for the first arriving unit at a marine rescue incident was 11 minutes 33 seconds (11:33), 90 percent of the time.

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

7. **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 9 minutes (9:00) for the arrival of the first fire department unit at a hazardous materials incident, 90 percent of the time.

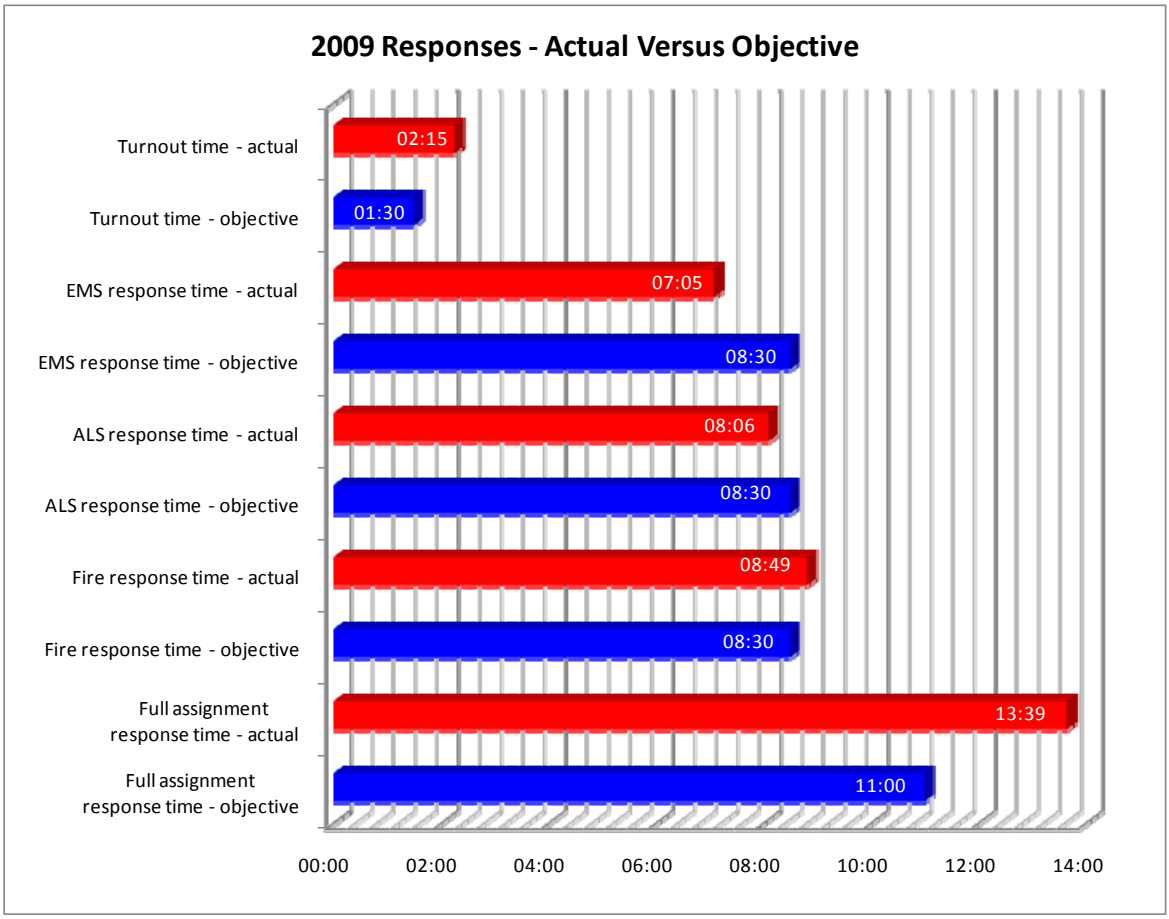
   Total hazardous materials incidents: 42

   Actual department performance for the review period: The Spokane Fire Department met the response time objective **96 percent** of the time. The Fire Department's response time for the first arriving unit at a hazardous materials incident was 8 minutes 17 seconds (8:17), 90 percent of the time.

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

The following chart shows response time performance against the first five objectives (objective 1, 4, 5, 2, and 3) listed above for calendar year 2009.

Figure 28. Response Times: Actual vs. Objective, 2009



In nearly all cases the department is meeting its established objectives. Turnout time exceeds the objective by 45 seconds at the 90th percentile. Improving turnout time represents an opportunity to improve overall results.

Actual performance for the arrival of the full assignment at a structure fire exceeds the objective by 2 minutes 39 seconds. The reliability of the data behind this result, though, is of concern. Data kept by the fire department does not record if a particular unit responded all the way to the scene in emergency response mode or if the unit was slowed to non-emergency status. This can have a marked effect on the calculated result.

To conclude, the Spokane Fire Department, with the exception of the full assignment to a structure fire, is delivering service to its citizens at the level it has defined. This should continue for the short term; but as the community continues to grow and response workload increases, degradation of overall response time performance will occur. Thus, it is important that the department and city begin planning for delivery system improvements that will at least keep the department performing in accordance with its objectives. It should also consider system enhancements that would improve the delivered level of service. These are discussed in detail later in this report.

Fire Service Industry Standards and Comparisons

There are a number of other standards and comparisons that can be used to evaluate the capabilities of the City of Spokane Fire Department.

Insurance Rating

The Washington Survey and Rating Bureau (WSRB) evaluates the fire protection capabilities of communities within the state. The WSRB uses a 1 – 10 rating scale, with Class 1 being the best level of service (and lowest fire insurance premium cost) and Class 10 defined as no service at all. City of Spokane received a Class 3 rating at its last rating survey in 1999.[1] Though the department previously had a Class 2 rating, Class 3 is a good rating and speaks well of the fire department and its capabilities.

The WSRB reviews fire protection based on:

- Adequacy of the water system to provide water for firefighting
- The qualifications of the fire department and the resources available to it
- The ability of the public to communicate the existence of an emergency to the department and the department's ability to quickly dispatch response forces
- The quality of the department's fire prevention programs
- Local climate conditions that may affect response

Concerns that resulted in the Class 3 rating included:

- The reduction in on-duty staffing from 83 to 66 as a result of the transition from a three-shift system to four. Note that current minimum on-duty staffing is now at 58 personnel.
- The discontinuance of routine fire safety inspections of businesses.

Focusing system improvements solely to improve the WSRB rating would likely provide little community benefit. In most cases homeowners received the least expensive fire insurance premium at Class 5. Businesses may see small reductions below Class 5. Larger businesses are rated individually and are not affected by the community's overall rating. The department should consider measures to prevent further degradation of the rating.

[1] From 1979 until April 1, 2000, the effective date of the new rating, the city had a Class 2 rating.

National Benchmarks and Comparables

There are a variety of other standards and performance criteria developed by various organizations with an interest in fire and emergency services. The chart that follows lists a number of them.

Figure 29. National Benchmarks and Comparables

National Standard or Comparison	Organization	Spokane Fire Dept
Minimum effective company staffing is 4 firefighters	Dallas FD Study, Seattle FD Study, NFPA Standards, Federal OSHA	Met in some cases. Current staffing levels for engines is 3 or 4 firefighters
Engine company within 1.5 miles of built upon areas	Washington Survey and Rating Bureau	Nearly met. Areas in south and west far exceed this standard
Ladder truck within 2.5 miles of built upon areas	Washington Survey and Rating Bureau	Approximately 2/3 of the city is within this distance
Staffed ladder truck if five or more buildings exceed 35' high	Washington Survey and Rating Bureau	Met
Average fire ground staffing to be 15 firefighters for moderate risk fires (single family residential) and up to 53 for high risk fires (industrial, high risk unprotected residential, etc.)	Center for Public Safety Excellence (International Association of Fire Chiefs)	The department is able to deliver sufficient personnel for high risk fires
National average of on-duty personnel = 0.48 per 1,000 population	International City/County Management Association	Current minimum staffing level is 0.29 per 1,000 population
Average number of firefighters per 1,000 population in the western United States = 0.79	National Fire Protection Association	Current strength is 1.44 per 1,000 population
Arrive at structure fire prior to flashover (typically 5 to 7 minutes from ignition)	FEMA, National Fire Academy	First unit arrival is 8:49 or less, 90 percent of the time
Arrive at EMS call within 4 to 6 minutes of cardiac or respiratory arrest	American Heart Association	First BLS or ALS unit arrival is 7:05 or less, 90 percent of the time

National Fire Protection Association Standard 1710

The National Fire Protection Association (NFPA) has issued a performance standard for fire departments (NFPA 1710).[2] This standard, among other things, identifies target response time performance objectives for career fire departments and a target staffing standard for structure fires. Though not a legal mandate, NFPA 1710 does provide a useful benchmark against which to measure fire department performance.

[2] National Fire Protection Association Standard 1710 "Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments – 2004 Edition."

In the "Response Performance and Outcomes" section of this report the progression of fire and the chance of surviving a cardiac arrest were discussed in relation to time. The NFPA 1710 response time objectives evolved from the science described in that section.

NFPA 1710 contains time performance standards for structure fire response as well as emergency medical response. Each will be discussed individually.

Structure Fire Response

NFPA 1710 recommends that the first company arrive at the scene of a structure fire within five minutes or less from dispatch, 90 percent of the time. The standard establishes that a response "company" consists of four personnel. The standard does not require that all four be on the same vehicle but does expect that the four will operate as a single functioning unit once on scene.

There is another reason the arrival of four personnel is critical for structure fires. As mentioned earlier, current safety regulations require that before personnel can enter a building to extinguish a fire, at least two personnel must be on scene and assigned to conduct search and rescue in case the fire attack crew becomes trapped. This is referred to as the "two in, two out" rule. The only exception to this regulation is if victims are known to be trapped inside the building. SFD emergency scene practices already adhere to this requirement.

The SFD currently staffs its engines with either three or four personnel. In the case of a three-person staffed fire engine, a second response unit must arrive on scene of a structure fire before interior fire attack can commence, unless it is known that a victim is trapped inside the building.

Finally, the NFPA standard calls for the arrival of the entire initial assignment (two or three engines, a ladder company, rescue and/or squad, and a chief officer) within nine minutes or less from dispatch, 90 percent of the time. This is to ensure that enough people and equipment arrive soon enough to be effective in controlling a fire before substantial damage occurs.

NFPA 1710 describes the following performance as meeting the structure fire response criteria of the standard:

- *Turnout time within 80 seconds, 90 percent of the time* (the SFD objective is 90 seconds or less, 90 percent of the time)
- *Arrival of the first "company" within five minutes of dispatch, 90 percent of the time* (the SFD objective is 8 minutes 30 seconds or less, 90 percent of the time)
- *Or, arrival of the entire initial response assignment (all units assigned to the call) within nine minutes of dispatch, 90 percent of the time* (the SFD objective is 11 minutes or less, 90 percent of the time)

Emergency Medical Response

There are three time standards for emergency medical responses. They are:

- *Turnout time within one minute, 90 percent of the time* (the SFD objective is 90 seconds or less, 90 percent of the time)
- *Arrival of a unit with first responder or higher level of capability (basic life support) within five minutes of dispatch or less, 90 percent of the time* (the SFD objective is 8 minutes 30 seconds, 90 percent of the time)
- *Arrival of an advanced life support unit, where this service is provided by the fire department, within nine minutes of dispatch, 90 percent of the time* (the SFD objective is 8 minutes 30 seconds or less, 90 percent of the time)

There is, in nearly every case, a significant difference between the current SFD objectives, which are being met, and those proposed in NFPA 1710, which are not being met. The following table compares the NFPA 1710 standards with SFD's performance.

Figure 30. NFPA Comparables

Response Interval	NFPA 1710 Standard	SFD Performance
Turnout time	60 seconds or less, 90% of the time	2 minutes 15 seconds or less, 90% of the time
Travel time	4 minutes or less, 90% of the time	5 minutes 44 seconds or less, 90% of the time
Response time – fire	5 minutes or less, 90% of the time	8 minutes 49 seconds or less, 90% of the time
Response time – EMS	5 minutes or less, 90% of the time	7 minutes 5 seconds or less, 90% of the time
Response time – ALS	9 minutes or less, 90% of the time	8 minutes 6 seconds or less, 90% of the time

Analysis

The City of Spokane should consider whether its current standards provide an adequate level of service to the community, or whether a more aggressive standard should be established. As with any improvement, cost is a factor. Ultimately it becomes a question of what level of service the community is willing to pay for. The following table explores factors contributing to current levels of service and options available to improve service. Performance objectives described in NFPA 1710 will be used for this analysis since they are a recognized national standard.

To better understand why SFD is not meeting the NFPA 1710 recommendations, an analysis of incident data was conducted to determine specific factors that may be involved. All priority incidents with valid incident times (dispatch, enroute, and arrival) were reviewed. The results are shown in the following table

Figure 31. Incident Data Analysis

Criteria	Number of Incidents	Percentage of Total
Total incidents in the evaluation data set	10,887	100.0%
Incidents that met the NFPA 1710 five-minute response time standard	6,777	62.2%
Incidents that did not meet the standard due solely to long turnout times (in excess of 60 seconds)	1,257	11.5%
Incidents that did not meet the standard due solely to long travel times (in excess of four minutes)	2,853	26.2%

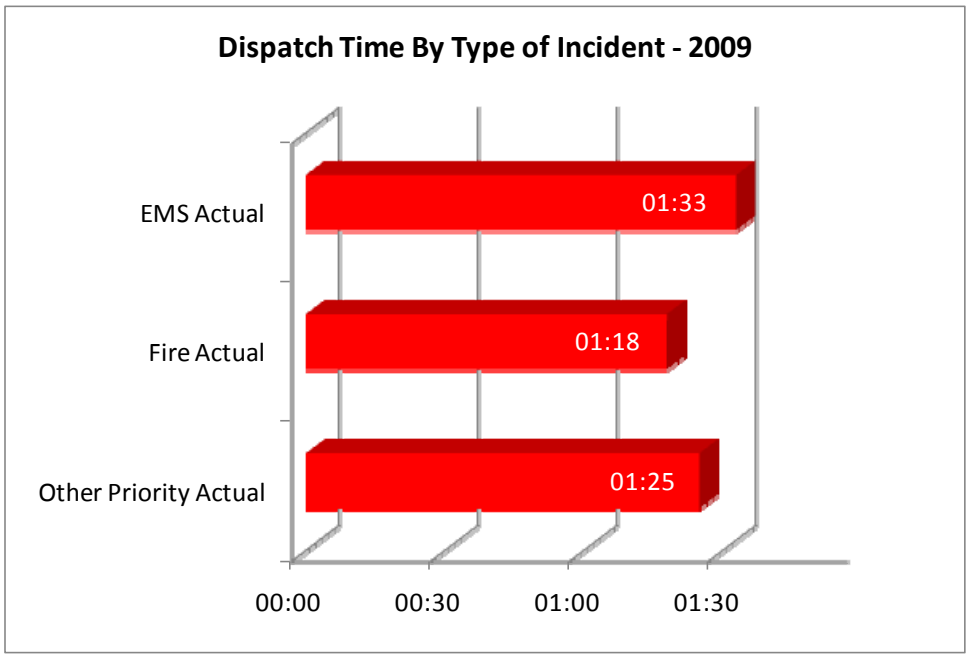
The following section discusses each response time interval, factors influencing current performance, and options for improvement.

Dispatch Time

From the customer's standpoint, the time it takes from the initial call to 9-1-1 to the arrival of fire department assistance is the true measure of response time. The time taken at the dispatch center to gather information about the emergency, determine who is to respond to assist, and notify those response personnel is an important period. The shorter the dispatch time, the more quickly assistance can be provided.

The following chart shows dispatch times for each of the three general priority incident types at the 90th percentile.

Figure 32. Dispatch Time by Type of Incident, 2009



SFD uses computer technology to speed the process of response unit selection and dispatch. However, observations of the call taking and dispatch process offer an opportunity to shorten the overall time from initial call for help to arrival of assistance.

In a typical sequence, a call taker answers the 9-1-1 call and gathers sufficient information from the reporting party to determine the nature and location of the emergency. Usually this is enough to determine which response units should be dispatched. Once this is determined, the call taker transfers that information to a dispatcher who notifies response units of the type and location of the emergency. This allows the call taker to gather additional information useful to responders and, if appropriate, give instructions to the caller about actions they can take, such as how to perform CPR in the case of cardiac arrest.

In SFD's case the call taker is also the dispatcher. Since the call taker must wait until the caller interrogation is complete to dispatch response units, time is lost in initiating the response. Most similar systems allow the call taker to "send" the call information electronically to another person who then dispatches the appropriate response units. Other options allow the call taker to send incident information directly to response units via computerized systems, including synthesized voice information. The call taker is free to continue gathering other information and provide pre-arrival instructions without interrupting the call taking process.

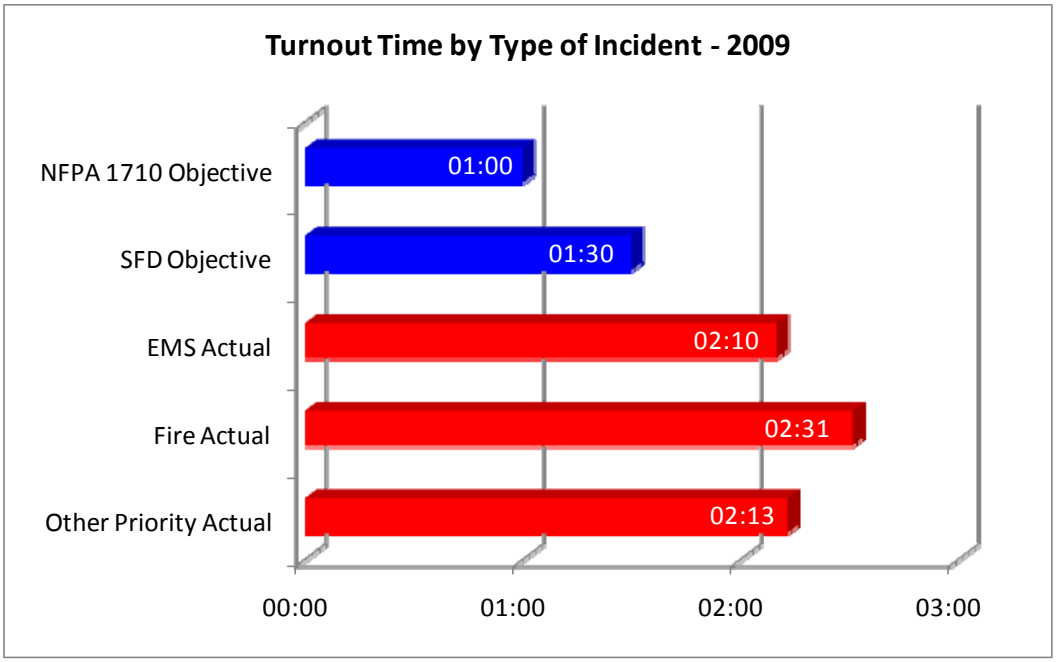
SFD is aware of the opportunity to shorten the dispatch time by using this procedure and intends to implement this change at the earliest opportunity.

Turnout Time

Turnout time is the interval between notification of response personnel of the incident by the dispatch center and beginning of response apparatus movement towards the incident. During this interval response personnel must determine the location and type of incident, evaluate the best route of travel to the location, don equipment, board the apparatus, and initiate vehicle movement.

The department's turnout time performance during 2009 is presented in the following chart by type of priority incident, along with the NFPA 1710 and SFD objectives. Turnout time for all incident types is 2 minutes 15 seconds or less, 90 percent of the time. Approximately 39 percent of all priority incidents had turnout times in excess of 90 seconds; 77 percent had turnout times in excess of the NFPA 1710 objective of 60 seconds.

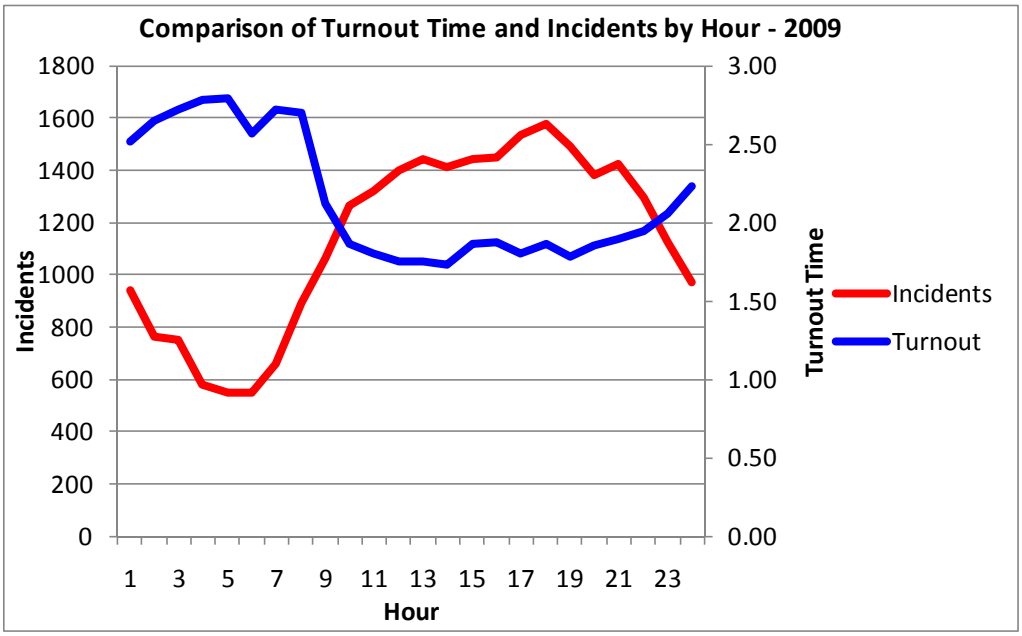
Figure 33. Turnout Time by Incident Type, 2009



The following chart shows average turnout time by hour of day compared to the number of incidents occurring by hour. Turnout time is longest during the night time and shortest during

the day. There is a more than one-minute difference between the slowest and fastest hours. Workload does not appear to be affecting turnout time.

Figure 34. Comparison of Turnout Time and Incidents by Hour of Day, 2009



Several factors may be affecting current performance:

- The time required to broadcast the details of an emergency may be considerable.
- Fire stations may not be designed to facilitate quick initiation of response.
- Firefighters may need to spend an excessive amount of time donning equipment, determining route of travel, and assembling on apparatus.
- Firefighters may not be sufficiently aware of their current performance to improve the time required to initiate response, or they may not be sufficiently motivated to do so.

There are numerous new technologies that can greatly assist fire department personnel in their response to and control of emergency events. The benefits of utilizing such technology include more rapid initiation of response, better response route planning, and improved pre-arrival intelligence about the event and its location.

Mobile computing technology, currently used to a small degree by SFD, has advanced substantially in the past several years. Current SFD equipment primarily provides some incident information and allows for data transfer of unit status changes. Expanding on this technology would provide substantial benefits for both turnout time and travel time.

It is possible to have the following information readily accessible on a computer in the response vehicle:

- A map showing the location of the incident
- A map and text display of the best route of travel (including real-time road obstruction information)
- Pre-incident plans of target structures
- Lists of hazardous materials used at specific locations
- Graphic display of fire protection features such as hydrants, fire department connections, and fire access roadways
- Topographic maps
- Aerial photographs
- Real-time display of the locations of response units and their status
- Current list of other incidents in progress and the status of units assigned to those incidents
- History of previous responses to the same and/or nearby locations

Full utilization of this technology can provide improved response time performance. Personnel would no longer need to spend time at the fire station locating the incident on a map and planning routes of travel. The best travel path is identified for the vehicle operator based on a variety of factors including road speeds, number of turns, predicted traffic congestion, and closed or obstructed roads. When incorporated into the dispatch system, the closest unit (based on these factors) can be dispatched regardless of who is normally assigned to the response area, leading to further improvement in response time performance.

Response personnel performance must also be addressed. Since the original report, fire department management has provided information to response personnel indicating current performance. This should continue, and performance expectations should be reinforced and periodic monitoring conducted to determine if improvements are being made and sustained. Response personnel must make serious efforts to improve their performance to meet the department's desired objectives.

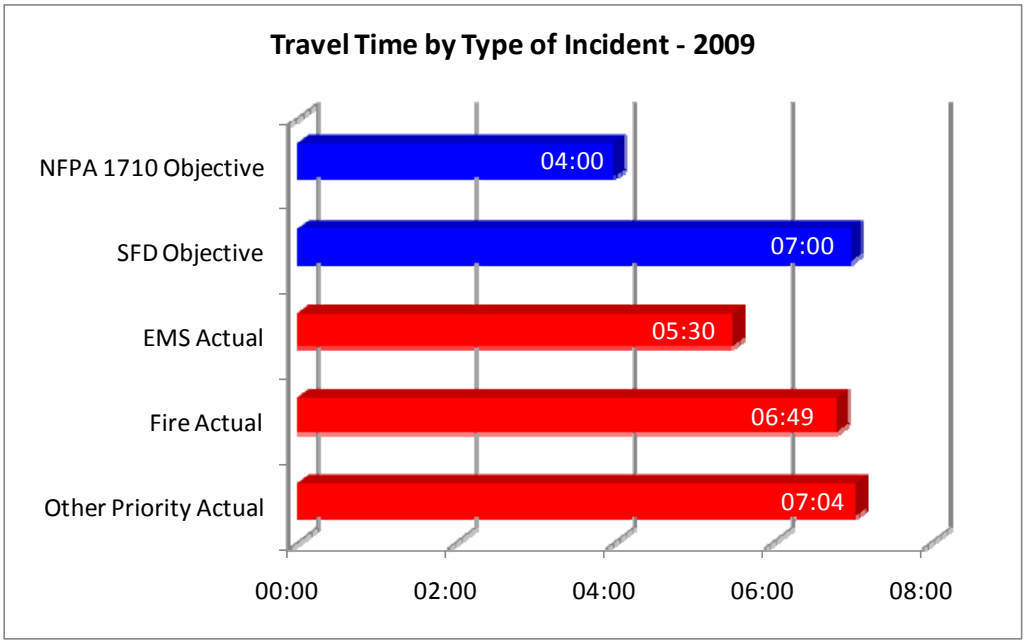
Travel Time

Travel time is the interval between the initiation of apparatus movement towards the incident and the arrival at the incident location. Travel times are typically the longest component in overall response time and are influenced by a variety of factors, including:

- Fire station location
- Vehicle condition
- Personnel training
    - Street design
    - Width
    - Interconnectivity
    - Existence of traffic "calming" devices
    - Traffic signal pre-emption capability
- Traffic congestion

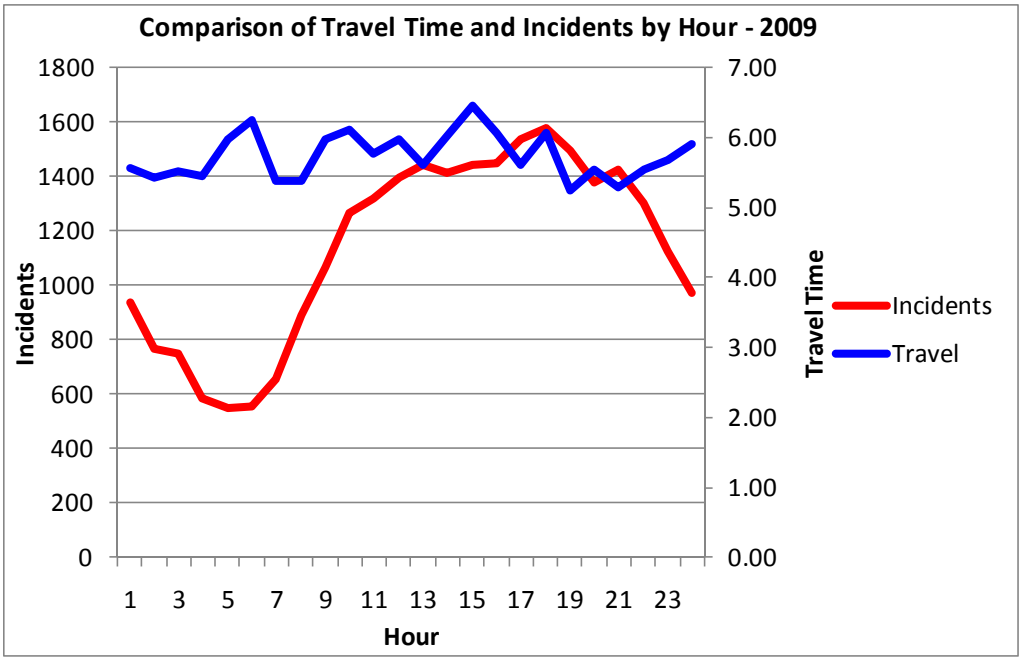
The NFPA 1710 target for travel time is four minutes. SFD's actual travel times during 2009 for all priority incidents was 5 minutes 44 seconds or less, 90 percent of the time. The following chart shows travel times during 2009 for each type of priority incident.

Figure 35. Travel Time by Type of Incident, 2009



Fire and other priority incident travel times are significantly longer than EMS. The next chart shows the hourly comparison of travel times and total incidents. There is a one minute 14 second difference between the slowest and fastest hours. Again, travel times seem unaffected by workload, nor does evening commute congestion seem to be a factor. There may be some influence from the morning commute.

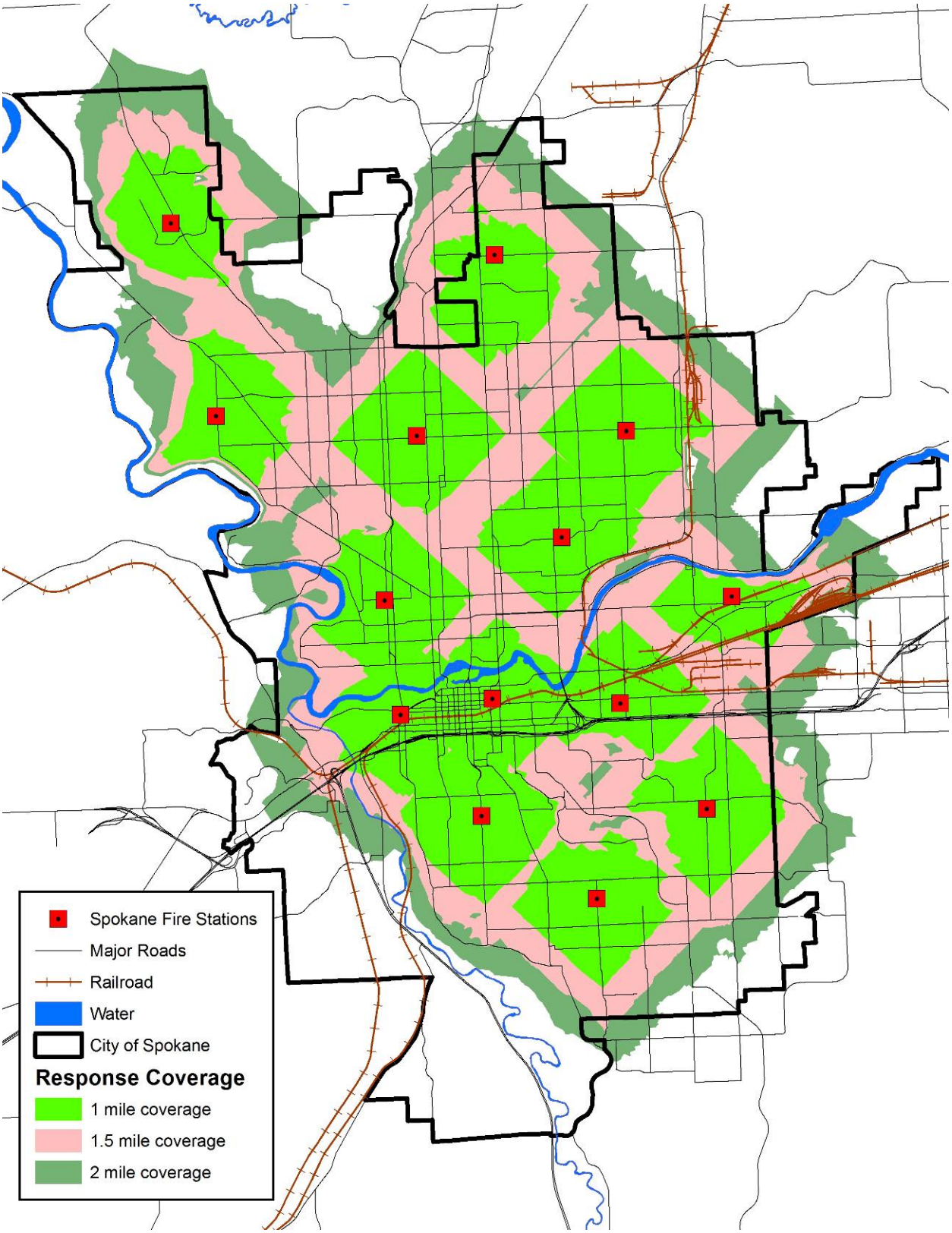
Figure 36. Comparison of Travel Time and Incidents by Hour of Day, 2006



The location of fire stations is a very important factor in achieving travel time performance objectives. At an average response travel speed of 25 mph, a vehicle can travel 1.5 miles in four minutes—the NFPA 1710 travel time target.[3] The following map shows the locations of existing SFD fire stations and the response coverage provided at the one, one and one-half, and two mile distance. The areas are drawn based on actual travel distances along roadways.

[3] This average speed compensates for acceleration and deceleration at intersections, turns, and other maneuvers.

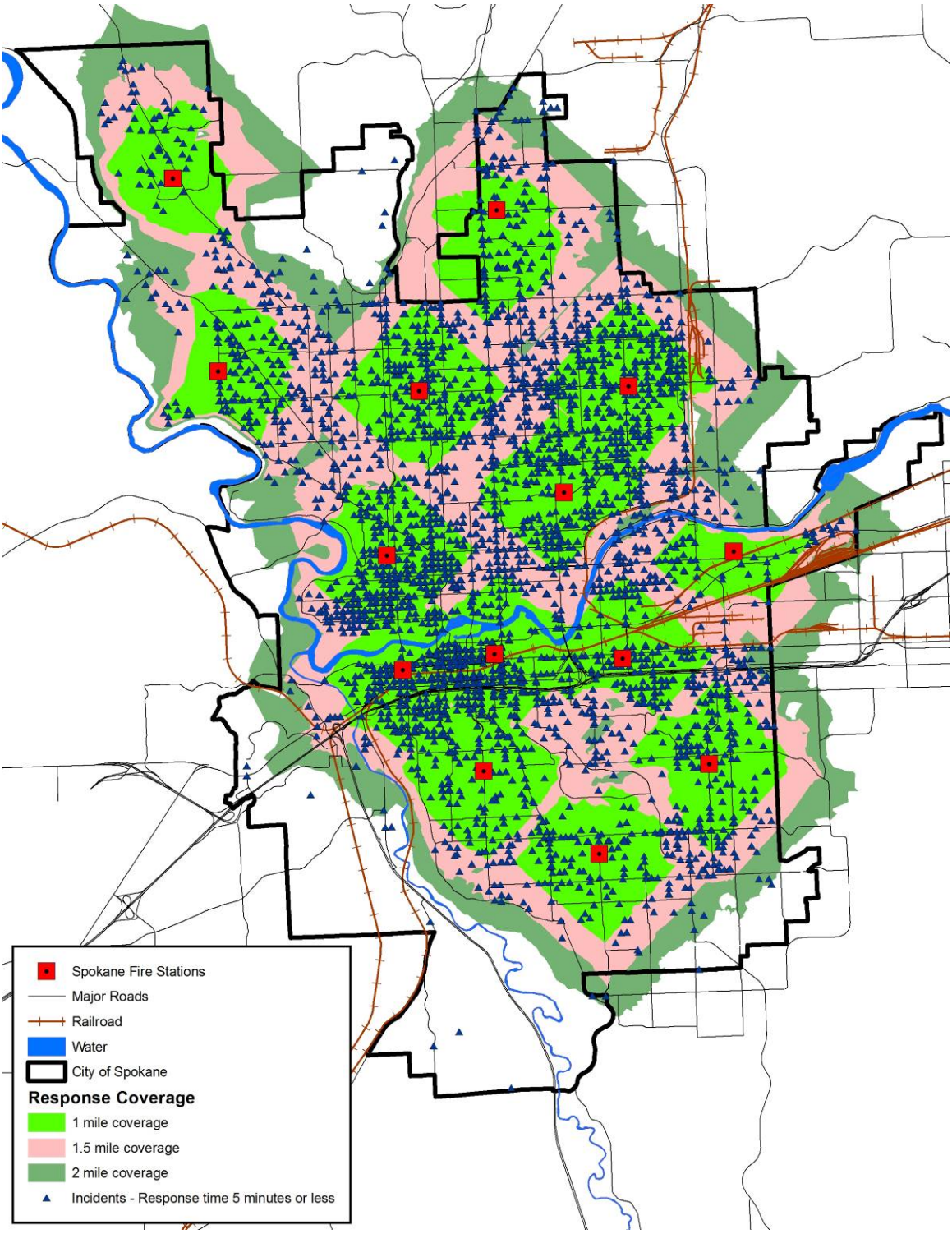
Figure 37. Response Coverage from Existing Fire Stations



The quality of this coverage was tested by evaluating the number of incidents that occurred within four travel minutes of a fire station using the 25 mph average travel speed (1.5-mile travel distance). During 2009, 87.8 percent of all priority incidents were within four travel minutes of a station. Overall, 93.6 percent of incidents that met the NFPA 1710 response time target of five minutes or less were within four minutes (1.5 miles) of a station. However, 77.5 percent of incidents that did not meet the target were also within four minutes (1.5 miles) of a fire station. This indicates that something other than geographic coverage is influencing response time performance.

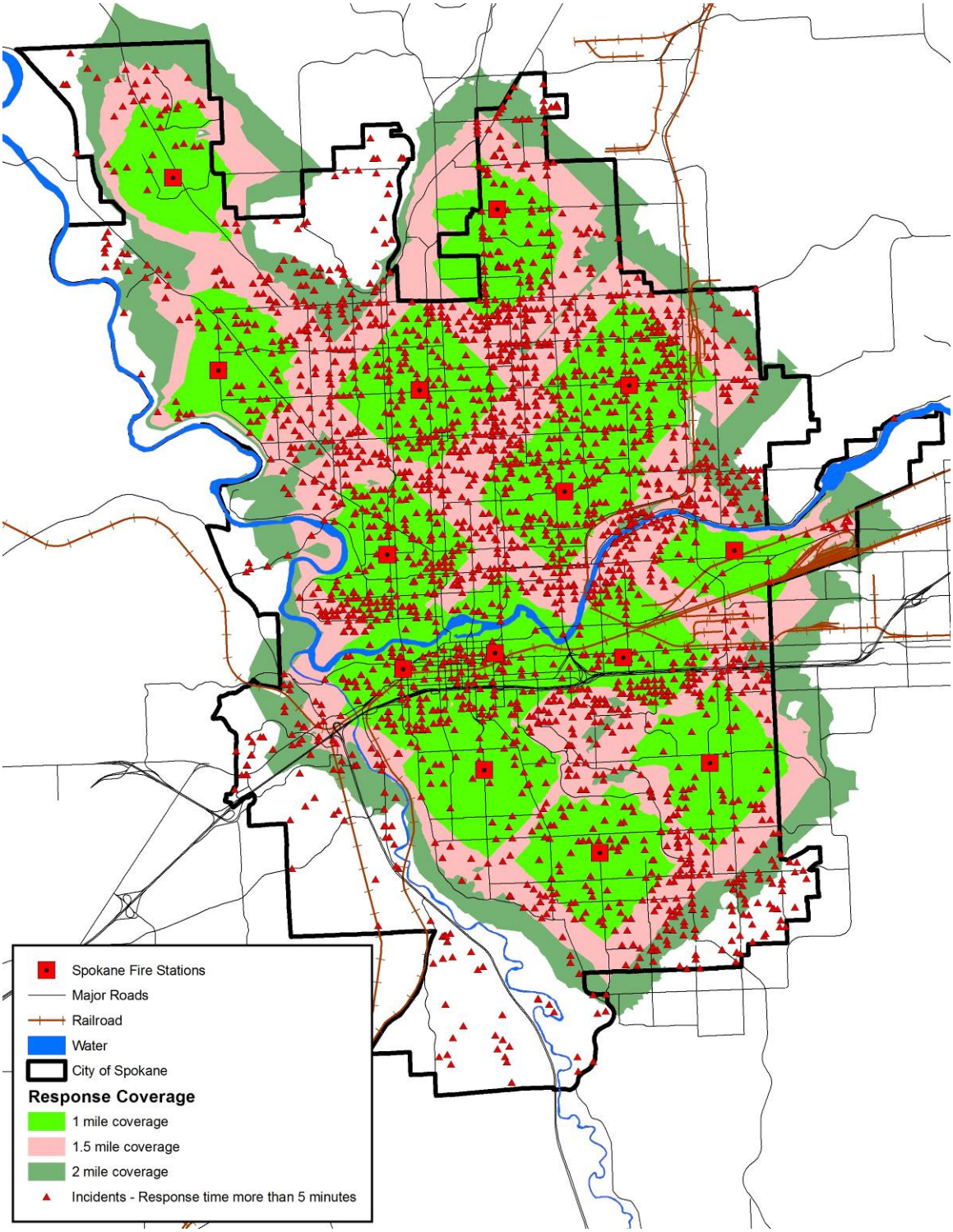
The following map shows the location of priority incidents that met the NFPA 1710 response time target of five minutes or less.

Figure 38. Incidents with Response Time of Five Minutes or Less, 2009



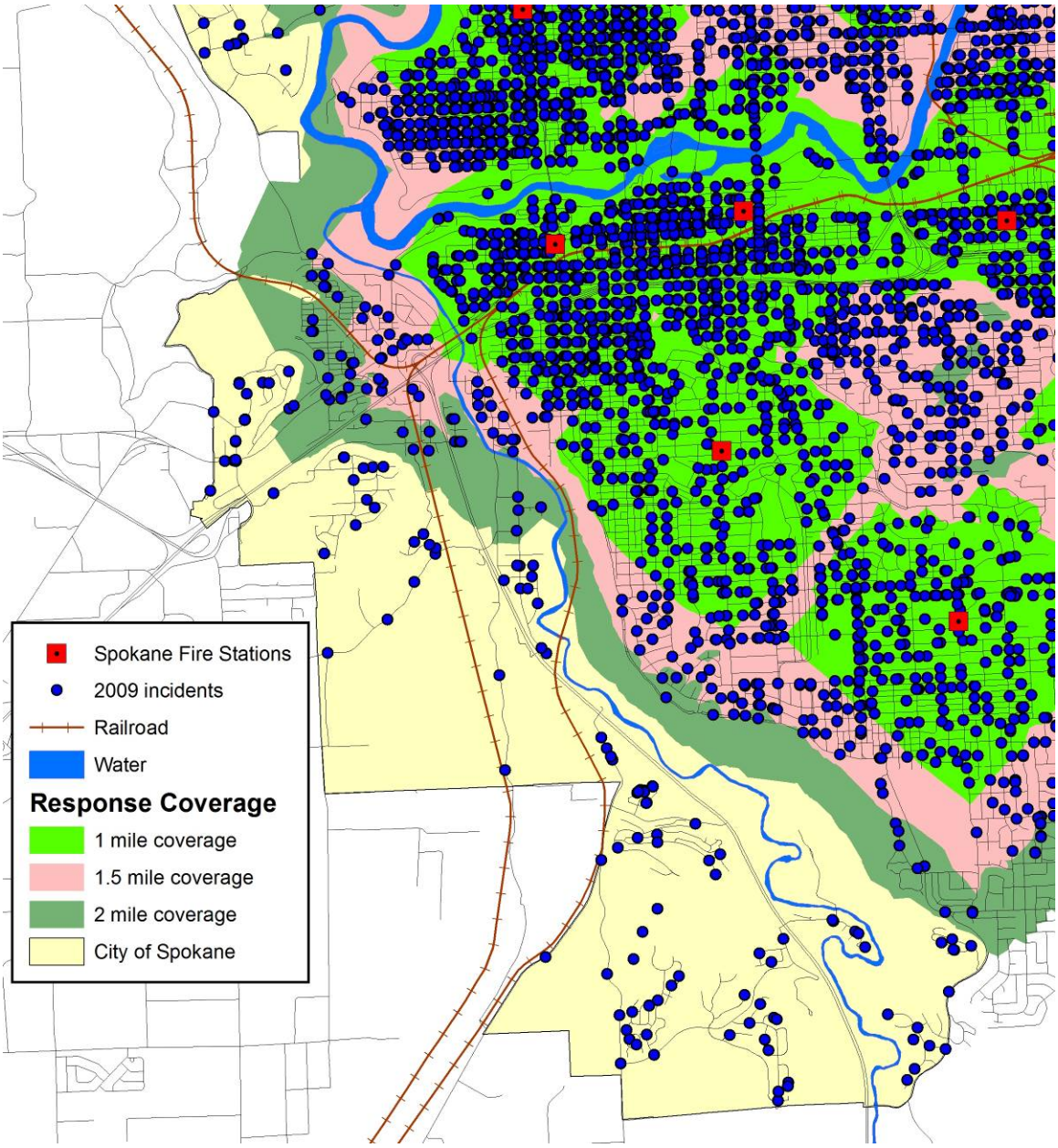
The next map shows the location of incidents that did not meet the NFPA 1710 response time target of five minutes or less.

Figure 39. Incidents with Response Times Greater than Five Minutes, 2009



At the southern and southwestern edges of the city are areas that fall well outside reasonable geographic coverage of a fire station. The following map shows this area in relation to coverage provided from existing stations. Travel distances from existing stations exceed five miles. This translates to travel times in excess of ten minutes. In addition, the Washington Survey and Rating Bureau considers areas beyond five miles of a fire station to be essentially "unprotected," and assigns a Class 10 rating to these areas.

Figure 40. Coverage Areas by Distance from Stations



On the other hand, there is relatively little response activity in this area. During all of 2009, only 214 calls for service occurred within the area west of the river and beyond two road miles of a fire station. It's not likely that this area will warrant a fire station based solely on response activity.

Determining an appropriate level of service to this area should be an important policy discussion for the Spokane Mayor and City Council. The choice will be either to provide a level of service to this portion of the community more in keeping with that provided to the balance of the city, or to invest city resources to improve service to a greater number of people.

The Mayor and Council have a responsibility to provide somewhat equitable levels of service to its entire citizenry. The decision to annex this territory should have also included a commitment to provide services in keeping with general city standards. Response times to priority incidents in this area generally always exceed the city's adopted 8-minute, 30-second standard. Current service levels cannot be considered equitable with the balance of the city.

On the other hand, an investment in response resources in other areas of the city would benefit a greater number of people. The effect of adding resources, for example in the central city area where incident concentration is the highest, will provide a quicker response to far more emergencies than to the southwest city territory. The decision of where to invest in improved service is a difficult one that should be given careful consideration.

Response unit availability can also affect travel times. If the response unit assigned to a given station area is not available at the time of an emergency, a more distant unit must respond in its place. Unit workload and time away from the station for training or administrative purposes negatively impact emergency response travel times.

Recall the table earlier in this report that identified unit hour utilization rates for all SFD response units; the table is reprinted below. Achieving a target response time at least 90 percent of the time requires that the primary unit for a response area be available in its area at least 90 percent of the time. Based on workload alone (and not other causes for a unit being out of its primary area), the highlighted units in the following table would not be capable of delivering on a five-minute response time as described by NFPA 1710, given current response coverage.

Figure 41. Response Unit Utilization Rates

Unit	Unit Hour Utilization
Engine 1	0.10
Ladder 1	0.07
Rescue 1	0.07
Ladder 2	0.08
Engine 3*	0.13
Engine 4	0.10
Ladder 4	0.08
Engine 7*	0.11
Engine 8	0.05
Engine 9	0.05
Pumper Ladder 11	0.08
Pumper Ladder 13*	0.11
Engine 14	0.06
Engine 15*	0.14
Engine 16	0.06
Engine 17	0.03
Engine 18*	0.12

*Current workload/response coverage prohibits five-minute response time.

The figures in the table above do not include time out of primary response areas for training and other administrative purposes. No information is available to quantify the amount of time a unit is away from its area for these purposes. There are opportunities available to reduce the need for out of area travel; most particularly video conferencing to fire stations for delivery of training.

Reducing the resistance of response routes can provide significant improvements in travel time performance. In a report released by the United States Fire Administration, the benefits of traffic signal pre-emption for emergency response speed and safety are well described.[4] Studies reveal that signal controlled intersections are the most common location for emergency vehicle collisions, and that traffic signal pre-emption by emergency vehicles is an effective way to minimize the occurrence of collisions and improve response times.

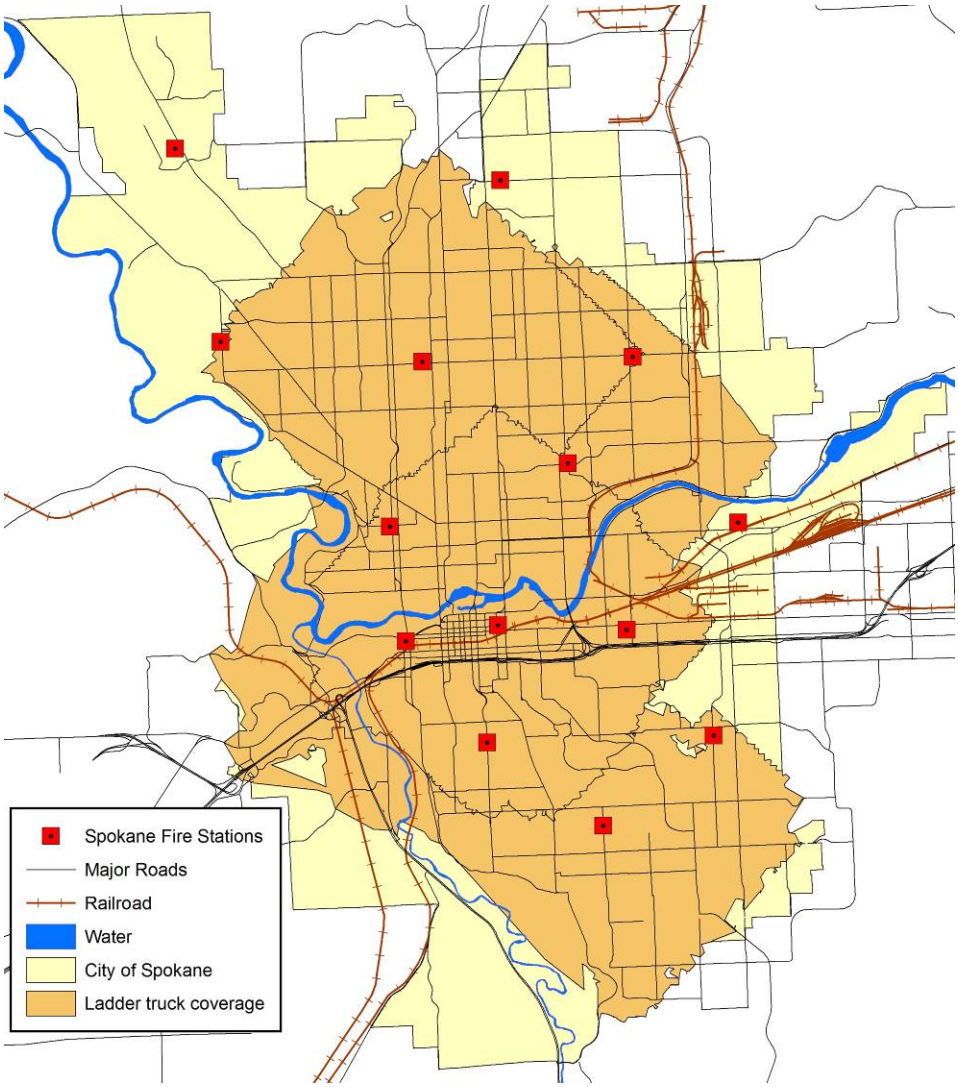
Given the amount of traffic carried on city roadways, installation of traffic signal pre-emption equipment should be given serious consideration. The benefits of improved safety to all motorists and reduced travel times for emergency vehicles make this a worthwhile investment.

[4] "Emergency Vehicle Safety Initiative" FA-272, August 2004, FEMA – United States Fire Administration.

Ladder trucks are a specialized and important resource. Though a ladder truck is not needed in every fire station, the ideal distribution places a ladder truck within 2.5 miles of all built upon areas of the city.

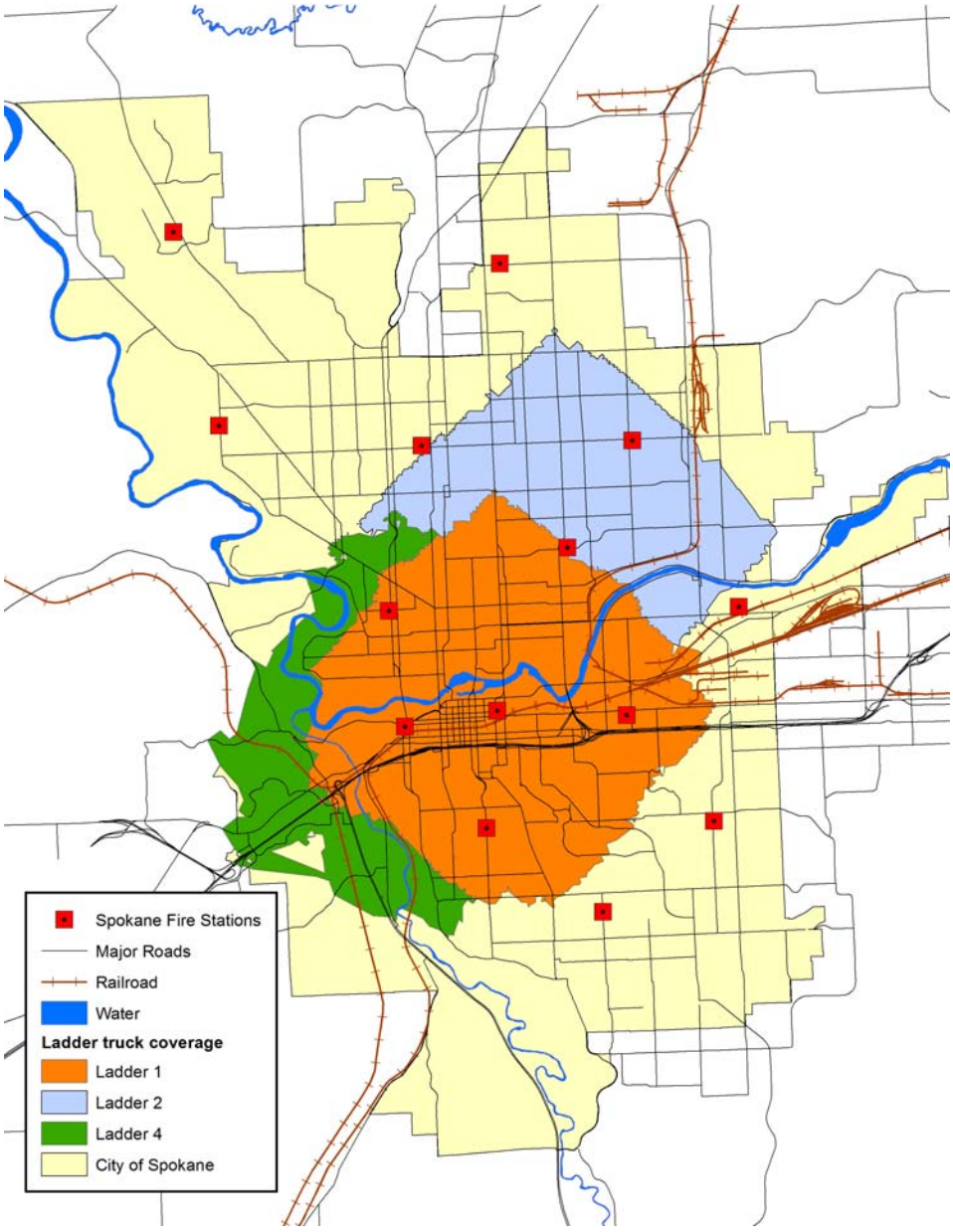
The following map shows current ladder truck coverage based on this target distance. The northwest portion of Spokane could benefit from improved coverage, but for the most part current ladder truck distribution is adequate. It is important to note that two of the department's ladder trucks (PL11 and PL13) also serve as the fire engine from their respective stations. In practice these "pumper-ladder" trucks can only effectively perform as a pumper or a ladder truck. Given current staffing, it is not reasonable to expect one unit to perform both functions on an incident.

Figure 42. Current Ladder Truck Coverage - All



If Pumper-Ladders 11 and 13 are not available to serve as ladder trucks, ladder truck coverage is significantly reduced, as shown in the following map. The three dedicated ladder trucks are positioned where each will most likely be needed; however, there are significant portions of the city outside the 2.5-mile rating bureau standard.

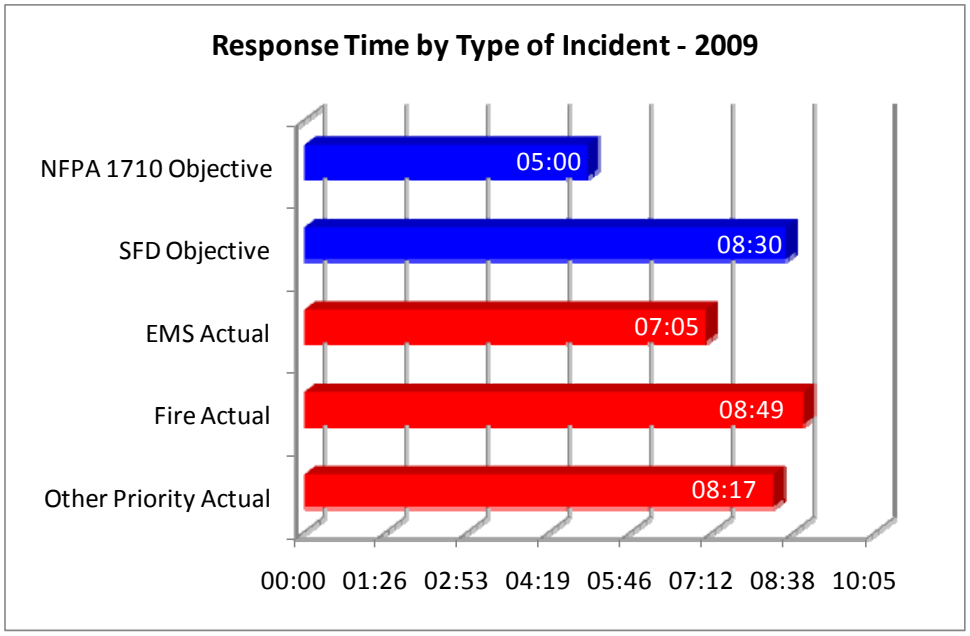
Figure 43. Ladder Truck Coverage - Three Ladder Trucks



Overall Response Time

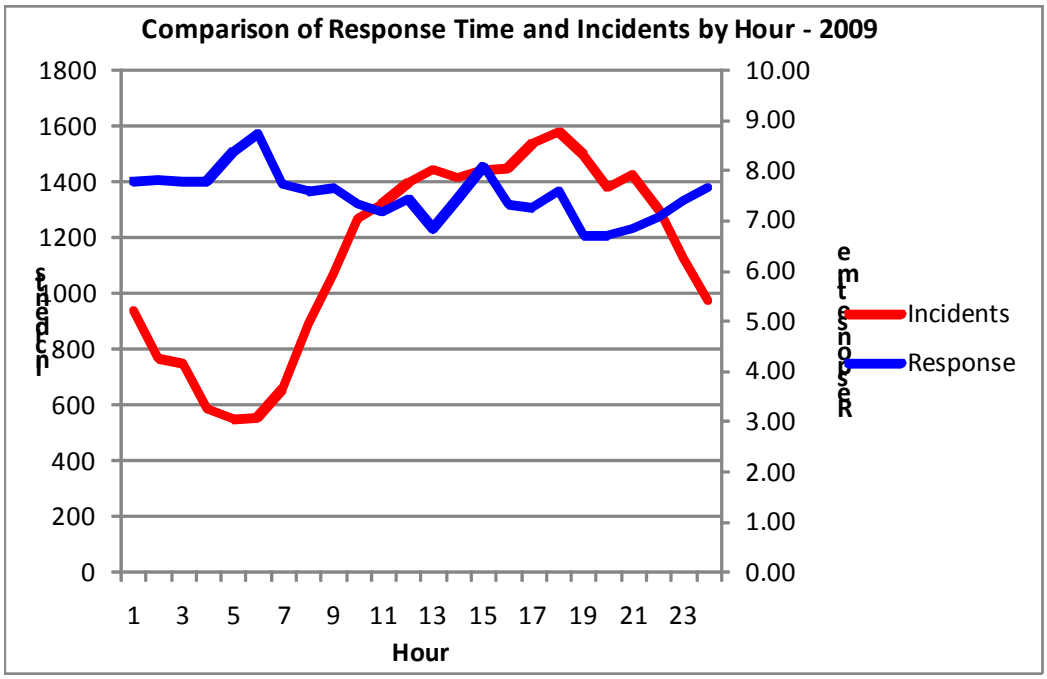
Response time is the combination of turnout time and travel time for any given incident. Minimizing response time contributes to the successful outcome of an emergency event. The following chart shows response time during 2009 for each type of priority incident. The only type of incident not meeting SFD objectives is the "other priority" class. None of the priority incident types are achieving response times recommended by NFPA 1710.

Figure 44. Response Time by Type of Incident, 2009



The following chart shows the 90th percentile response time by hour of day compared to the number of incidents occurring within each hour.

Figure 45. Comparison of Response Time and Incidents by Hour of Day, 2009



Overall workload clearly is not an influence on response performance. SFD's longest average response times occur during the periods of least response activity. Reducing turnout time in particular and (to some degree) improving response area coverage are strategies to pursue.

Full Initial Alarm Assignment

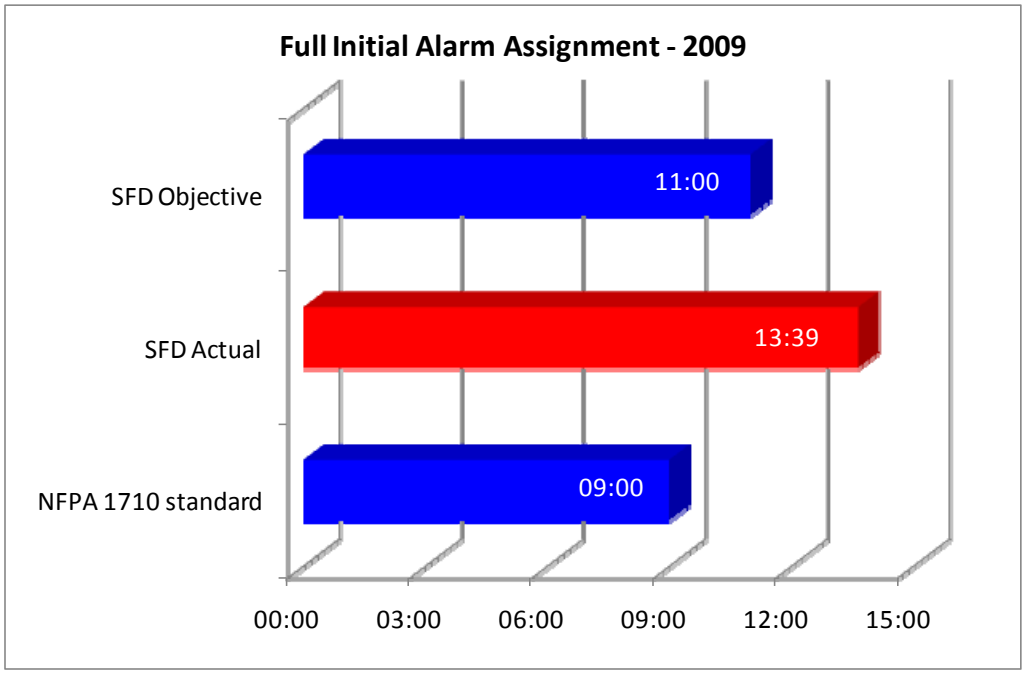
The time it takes to deliver a sufficient number of personnel, apparatus, and equipment to significant incidents requiring multiple response units, such as structure fires, has a marked impact on incident outcome. Various studies, including one just released by the National Institute on Standards and Testing (NIST) confirms that delivering the number of personnel needed to perform critical incident tasks early in the incident provides much better opportunity to save property and lives.

SFD has established its objective to deliver the full initial alarm assignment to a structure fire within 11 minutes or less, 90 percent of the time. This response time was achieved only 78 percent of the time during 2009.

To deliver this level of response performance, response units must be positioned so that the full initial response force is within 11 minutes or less response time of the occurring incident (9 minutes 30 seconds, assuming turnout time is less than or equal to the standard of 90 seconds).

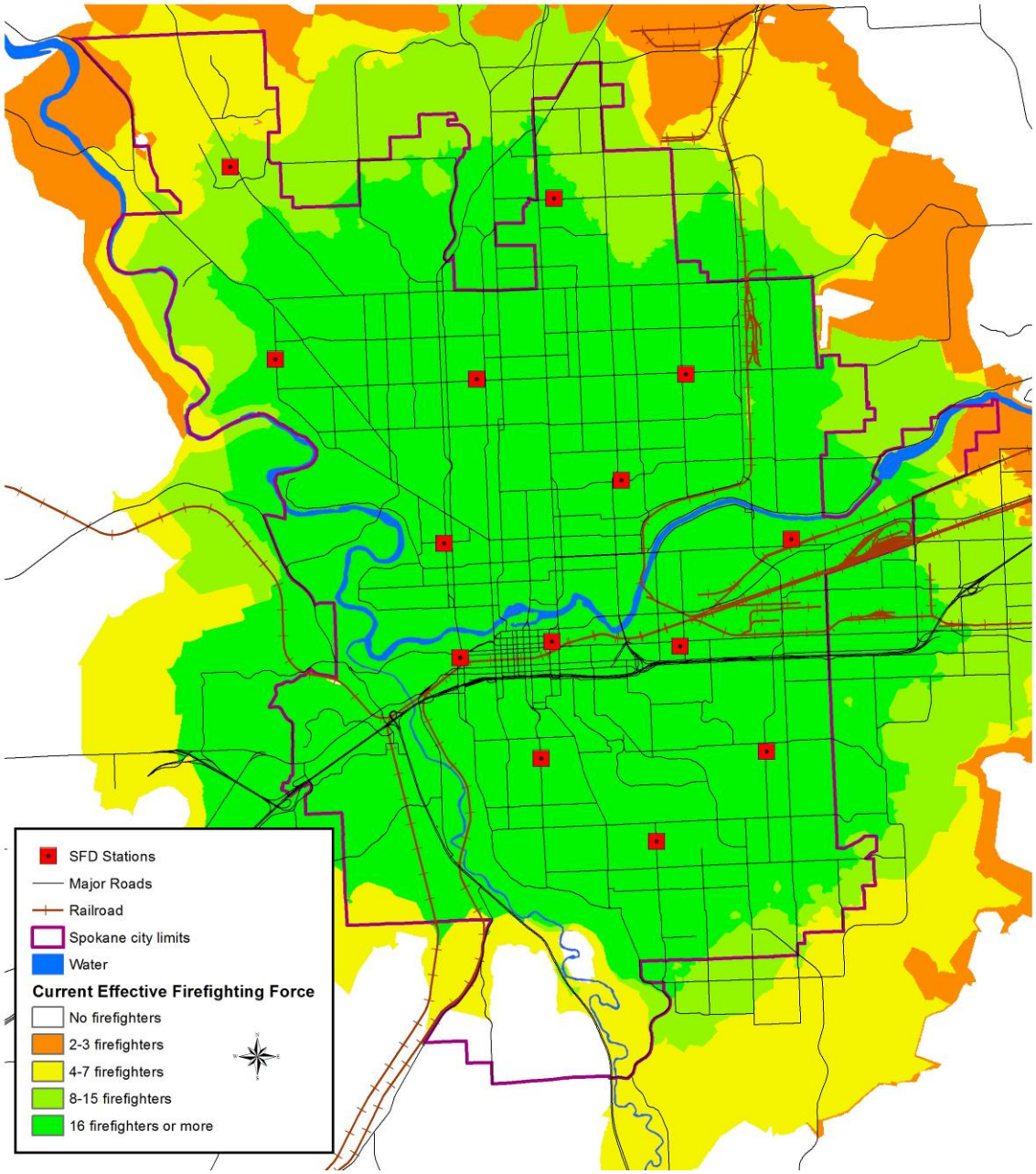
NFPA 1710 suggests that the full initial response force should arrive within 9 minutes 20 seconds or less, 90 percent of the time (80 seconds for turnout time and eight minutes for travel time). The chart below compares the two standards and SFD's actual performance.

Figure 46. Full Initial Response Force Response Time Compared



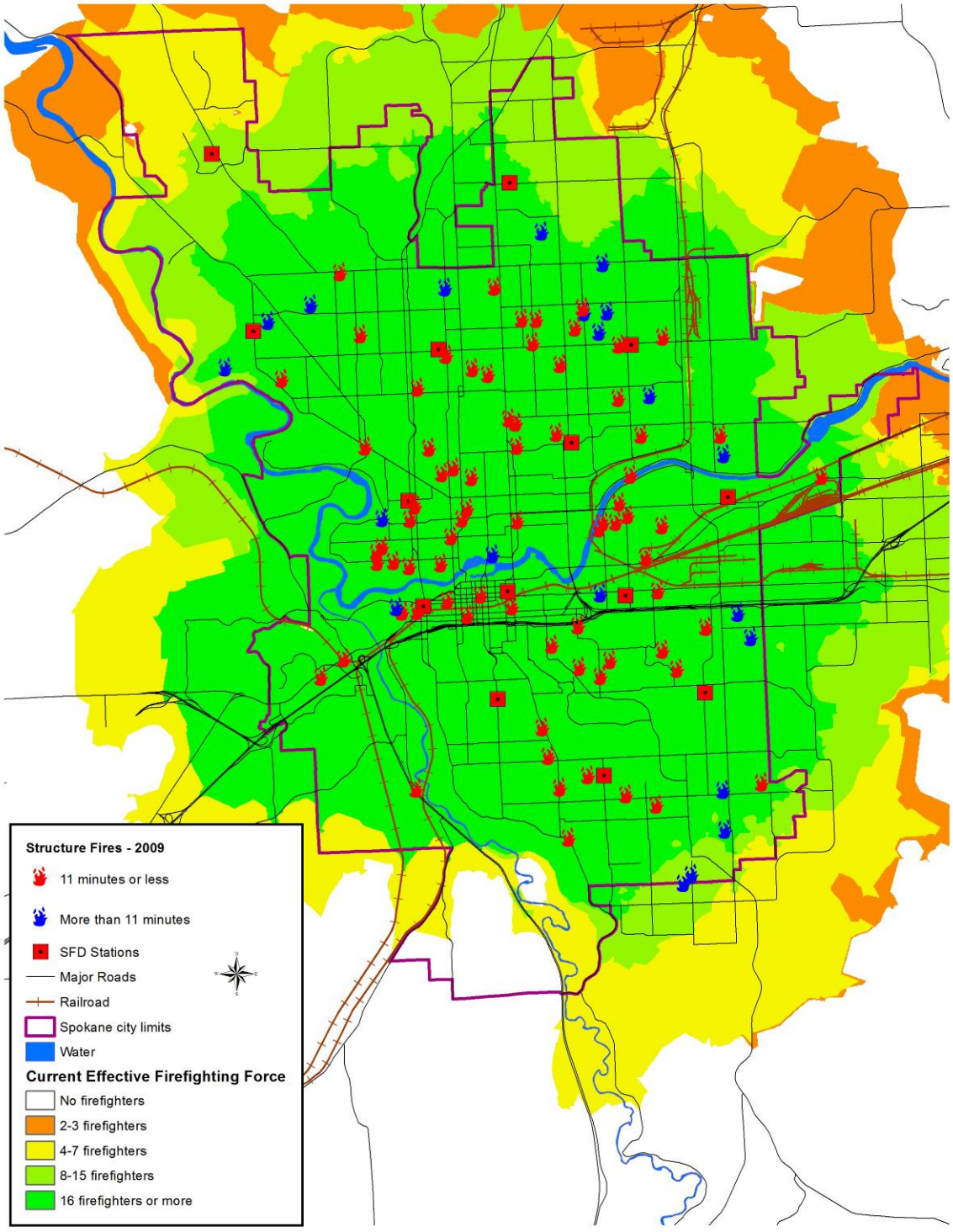
The following map illustrates the SFD service area to which various numbers of firefighters can be delivered within target response time standards, assuming all response units are available for response within their respective service areas. Structure fire incidents during 2009 are included on the map. Most of the city has sufficient coverage, except areas in the northwest and in the southwest.

Figure 47. Current Effective Firefighting Force Coverage



The next map shows those structure fires to which the full effective firefighting force arrived at the incident's location. The location markers in red indicate those for which the 11 minutes or less response time objective was achieved. The blue markers are those incidents in which the response time objective was not achieved.

Figure 48. Structure Fires 2009 and Response Time Performance



Structure fires not meeting the response time objective generally occurred away from the central city area.

Actual full effective response time performance exceeds SFD's objective by 2 minutes 39 seconds. There are several reasons for this:

- At least one minute can be attributed to long turnout times
- System activity at the time of the incident may have prevented closer units from responding
- The incident occurred in an area not served by an effective firefighting force
- Not all units responded in emergency status to the scene. Some units may have been downgraded to a non-emergency response. Incident data does not contain information to distinguish response status.

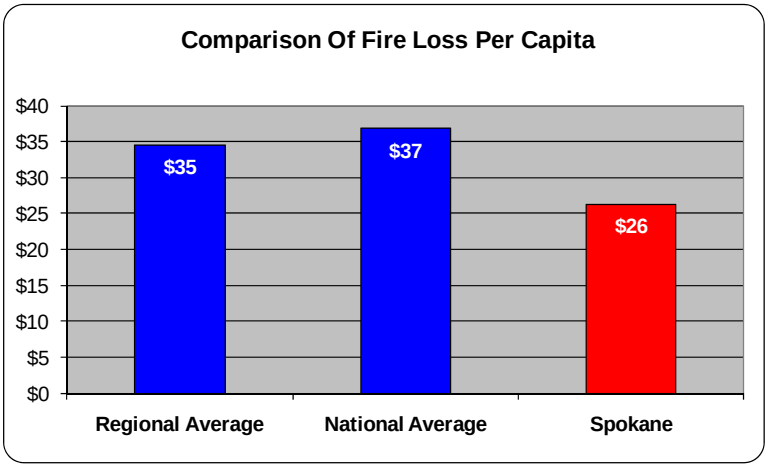
Analysis of Outcomes

Fire departments respond to emergency events to control the emergency in progress in such a way that the damage to life and property is minimized. Given complete and accurate data, there are a variety of ways to measure this.

Fire loss information is available and provides a useful review of structure fire outcomes. In the following charts, fire occurrence and losses for the city are compared with regional and national experience.

The following chart displays the property loss in dollars per capita and compares this against other communities of similar population in the western region of the United States as well as the national average for communities of similar population size.

Figure 49. Fire Loss Per Capita, Regional and National Comparables



Source: National Fire Protection Association

The city compares favorably to the regional average and is below the national average.

No information is available to evaluate emergency medical incident outcomes. Various privacy laws make this a challenge, regardless of a fire department's desire to keep records by which to evaluate success. Statistics can be kept that would contribute to an understanding of emergency medical incident outcomes.

Summary of Analysis

The Spokane Fire Department is meeting the expectations of City Council as established in the city's Comprehensive Plan. SFD recognizes it is not performing to the level defined by national standards and is taking steps to improve performance, this study being one such effort.

The department regularly reviews performance and outcomes, makes adjustments to response unit deployment, and incorporates other initiatives into actions to deliver better service. But SFD can only provide service to the level funding allows.

Most all of the following recommendations will provide improved service to the Spokane community, but will require a commitment of funding to accomplish. The city's policy makers are encouraged to give them due consideration.

Recommendations

The remainder of this report identifies and details a variety of options and recommendations for the city and its fire department. Included are short term recommendations to capture service delivery improvements through such things as adjustments to business practices, staffing, technology, and others. In addition, the implications of future community growth are addressed in long term recommendations for the relocation or addition of fire stations, apparatus, and personnel.

Level of Service Definition

The Spokane Fire Department is, in nearly all cases, meeting its currently adopted response time level of service objectives. The Spokane Mayor and City Council should re-evaluate the level of service definitions expressed in the city's comprehensive plan. Current response time performance objectives significantly exceed national recommended practice as described in National Fire Protection Association Standard 1710.[5] The science of fire behavior and survivability of a serious emergency medical event necessitates earlier intervention than can be provided by currently defined levels of service.

Spokane's adopted level of service objectives are also significantly longer that other comparable cities in Washington. The following have all adopted response objectives emulating those found in NFPA 1710.

Figure 50. Level of Service Objectives, Washington Comparables

City	First Unit Arrival	Full Structure Fire Assignment Arrival
Seattle	5 minutes or less, 90% of the time	9 minutes or less, 90% of the time
Everett	5 minutes or less, 90% of the time	9 minutes or less, 90% of the time
Vancouver	5 minutes or less, 90% of the time	10 minutes or less, 90% of the time
Tacoma	5 minutes or less, 90% of the time	9 minutes or less, 90% of the time
Bellevue	5 minutes or less, 90% of the time	10 minutes or less, 90% of the time
Spokane	8 minutes 30 seconds or less, 90% of the time	11 minutes or less, 90% of the time

If the Mayor and City Council choose to adopt a more aggressive standard, they must understand that additional fire department resources will be required to meet the new expectations. The department has seen a significant decline in staffing over the past years, in

[5] First unit arrival within 8 minutes and 30 seconds of dispatch or less, 90 percent of the time, for both fire and emergency medical incidents.

spite of increasing workload. A consequence of these reductions has been a downgrade in the community fire insurance rating and a degradation of emergency intervention capability. Reversing this trend will be important to preserving, and improving, this important aspect of public safety.

Recommendation:

The Spokane Mayor and City Council should re-evaluate current level of service (response time) objectives and, if desired, adopt more aggressive standards to define the desired level of service to be provided by its fire department.

Turnout Time

NFPA 1710 sets a target of 60 seconds or less, 90 percent of the time to initiate response (turnout time). This is the time period between when dispatchers notify response personnel of the incident and when response crews begin travel towards the location. SFD's current turnout time performance is nearly 75 seconds longer. Approximately 11.5 percent of all responses that did not meet NFPA 1710 response time objectives were solely due to long turnout times. Improvement is needed.

The department should explore whether dispatch broadcast times can be reduced, fire station layouts can be modified to improve turnout time, and technology opportunities such as enhanced mobile data computing capability can be implemented to shorten turnout times.

Response personnel performance must also be addressed. Fire department management has prepared and provided information indicating current performance by response crews. Performance expectations should be reinforced and periodic monitoring continued to determine if improvements are being made and sustained. Response personnel must make serious efforts to improve their turnout time performance for the benefit of the community.

Recommendation:

Reduce emergency incident turnout times through various initiatives, including technology implementation and continued personnel performance monitoring and improvement efforts.

Travel Time

Another phase of overall response time that needs attention is travel time. Twenty-six percent of responses during 2009 not meeting the NFPA 1710 targets were due to long travel times, even though almost 88 percent of these incidents occurred within four travel minutes of a fire station using the more conservative 25 mph average travel speed. The most likely reason is that response units were not available in their primary service areas because they were out of position for training, administrative, or other duties; or they were already committed to another incident.

When the response unit that would normally be assigned to an incident is not within its primary response area, is already on another incident, or is not available at the time of the call for other reasons; more distant response units must be sent to handle the incident. This results in travel times that preclude the fire department from achieving effective performance.

Response Resource Location Management

The daily activities of response personnel can require they be out of their primary service area for activities such as apparatus maintenance, picking up supplies, and for training. While these are all necessary functions, the fire department should, and to a degree does, have practices that minimize this "out of area" time.

Most of the fire department's training takes place at a single location; on-duty personnel train there regularly. The consequence of this is that responses in station areas vacated during the training period will result in extended response time.

The fire department should explore ways to minimize "out of area" time as much as possible. A number of options are available:

- Schedule training during periods of predicted low activity (see the previous graph illustrating response activity by hour of day)
- Install two-way video conferencing equipment in all stations so response units can stay in their primary area during classroom-based training, meetings, and other suitable group activities
- Staff additional engine companies during training periods to cover stations left vacant for training activities
- Use a delivery service, volunteer, or staff to deliver supplies and mail to fire stations

Recommendation:

Identify and implement methods to minimize the amount of time response units are out of their primary service areas for non-emergency activities.

Advanced Life Support Delivery

The fire department has committed to delivering advanced life support levels of care to all priority emergency medical incidents. However, only eight of the department's 17 in-service response apparatus are staffed and equipped to provide advanced life support care. Thus, on many emergency medical incidents two fire engines, along with the private ambulance, are sent. This is not only inefficient in that it expends more resources than needed for most emergency medical incidents, it also increases travel times to other concurrent emergencies because of decreased unit availability.

SFD should consider adding and/or redistributing its advanced life support personnel to staff more of its response apparatus at the advanced life support level. While having two paramedic/firefighters per unit is desirable, one is sufficient. The private ambulance company will deliver a second paramedic on its arrival.

Recommendation:

Add or redistribute advanced life support personnel so that more response units are advanced life support capable.

Traffic Signal Pre-emption

The city should continue investing in technology that allows responding emergency vehicles to control traffic signals. Improved travel times and increased motorist safety will both result.

This technology is not inexpensive. Each traffic signal controlled intersection will cost $8,000 or more depending on the age of the controller. Each apparatus will require equipment costing approximately $1,500. However, this should be considered an investment against response time degradation as traffic volumes increase.

Recommendation:

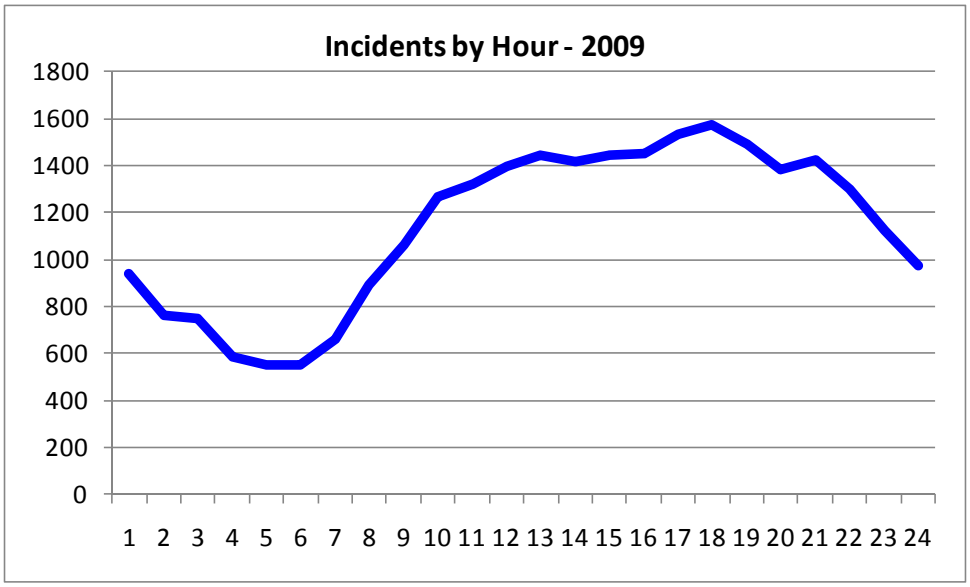
Equip controlled intersections with emergency vehicle signal pre-emption equipment.

Peak Activity Units

Response activity is highly variable during the course of a given day. Workload tends to be highest during the times the department needs to conduct training, meetings, and other activities that can move a response vehicle from its primary area.

Adding response units only during periods of peak activity can have a dramatic impact on response time performance. This will also assist in reducing the workload on response units identified earlier as being over the target 10 percent utilization.

Operating two peak activity engine companies between the hours of 9 a.m. and 9 p.m. seven days per week will add nearly 12 percent additional response capacity to the SFD system during the period of highest workload. These engine companies should be utilized in a mobile capacity, filling in stations vacated by units in training or when an area is depleted due to a multi-unit response.



Recommendation:

Add two (or more) peak activity engine companies operating between 9 a.m. and 9 p.m. seven days per week. These units should be deployed to cover for stations vacated due to training and responses.

Geographic Coverage

Current geographic coverage provided by existing stations places 88 percent of all incidents within four travel minutes (at an average 25 mph travel speed) of a fire station. The city's south-

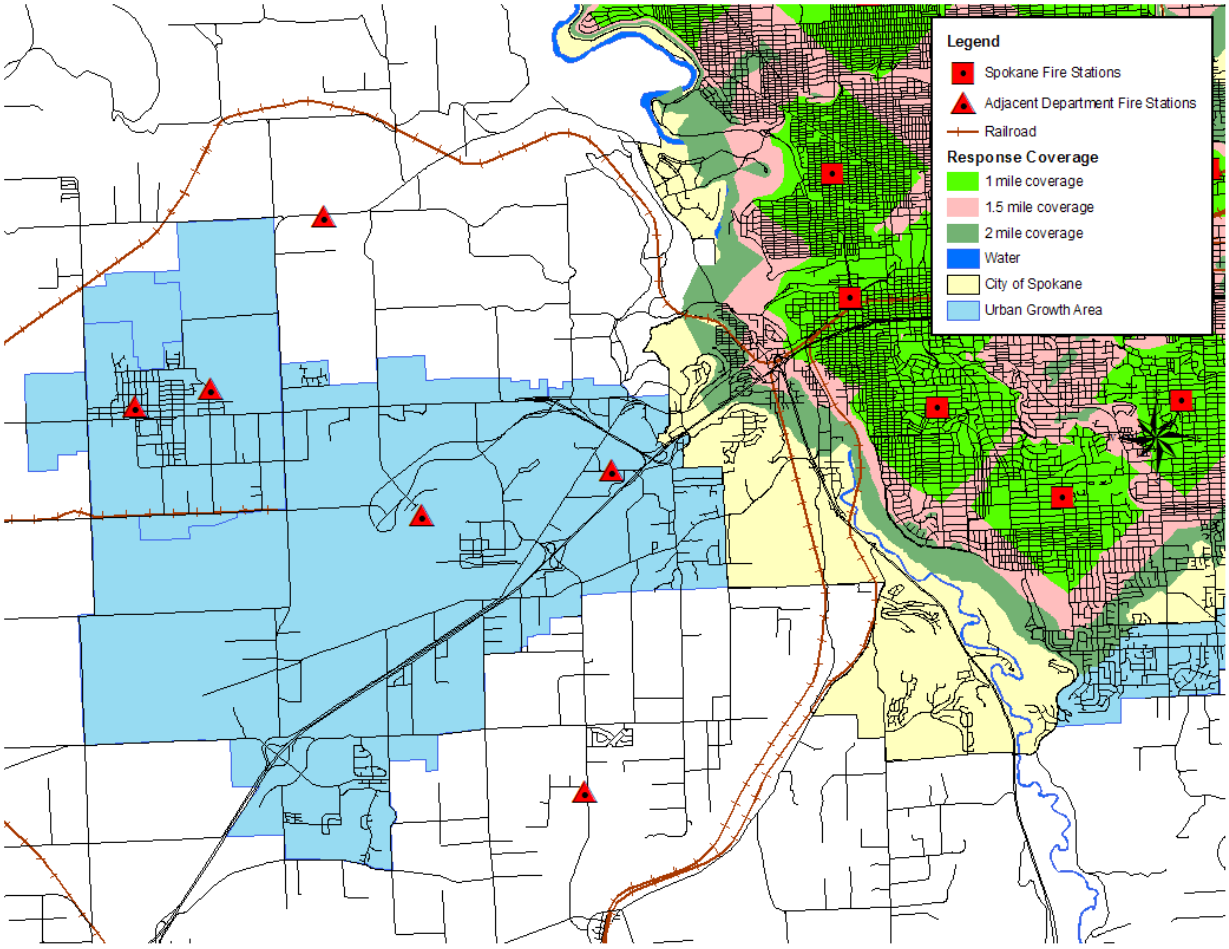
southwest side (west of the river) is the only area that lies considerably outside this level of coverage.

As described previously, there is not sufficient emergency response workload to, in itself, warrant adding a fire station. However, the distance between this area and existing fire stations clearly is cause for concern.

The Spokane Mayor and City Council will need to determine if the city wishes to provide fire services to this area more closely approximating the level of service provided the rest of the city. If so, an investment in a fire station, apparatus, and personnel will be necessary, with the full realization that this will be a very low workload station.

There is no easy solution to serving this area. The map below shows that regardless of future annexations to the west, this area will always remain an isolated portion of the city due to road networks and the river.

Figure 51. Geographic Coverage, Existing Stations



There are several options available, with increasingly greater cost:

1. Provide a two-person emergency medical service response unit. The majority of emergencies are medical in nature. This type of unit would provide more prompt response to the majority of the department's calls for service.
2. Provide a two-person quick response unit. This type of apparatus is a smaller fire engine equipped with a small water tank, pump, and tools and equipment to respond to small fires (grass, vehicle, trash, etc.) and provide emergency medical care. It is critical to note that this type of unit is not staffed or equipped to initiate an attack on a structure fire.
3. Provide a three person fully capable fire engine. This unit would be able to provide a full range of services for nearly every emergency incident.

All of the options would require purchase of apparatus and equipment, additional personnel, and the acquisition of a facility at which to base the response unit. The advantage of providing some level of improvement is the delivery of a more equitable level of service to residents of this

region. As discussed previously, any additional resources may provide more overall good located elsewhere in the city.

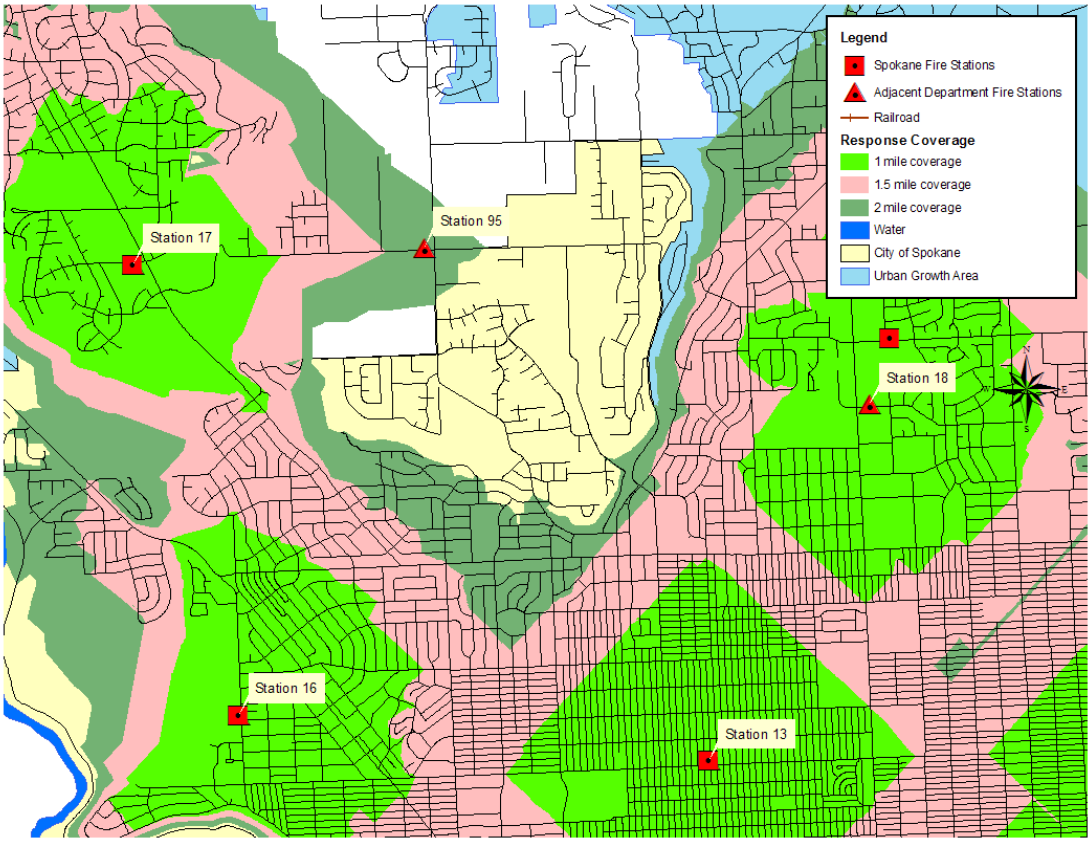
Recommendation:

Determine if providing improved service to the south-southwest portion of the city justifies the expense of doing so.

Mutual and Automatic Aid and Joint Ventures

SFD calls on neighboring fire agencies for assistance very rarely. There are clear opportunities to share response capability for mutual benefit that are presently untapped. The following map shows one opportunity. Station 95 of Spokane County Fire District 9 is positioned to provide service into an area not well served by SFD. However, this station is staffed by volunteer personnel only. Further, the station is not designed to house a 24 hour per day crew, requiring the addition of living quarters before co-location could be accomplished.

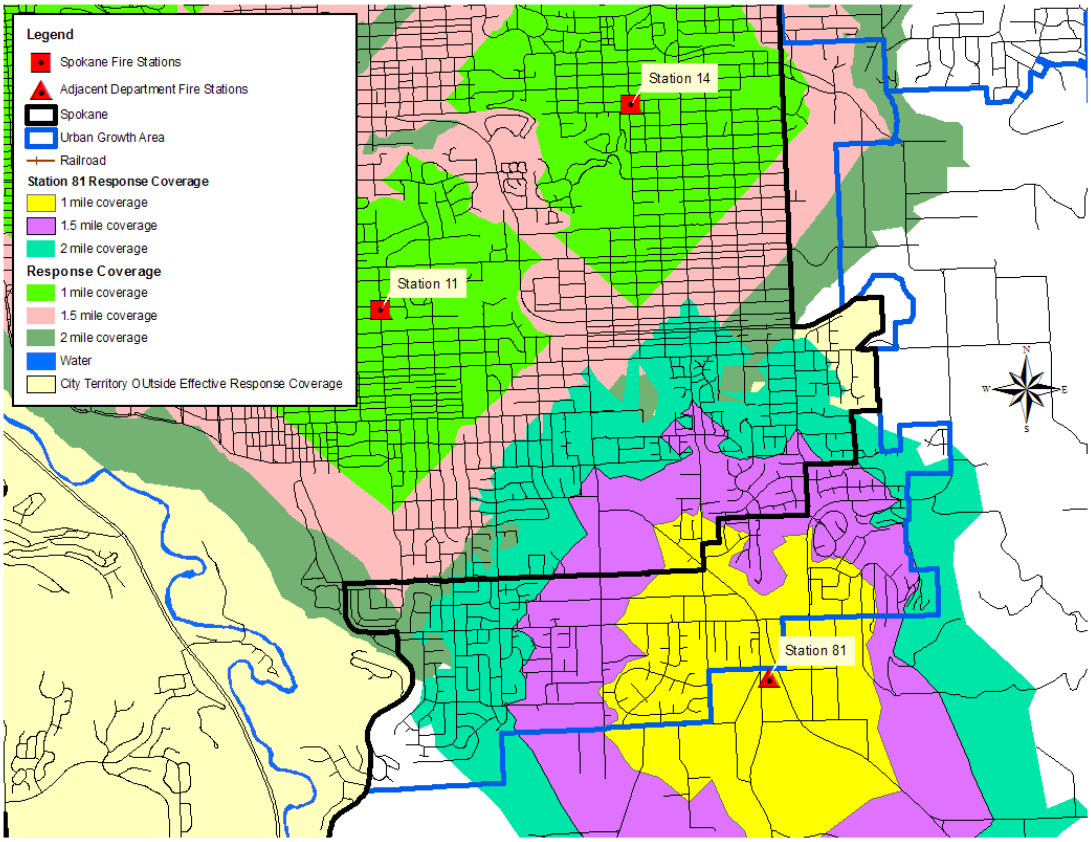
Figure 52. Shared Response Opportunity, Spokane County Fire District 9 Station 95



SFD should explore the option of assisting with full-time staffing of this station, on a shared cost basis, with Spokane County Fire District 9. Both departments would benefit from this approach.

Another opportunity exists in the extreme south end of the city. Current coverage from Spokane stations is not sufficient to provide rapid service to existing portions of the city, and in particular to areas within the city's urban growth boundary. There is an existing fire station operated by Spokane County Fire District 8 (Station 81) that is well placed to service this area.

Figure 53. Shared Response Opportunity, Spokane County Fire District 8 Station 81



Though well placed, it is staffed with only two personnel. Additional staffing would be needed to provide a response force in accordance with SFD's standards. Developing a shared staffing and response arrangement with Spokane County Fire District 8 for this station would be far less expensive than if SFD added a station to serve this area.

Recommendation:

Increase the utilization of neighboring agency automatic and mutual aid. Explore the option of shared or joint staffing of Spokane County Fire District 9 Station 95 and Spokane County Fire District 8 Station 81 to better serve portions of north and south Spokane.

Closest Unit Dispatch Technology

Many departments across the country have implemented technology that ensures the closest available response unit is sent to an emergency. This technology incorporates global positioning systems on fire apparatus linked to the dispatch center's computer aided dispatch system. When a call is received at the dispatch center, the incident's location is instantly compared to the actual location of every available response unit. Travel times are computer calculated and the closest unit selected for dispatch. Implementation of this system requires:

- Dispatch center computer software capable of this function
- Street information for use in the system that includes data points required to conduct "closest unit analysis"
- Global positioning equipment installed on fire apparatus (SFD has already installed this equipment)

Communities that have implemented this technology have realized significant improvements in response times and emergency event outcomes. Shift commanders are able to better redistribute response resources to ensure effective city-wide response coverage. The Spokane Fire Department is working to implement this technology.

Recommendation:

Implement "closest unit" dispatch technology to improve response time performance.

Dispatch Time

Though not a large amount, some time is lost in the process of gathering information from a caller about the nature and location of an emergency and then dispatching the appropriate response units. The practice of having a single person as both the call taker and dispatch should be discontinued.

Instead, the call taker should be able to gather sufficient detail about the call type and location to determine appropriate response and then "send" that information electronically to another person, who dispatches responders, or directly to response personnel. The call taker is free to

continue gathering information and provide pre-arrival instructions. SFD is purchasing necessary technology now to implement this change in the near future.

Recommendation:

Develop procedures or acquire technology that allow a call taker to transfer incident information to a dispatcher or directly to response personnel to shorten the overall dispatch time.

Data Collection

Additional information captured for each incident will help in evaluating the causes of current performance and solutions for improvement. In particular, recording the mode of response by each response unit will help distinguish between incidents not achieving performance standards because of system issues and those not appearing to achieve standards because the response was downgraded to non-emergency status.

Capturing response mode for each unit will provide better data for analysis purposes.

Recommendation:

Capture data that defines whether a unit responded "emergency status" from dispatch to arrival or whether its response was downgraded to "non-emergency" while enroute.

Spokane
FIRE DEPARTMENT