8.2 Fires

- Fires include a broad range of incidents from wildland fires especially where urban areas abut natural areas, large single structure fires, multi-structure fires, ship fires, industrial fires, brush fires, and vehicle-related fires.
- Seattle has lost fourteen firefighters since 2000 and 104 civilians since 1994.[440] The trend in the number of casualties seems be dropping, but it is still statistically impossible to verify the drop because of the small amount of data. The number of structural fires has also been dropping, but the dollar losses have not been.
- Seattle has experienced large fires, including the 1889 fire that destroyed downtown and the 1970 Ozark Hotel fire that killed 20 people. Both fires occurred under different historical circumstances than those that exist today. The 1889 fire occurred before a modern fire code and the Ozark Fire happened when Seattle had many multi-unit dwellings without sprinklers.
- The 1970 Ozark fire led to legislation mandating that safety systems, such as sprinklers, be retrofitted into older buildings. In an unintended consequence, many owners chose to leave floors unoccupied because the costs of retrofitting outweighed the revenues they produced.
- Fires have been a deadly secondary impact of earthquakes and civil disorders. In the 1995 Kobe and 1906 San Francisco earthquakes, more people died from fire than building collapse. Following the 1992 Rodney King verdict, multiple fires were set in Seattle, taxing Fire Department resources.
- While wildfires have not been a threat to the Puget Sound area traditionally, climate change is increasing the likelihood of wildfire west of the Cascade Mountains. A wildfire is still unlikely in Seattle because the city is far from any wildland areas but could threaten some city infrastructure located in wildland areas. Seattle regularly gets brush fires along roadways, such as I-5, that can threaten adjacent homes.
- Large structural fires remain a substantial risk and are most likely to occur in areas with older buildings, such as Downtown, the International District, First Hill, Ballard, and the University District.
- Fires in underground electrical vaults have caused prolonged outages in downtown and other dense areas where power has been placed underground. The effects of these power outages are covered in the chapter on power outages.

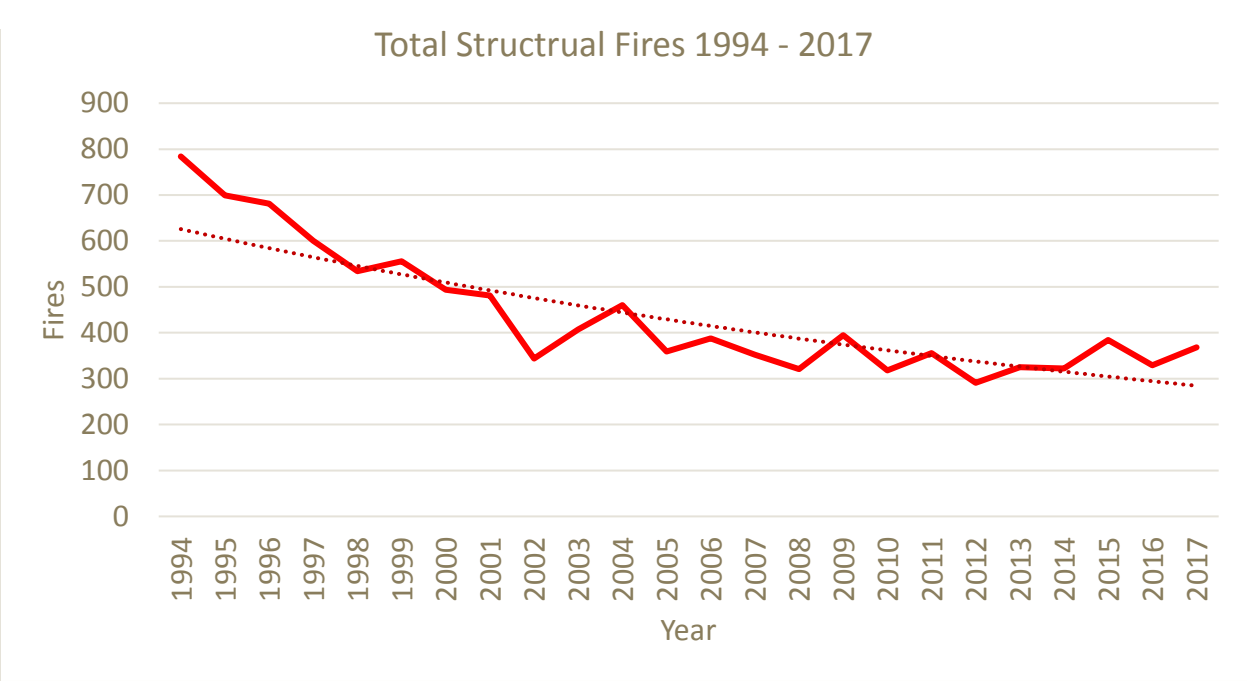
8 2.1 Context

Fires have long been a major hazard in urban areas. A series of catastrophic 19th century fires, including one in Seattle, led to the creation of modern fire departments. Even now, fires are among the deadliest of hazards nationally, with around 3,200 deaths per year (since 2006). The functions and capacity of the Seattle Fire Department (SFD) is discussed in detail in the Community Profile.

This section covers all major types of fires: multi-structure fires, large single structure fires, ship fires and fuel tanker fires. Seattle can also be affected by wildland fires in its Cascade watersheds. Electrical fires within the power system are a special category that is covered under the power outage chapter. Nationally, some of the worst urban fires have been in cities with a large urban-wildland interface. Seattle does not have such areas.

Nationally, structural fires are on the decrease, both in total number and in the number of deaths and injuries. Better education, a decline in smoking, and an increase in the number of smoke detectors seems to be behind this decrease.

Figure 8-3. Structural Fires by Year



Effective firefighting depends on speed. Firefighters have the best chance to respond effectively when they can detect a fire and reach it quickly in overwhelming numbers. The first step is to isolate the fire to prevent it from spreading; only then do firefighters try to extinguish it. Fires get out of hand when they spread too quickly to be contained (like the 2017 Santa Rosa fire), when automated suppression systems do not work properly, or when they occur in places that are difficult to reach.

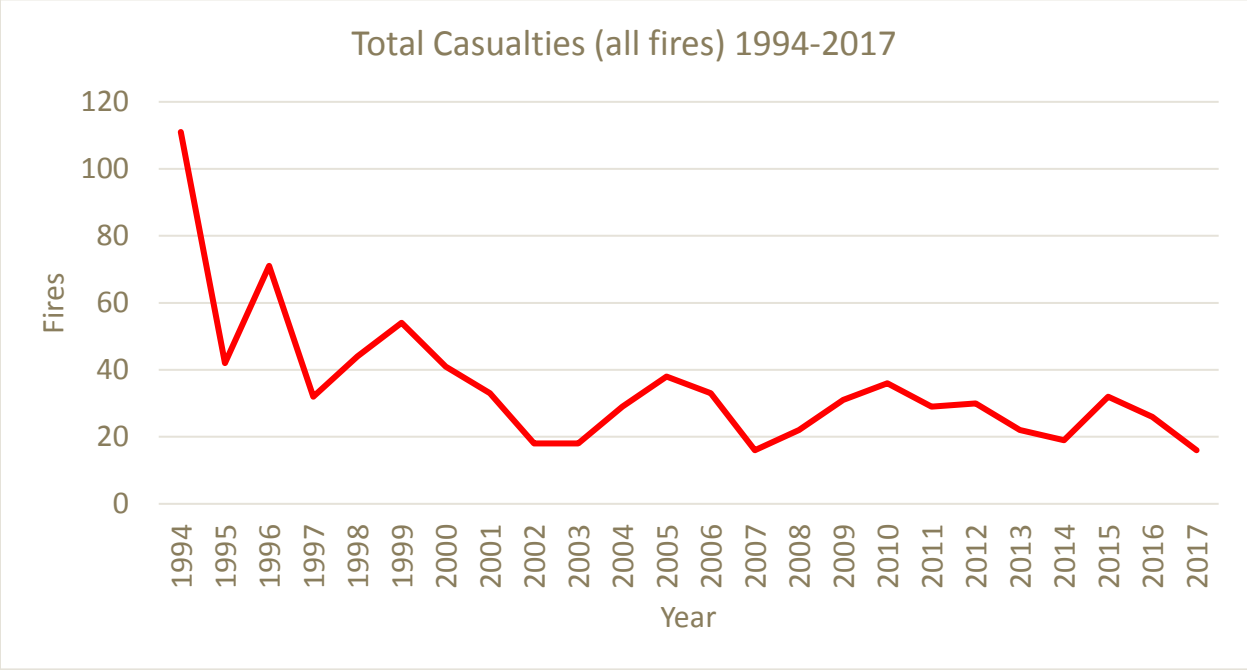
Fires can be a secondary impact of other hazards, as well as a trigger for hazards. Fire following earthquakes and during unrest are especially threatening. Damage to transportation infrastructure or security problems can result in fire fighters being unable to reach fires quickly or in adequate strength. An earthquake may damage the water distribution system, lowering water pressure at hydrants. In these circumstances, unattended fires could grow and threaten large areas. From 1900 to 2014 there have been 11 large fires following earthquakes, including Kobe. They can be extremely devastating. The 1906 San Francisco fire destroyed 28,000 buildings. Civil disorder presents the other major fire risk. Arson fires are commonly set during disorders. The 1992 LA riots produced large fires that engulfed whole city blocks. Some of these fires were left to burn after fire fighters were assaulted. The use of accelerants often makes these fires worse.

Since 2000, the number of structural fires in Seattle has decreased, following national trends, with a very slight increase after 2012 (see figure [STRUCTURAL FIRE TREND]). Since 2012, Structural fires in multi-family dwellings have increased more than fires in single-family dwellings. The overall decline in structural fires has occurred despite a building boom over the last decade that have added a considerable number of new structures Since 2013, there has been an average of about 345 structural fires per year. As with the rest of the country, a combination of better education, decreases in smoking and increases in the use of smoke detectors has contributed to fewer fires in the 21st century.

Besides the decrease in incidents there has been a decrease in casualties (see figure [Casualty Trend]). The trend in the number of deaths is less clear. Since 1994, the average number of fatalities has been 4, but 2000, 2005, and 2010 saw spikes with 11, 8, and 9 fatalities, respectively.

What has not decreased is the amount of property loss. While the number of casualties correlates with the number of incidents, property loss does not. This is because a few large fires dominate losses every year. This suggest that despite an overall downturn in the number of fires, the magnitude of events are staying large or getting larger. Structural fires result in average yearly property losses of about $15.5 million.

Figure 8-4. Fire Casualties by Year



Non-structural fires (i.e., brush, dumpster, vehicle fires, etc.) are another class tracked by the SFD. Like structural fires, vehicle fires have declined between 1994 and 2012, and stayed relatively flat, with an average of 232 per year since 2012. The other categories have not, they have held steady or slightly increased in recent years. It is not clear why.

8 2.2 *History*

Seattle is a city shaped by fire. The catastrophic Great Seattle Fire of 1889 consumed 60 acres of downtown Seattle just as the city was poised to become Washington State's leading urban center.[441] Amazingly, it caused no fatalities or major injuries. Equally impressive was the speedy and complete recovery. The fire occurred right before the biggest period of growth in Seattle's history. Seattle was able to totally rebuild the downtown within eighteen months, doing so with masonry instead of wood. This experience demonstrates how complete a recovery can be given the right circumstances and how hazard vulnerability can be mitigated during the recovery process.

Significant Fires After the Great Seattle Fire

SFD has kept records of all multiple alarm fires since 1912. While Seattle has not experienced an event as large as the Great Seattle Fire since 1912, there have been a number of large fires.

July 30, 1914. Colman Dock Fire. Colman Dock stood at the site of the current ferry dock in downtown Seattle. The dock was the largest on the west coast. Five people were killed and 29 were injured. Wooden docks, often treated with creosote as a preservative, are very vulnerable to fire.

June 30, 1916. Bell Street Pier. This fire at an army ammunition depot exploded much ordinance, including artillery shells. A bystander, a young boy, was killed by one of them.

April 20, 1920. Lincoln Hotel Fire. A large hotel in downtown Seattle burned completely, resulting in four deaths.

April 30, 1935. City Light South Lake Union Steam Plant. The fire caused a power outage and severe traffic disruption but no deaths.

February 18, 1943. B-29 Crash and Fire. This fire, detailed above in transportation incidents, resulted in 32 deaths.

September 9, 1945. St. Vincent de Paul Fire. An arson fire set by a homeless man destroyed a whole block of property and caused four deaths.

July 6, 1948. Lyle Branchflower Explosion. An explosion and fire at a Ballard fish oil producer killed three workers and blew a car off the Ballard Bridge.

May 20, 1958. Seattle Cedar Lumber. Another major fire near the north end of the Ballard bridge resulted in no deaths.

November 11, 1961. Pike Place Market. Fire destroyed 20 stalls and stores, a pedestrian overpass over Western Avenue, and a meat market connected to Pike Place Market. A new pedestrian overpass was constructed in 2017.[442]

March 20, 1970. Ozark Hotel. This arson fire killed 20 people and had a major impact on Seattle's older neighborhoods. The Ozark was a single room occupancy (SRO) hotel, a type of housing that commonly served homeless and seasonal workers. It was a known fire risk. The fire department had inspected in often, but it was still vulnerable. It was in disrepair, had no sprinklers, and a poor escape route.

April 25, 1971. Seventh Avenue Hotel. A little over one year after the Ozark fire, another SRO burned, killing 12. Following these fires, stringent new fire ordinances were passed, including requiring buildings to be retrofitted with sprinklers and smoke detectors. Most building owners found it was not financially viable to retrofit upper floors and chose to abandon them.

December 4, 1975. Fuel Tanker Explosion/Fire on Alaskan Way Viaduct. (Also listed under Transportation Incidents and Hazardous Materials). A gasoline tanker truck crashed. Gasoline leaking from the truck caught fire, causing extensive damage to surrounding buildings. The fire caused a major downtown power outage when it burned though a power trunk line.

December 22, 1976. Pike Place Market. An apparent arson fire burned the Economy Market Building at 89-99 Pike St.

March 4, 1985. Health Sciences Center. A complex fire occurred on the 13th story of a 17-story building housing an infectious disease lab and trace amounts of radioactive material.

May 9, 1989. M.V. Golden Alaska. A 340-foot seafood processor caught fire below decks, initiating a complex incident requiring days to fully extinguish.

September 9, 1989. Blackstock Lumber. An arson fire at a lumberyard caused the death of one firefighter and severely injured another.

September 16, 1991. M.V. Omnisea. Another fish processor fire involved Seattle Fire units on site for five days.

September 21, 1991. Villa Plaza Apartment Fire. The day after the last units left the scene of the M.V. Omnisea fire, a huge fire broke out in the Villa Plaza Apartments. The complex was grandfathered in under the Ozark Ordinance and did not have sprinklers. There were no deaths, but 232 people were displaced. Because of the media stories alleging that it was a haven for criminals, many residents found it hard to find new housing.

January 5, 1995. Mary Pang Fire. An arson fire in a warehouse resulted in the deaths of four firefighters. SFD came under heavy criticism and undertook major reforms after this fire.

May 21, 2001. UW Center for Urban Horticulture. An arson fire set by environmental extremists caused $7 million in damage and destroyed years of research.

8 2.3 Likelihood of Future Occurrences

As noted above, the total number of incidents and casualties is decreasing for all structural fires and highway vehicle fires. This is a major success. It reduces the cumulative impact of all fires.

The amount of property loss is increasing rather than decreasing. It seems that the number of large fires is holding steady. Seattle is experiencing fewer fires, but a higher percentage of those that occur are major fires.

One very important fact the data show is that fires do not have to be large to cause injury and death. The number of casualties correlates well with the total number of incidents but very poorly with property loss.

The number of non-structural fires (any fire outside a building: trash fires, grass fires, vehicle, and ship fires) is holding steady with the exception of vehicle fires which are showing a major decrease.

Based on the trends and an analysis of the historical data, there is a strong likelihood that Seattle will continue to have fires that result in high property losses but that are less likely to result in high numbers of casualties.

The 1889 Fire remains the largest in Seattle's history. Seattle was a very different place when it occurred. The chance of another fire like it is remote. The most likely scenario for a multi-block fire is a post-earthquake fire. Large sections of Kobe, Japan were destroyed is a huge blaze following the M 6.9 earthquake. Damage to the water system crippled the response.

8 2.4 Vulnerability

A review of all multiple alarm fires reveals a clear profile of Seattle's vulnerability to major fires. Several factors emerge repeatedly:

- Businesses that contain a lot of fuel. Lumberyards, furniture stores, carpet warehouses, and other businesses using flammable materials are overrepresented in the record because fires started in these businesses are more likely to develop into major blazes.
- Apartments and hotels. These structures are vulnerable because of their high occupancy.
- Nightclubs, stadiums, and theaters are also vulnerable due to high occupancy.
- Substandard buildings.
- Arson Targets.
- Ships.
- Bridges.

In general, there are two types of fire vulnerability: 1) the conditions that allow the fire to spread, and 2) the concentration of people and property. Where the two factors overlap is the area of greatest vulnerability.

In the first category, factors that are more likely to turn an ignition into a major fire, are fuel-rich environments, substandard buildings, arson targets, and ships (because of the challenges in fighting them). To these must be added the capabilities of the fire suppression resources. Response time is a key

variable. The National Fire Protection Association has determined that a "room and contents" fire will flashover to a structural fire within 5 to 10 minutes. The longer a fire burns without response the more likely it will spread to additional structures.[443] Therefore, a response time under five minutes is considered good. SFDs has set their own standard for the first fire engine to arrive on scene within 4 minutes 90% of the time. Between 2013-2017, they met this standard 83% of the time, on average.[444] In comparison, the Portland Fire Department responds under 5 minutes and 20 seconds 60% of the time. The Atlanta fire department has a response time of 7 minutes 90% of the time.

Building architecture governed by building and fire codes the other critical factor in reducing fire risk. Many high-population areas are now made from fireproof materials like brick, steel, and concrete that reduces the risk of fire spread. However, most of the city's residential structures are wood, which is vulnerable. In these places, the key variables are early detection, spacing between structures to isolate a large fire and easy access for fire trucks. Seattle building officials say that the majority of multi-family structures being built are wood-frame, because it is a cheap and abundant local material. This is the general trend along the West Coast.[445] There have also been recent moves to allow large multi-family structures to use wood and cross-laminated timber in their construction. In 2018, the Seattle City Council approved an ordinance allowing six floors of wood construction on top of two floors of concrete.[446] These new building ordinances could increase the density of wood frame structures in the city, in turn increasing fire vulnerability. Seattle requires smoke detectors in all new and existing residential buildings and most other types as well. This law improves the chances that the Fire Department will detect fires early, decreasing the probability of a fire getting out of control. Due to these factors, the older neighborhoods, where the houses are closer together and the streets are narrower, are more vulnerable to a multi-structure fire than new areas.

The second category is concentration of lives and property. Seattle has the densest residential areas between San Francisco and Vancouver, B.C. and this density is increasing. More people are working and living in large structures. Density has many positives aspects like reducing sprawl but can put more people at danger if a fire does occur. The densest residential areas include Belltown, Capitol Hill, First Hill, and University District neighborhoods, with over 100 people per acre in some blocks.[447] Seattle's deadliest fire, the Ozark Hotel fire, occurred on the edge of downtown in the Denny Triangle area at 7th Avenue and Westlake. Because of the heightened vulnerability of dense areas of the city, more effort has been made to reduce frequency, mitigate the effects of, and heighten the response to fires in these areas.

In large buildings, the most critical factor is the functioning of passive and automatic systems. In high rises, the upper floors are impossible to reach from the outside and HVAC and elevator shafts create corridors to spread a fire throughout the whole structure. Compartmentalized refuge areas, detectors and excellent sprinkler systems are the most effective means to deal with this type of fire. Seattle's codes employ all of these devices. The most vulnerable area, as measured by the size of the exposed population, is Downtown. Fortunately, most of the high-rise buildings in Downtown were built after 1970, when fire codes improved. Seattle still has some older high-rise buildings, but these buildings are being replaced or retrofitted due to developmental pressures.

Structural fires can occur as a secondary impact from a civil disorder or earthquake. The Seattle Fire Department has prepared plans for triaging incidents in this situation. This planning emphasizes first performing windshield surveys to grasp the extent of the problem, then responding to the most critical situations. If resources are unable to command all incidents, some fires may be left to burn or only enough resources will be committed to prevent the fire from spreading to adjacent structures

Wildfire exposure is greatest near large open areas, especially those with large fuel loads. Few of these areas are close to high population areas. Areas near transportation corridors seem to have an increased frequency of fires, especially in the summer as brush dries out. A few times, brush along I-5 has burned,

threatening homes adjacent to it and slowing traffic. SFD has been able to put these fires out using its own crews. Seattle has never experienced devastating urban wildfires as has happened in California, New Mexico, and Florida because it lacks large wildlands close to the city. Additionally, SFD has good access to most areas where they could occur. Wildland fires are a threat to Seattle's watersheds and power generation and transmission systems, which are in heavily forested, remote locations. Seattle Public Utilities and Seattle City Light maintain their own wildland firefighting capability to combat fires in the City's watersheds and project power generating equipment.

8 2.5 Consequences

Because of a long-term effort to reduce the effects of fires through fire codes, vehicle safety standard, public education, and professional firefighting services, the number of fires and the number of casualties is dropping, mainly through a reduction in structural and vehicle fires. Reducing yearly property loss has remained elusive mainly because yearly losses are dominated by a few big incidents.

Large fires are likely to happen again because there are so many potential sources. One of the main goals in any response is to contain the fire in the structure, vessel, or location where it started. Despite some tragic fires, the strategy of containing these fires has largely been successful. This reduces the likelihood of another conflagration like the Great Seattle Fire. While unlikely, it is also possible Seattle could experience a large outdoor fire like those that have occurred in southern California. Sometimes, even a single structure fire can be disastrous as in the case of the MGM Grand fire that caused 85 deaths or the Station Nightclub fire that caused 100 deaths.

Seattle could be affected by a wildland fire that threatens water and power infrastructure. If power transmission towers and lines are exposed to fire, it could cause outages, but they would likely be localized. Fire has also threatened dams that generate some of the city's electricity. Damaged equipment in at these sites would not cause outages but would require the City to purchase additional electricity from external providers. A fire in one of the city's watersheds could decrease water quality by increasing turbidity, harming aquatic life, and drawing down the City's reservoirs. The consequences of wildland fire outside the city are discussed further in the power outage and water shortage chapters.

Due to the factors outlined above, the scenario that Seattle is most likely to face directly is a large, deadly structural fire or a fire associated with a transportation incident. Large structural fires still occur every year. Despite all the mitigation efforts, it is not implausible for a major fire to occur in a vulnerable structure. The result could easily be a large number of fatalities and property loss. Damage would probably be contained as long as adequate resources could be brought to bear. Economic effects would probably be limited unless there was destruction of critical infrastructure, such as a bridge that had to be closed, forcing transportation detours.

8 2.6 Conclusions

With many high-occupancy buildings and densely populated areas, Seattle has a high exposure to fire loss. The risk this exposure entails has been reduced by measures to decrease the frequency and mitigate the effects of disastrous fires. They include the adoption of stringent Fire and Building Codes and the maintenance of a four-minute Fire Department response time.