8.3 Hazardous Materials Incidents

- The 1984 disaster in Bhopal, India that killed over 2,200 people focused world-wide attention on the dangers of toxic chemical releases. In the U.S., it led to the 1986 Emergency Planning and Community Right-to-Know Act or SARA Title III. This law led to a lot of new planning and response infrastructure.
- The U.S. Department of Transportation (DOT) collects data on hazardous materials incidents occurring in the U.S. during transportation.[448] Most are received from shippers, e.g., UPS or Federal Express. Since 1998, 838 hazardous materials incidents in Seattle resulting in total of $3,056,573 in damage, but no fatalities or injuries requiring hospitalization. There have been 13 injuries not requiring hospitalization and 15 incidents were classified as serious.
- The Seattle Fire Department (SFD) records hazardous materials-related dispatches. It lists 1,243 incidents from 1995 to 2017, with a spike in 2001 following 9/11 and the 2001 anthrax attack. Forty-four incidents were fires with hazardous materials components.
- Fixed sites are the most frequent locations for accidents, but transportation accidents are often riskier because they happen in uncontained spaces, they can be in close proximity to people, and responders usually have less information about the materials involved.
- Areas up to one-half mile downwind from an accident site are considered vulnerable, according the US DOT. An incident could affect thousands of people in densely populated sections of Seattle.
- Other hazards, such as earthquakes and landslides, could produce hazardous materials incidents.

8 3.1 Context

Harmful material in the environment has been a problem for a long time, but it has only been since the publication of books like Silent Spring (1962), and tragedies like the Bhopal chemical disaster (1984), that hazardous materials have become recognized as a significant hazard. Hazardous materials pose problems that vary widely in intensity and duration. While many materials pose long-term problems (e.g. asbestos, PCBs, etc.), this chapter focuses on incidents that pose an immediate threat to large numbers of people. Chronic problems have their own regulatory infrastructure outside of emergency management.

The federal government plays a large role in all phases of hazardous materials management. Title III of the 1986 Superfund Amendments and Reauthorization Act (SARA) and the Clean Air Act of 1990 mandate “cradle to grave” tracking of designated hazardous materials by requiring users to report what chemicals they are using and releasing into the air, and how they will respond to an emergency. Under the act, EPA delegates implementation to the states. Washington State has passed the responsibility to local districts known as Local Emergency Planning Committees (LEPC). Seattle maintains its own LEPC. The reporting requirements mandated by these acts have produced a rich data set of chemicals in the community.

Around 80% - 90% of accidents involving hazardous materials occur at fixed sites such as factories and storage facilities; the remaining 10% - 20% occur during transportation. Most of these incidents are small, however, and not reported to the SFD because facility staff are able to contain and clean them. Facilities that commonly house hazardous materials in the Seattle area include hospitals, metal plating and finishing, aircraft manufacturing, public utilities, cold storage companies, fuel facilities, communications facilities, chemical distributors, research facilities, and high technology firms.[449] Illegal drug labs or dumping can also pose a risk.

Transport incidents are usually more difficult to manage because they often happen in uncontained settings and/or populated areas. Responders to transportation accidents do not have detailed site plans and chemical inventories. Hazardous waste dumps also present problems because they often house unidentified and unstable chemicals. An emerging concern is the increasing transportation of Bakken crude oil. This light, crude oil is more flammable than traditional crude. Bakken crude shipments began in 2012 and have increased to 1,100 tank cars per week being transported through the city in 2018.[450] In 2013, a train carrying Bakken derailed and exploded just outside of the U.S. in Quebec, Canada, killing 47 people and destroying 30 buildings. An oil train carrying Bakken derailed in Seattle under the Magnolia bridge in July 2014. Fortunately, no oil was spilled, and the incident was not catastrophic like the Quebec explosion, but it illuminated the risk of transporting highly flammable materials through dense, urban areas.

The Fire Prevention Division of SFD, commonly referred to as the Fire Marshal's Office, provides the leadership and inspection services to help prevent fires, explosions, and release of hazardous materials and to assure fire and life safety for Seattle's residents, workers, and visitors. The Hazardous Materials Section of the Fire Marshal's Office provides inspection services for the storage and use of flammable and combustible liquids and other hazardous materials and processes as required by the Seattle Fire Code and Administrative Rules.

SFD can call on help from private and governmental resources. On the private side, large companies often have response teams and the Chemical Manufacturers Association has created an organization, CHEMTREC, which runs a 24-hour hotline for emergencies that happen in transit. Additionally, several private companies specialize in responding to chemical emergencies. At the federal level, the EPA, Coast Guard, and the US Department of Transportation's Bureau of Explosives have strike teams that assist local responders in special situations. Washington State provides teams from the Department of Ecology and the Department of Natural Resources.

The Seattle Local Emergency Planning Committee (LEPC) was set up in 2002 to foster a working relationship between private industry and public agencies in addressing hazardous materials issues. In addition to promoting public awareness and industry reporting, the LEPC takes a cooperative approach toward the prevention and preparation for hazardous materials releases. LEPC membership includes City personnel and representatives from the Washington State DOT, Washington State Department of Ecology, Seattle/King County Public Health, Harborview Hospital, Port of Seattle, Boeing, BNSF Railway, Bank of America, and a member of the public.

The number of chemicals in use today makes it critical to know which ones are at a particular site. The Occupational Safety and Health Administration (OSHA) lists 28,000 toxic chemicals and each of them has a unique way of interacting with their environment and with other chemicals, including the ones used to clean up spills. Responders can make matters worse by applying a material that will react adversely with the spilled chemical.

The possible use of chemical, radioactive, and especially explosives in a terrorist act significantly alters the risk profile for hazardous material incidents. Bombs are one of the most common methods of attack in many parts of the world. The use of chemicals is rare due to the difficulty of manufacturing the chemicals; however, the Tokyo Gas Attack that killed 12 and injured thousands in 1995 is an example of chemical weaponry. The use of radiological devices is also rare. Radiological attacks are not nuclear bombs. Rather, they use a variety of means, including conventional explosives, to disperse radioactive substances. There is a debate about the effectiveness of these devices, however. The two examples of actual attacks using radiological devices come from Russia and Chechnya. Neither bomb exploded. The US Department of Homeland Security believes the most likely uses of a radiological attack would be to contaminate facilities where people live and work to disrupt their livelihoods, or to cause anxiety in

people who believe they may have been exposed. The amount of radioactive material released would likely not cause severe illness or death.[451]

8 3.2 History

The hazardous materials historical record does not extend past the early 1980s. Older records mix hazardous materials emergencies with fire emergencies. Constructing a long history is difficult, but since federal reporting requirements have taken effect, there is a wealth of data from local, state, and federal sources.

Prior to 1995, it is difficult to get consistent data. Two incidents stand out, however, in a review of multiple alarm incidents dating back to 1912.

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

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.

Hazardous materials responses have been recorded by SFD since 1995. Between 1995 and 2009, SFD responded to 1,082 incidents, of which only three (or 0.2%) required more than one alarm. Of these three, only one was a pure hazardous materials incident; the other two were associated with fires. All three had biological functions. They were:

March 24, 1997. Fire with Hazardous Materials. Kincaid Hall, University of Washington. The zoology lab burned.

June 10, 1999. Bellingham Pipeline Explosion. Although this incident did not occur in Seattle, it focused attention regionally on pipeline safety. Seattle has a spur of the same pipeline that runs from Harbor Island to Renton. It transports mostly gasoline.

May 21, 2001. Center for Urban Horticulture, University of Washington. Arson fire.

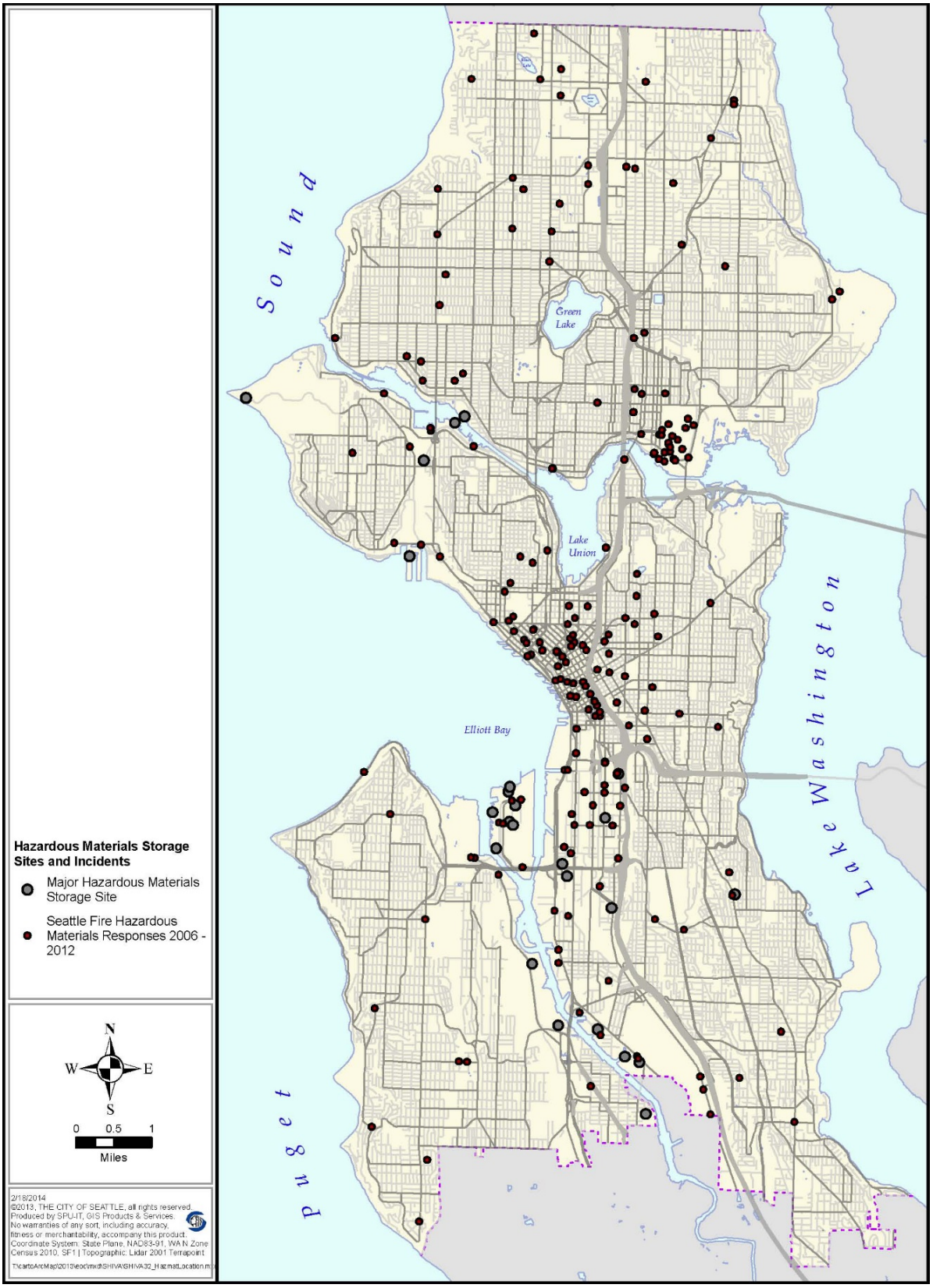
May 26, 2001. 509 Olive Way. Fire in a building housing many medical offices.

After the spike in 2001, hazardous materials incident dispatches fell steadily until 2008, where they have remained relatively flat since (See figure [Seattle Fire Department Hazardous Materials Dispatches]. Note: After the 2001 Anthrax attack there was huge spike in 911 calls related to white powder. These calls have been removed). There has been an average of about 38 incident dispatches per year from 2008 to 2017.

Some older data exists on transportation of hazardous materials. The Washington State Department of Health studied incidents that occurred in 1992. Most of the analysis covers the whole state and disaggregates the information by county. These data are too general for specific planning but do give some indication of the dangers faced in Seattle, especially when it is correlated with the logs of the SFD.

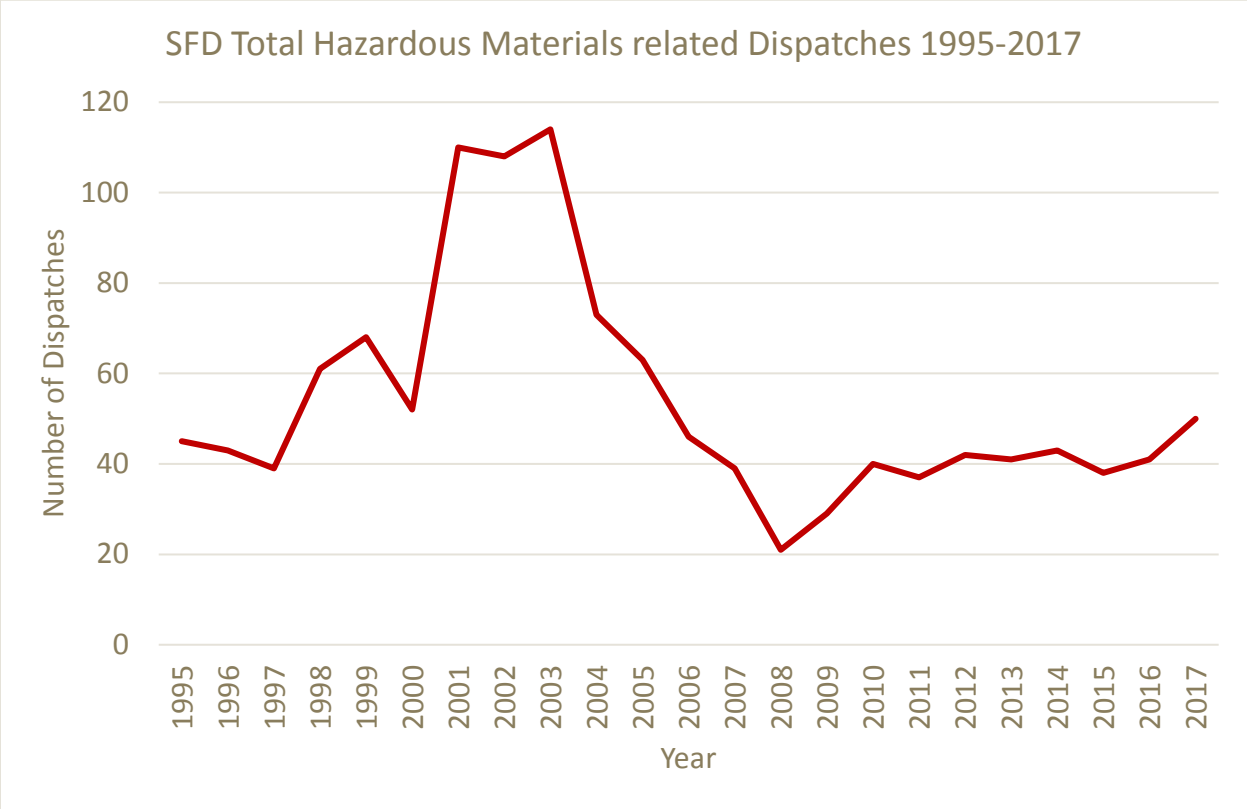
According to the report, there were 118 events in King County in 1992. Twelve (10.2%) of these involved transportation and 106 (89.8%) were at fixed facilities. Twenty-six incidents caused a total of 66 injuries. The most common injury incidents involved acids and volatile organic compounds. The report states there was one fatality in the state, but it does not indicate if it occurred in King County. Additionally, 29 incidents resulted in the evacuation of nearly 1,400 people. The report indicates that 44 incidents in King County occurred within one-quarter mile of residential areas, indicating some risk to people who are not directly involved with the released chemicals.

Figure 8-5. Hazardous Materials Incidents 2006 - 2012



A 1994 King County study shows that the most common material transported along I-5 is gasoline.[452] The most commonly released chemicals in transportation accidents were volatile organic compounds, acids, herbicides and insecticides.

Figure 8-6. Seattle Fire Department Hazardous Materials Dispatches 1995 to 2017



The federal Environmental Protection Agency has a Toxic Release Inventory (TRI) program. TRI requires facilities in certain sectors (manufacturing, mining, power generation, etc.) who have over 10 employees and produce, process, or use chemicals to report the amounts that were released each year on and off their facility.[453] They monitor chemicals that are either harmful to public health or the environment. In 2017, 105 Seattle facilities released around 50,000 pounds of toxic chemicals on-site.[454] Additionally, about 580,000 pounds of toxic chemicals were released by Seattle facilities off-site. A release does not mean that there was a hazardous materials incident. Rather, it means that a chemical was emitted into the air or water or placed in a type of land disposal.[455] However, these numbers reveal the amount of chemicals that are being used in the city and could potentially pose a risk to public health if handled improperly.

The U.S. Department of Transportation collects incident data at the state level and on the transportation mode. Washington ranks in the middle third in terms of the number of annual incidents. In 2009 in was 22nd with 230 and remained ranked at 22nd in 2018 with 272 incidents.[456] None were listed as major incidents. The most common transport mode is highway by far.

8 3.3 *Likelihood of Future Occurrences*

The available data on hazardous materials incidents is limited, but what does exist suggests the chance of an acutely disastrous incident has a low probability of occurring. Many programs exist to reduce the likelihood of an accident and to mitigate the effects of releases. These programs seem to be effective in limiting damage. The increase in transportation incidents from 1999 to 2009 runs counter to the general

decline and bears watching. Additionally, the recent increase in the amount of Bakken oil being transported by rail through the city may increase Seattle's likelihood of a disastrous incident. The railcars that carry the majority of Bakken oil in the state were not made to carry oil and have been known to puncture upon impact.[457]

Seattle has never experienced a chemical or radiological attack, or a successful bombing. The difficulty of obtaining or manufacturing chemicals makes an attack unlikely, though not impossible. While explosives have been used around the world in past terror attacks, recent terrorism trends point towards the use of simpler tactics (e.g. vehicles, knives, etc.) to cause harm.

While there may be very significant long-term problems involving the build-up of toxic chemicals in the environment, there have been very few large releases of chemicals that pose immediate risks to large numbers of people. Most of the largest past events have been secondary impacts to fires and transportation accidents. It seems most likely that a future event would be related to another type of hazard, such as an earthquake or fire.

8 3.4 Vulnerability

The most likely location of a hazardous material emergency is at a user site, an abandoned dump or landfill, or on a major transportation route. If the chemical finds its way into the sewer system, treatment facilities or sewer overflow locations could become additional damage locations. Additionally, Seattle is a city surrounded by water and a chemical spill into these water bodies could severely harm aquatic life.

The Washington State and SFD information refine this set of assumptions with some empirical data. The vast majority of accidents in the county (90%) occur at fixed facilities, which theoretically means 90% of the spill locations are identifiable prior to an incident. The State's data shows more transportation accidents happen in rural areas, while most of the fixed facility accidents occur in industrial areas. On the basis of this information, the picture of a typical hazardous material accident site is in an industrial area or along a major transportation corridor such as I-5, I-90, SR 99, SR 520, or the railways within the city. The most vulnerable locations are where high density, vulnerable populations, and critical infrastructure occur close to the areas that are more likely to have incidents. Besides these areas, the University of Washington also has a large share of serious hazardous materials incidents, due to its many research labs.

The most common sources of large accidents are petroleum, metal, and chemical plants. There are relatively fewer of these facilities in Seattle compared to other U.S. cities, decreasing the probably of a large event.

8 3.5 Consequences

The effects of a large hazardous materials incident are unpredictable because there is not a long history of such large incidents in Seattle. Hazardous materials emergencies can be complex because chemicals have so many ways they affect people. They can disperse through the air or water and can enter the body through the lungs, digestive system, or skin. Many can explode. Some will react with water and other common agents that fire-fighters use. Every chemical has a unique set of properties that pose a unique set of dangers and call for a unique response. In most cases, a fire will multiply the threat of direct contact either by causing the material to explode and/or dispersing it.

If future large incidents follow the historical pattern, only magnified, then they would most likely occur as a secondary effect or another type of hazard, especially a fire. It would most likely be at a fixed facility. If a transportation incident occurred in the city, consequences could be significant as was the case with the 1975 tanker fire. A crowded tavern was nearby the incident and could have caused multiple fatalities had it been affected.

These types of incidents are likely to be limited in geographic scope. The city is likely to have a quick and complete recovery. Unless there is a large explosion or fire in a crowded and enclosed location, fatalities are likely to be few, although the number of injuries due to chemical exposure could be quite large. In the 1995 Tokyo sarin gas attack there was about one fatality for each 200 injuries.

The most serious hazardous materials incidents would probably either involve an attack or multiple incidents occurring at the same time as a result of a trigger hazard, like an earthquake or flood. Attacks would be serious because of the deliberate intent to harm. Extremely dangerous substances would most likely be involved and would be released in locations that would impact many people, such as transit systems or entertainment venues. In a scenario where numerous hazardous materials releases occur as a secondary impact to another hazard, response capacity would be diminished. In past events, bystanders have been injured because people were not removed quickly enough or were allowed to return in a prolonged evacuation.[458]

The economic effects extend beyond immediate damage because chemicals produce a high amount of anxiety. A serious event would probably lower property values in the surrounding area, compounding economic damage into the future. They can also cause extreme environmental damage, especially if chemicals enter the water or sewer systems where they can spread and leach into groundwater or discharge into bodies of water. Many large maritime vessels are capable of leaking thousands of gallons of oil into the Puget Sound. If dangerous gases escape in large quantities, or if chemicals enter the water system through a Combined Sewer Overflow or direct runoff, an accident could escalate from a localized emergency to a wider environmental disaster.

8 3.6 Conclusions

Minor hazardous materials incidents are fairly common, making them high probability events that typically do not involve emergency management. Fortunately, more serious threats, including fatal accidents, are extremely rare. Many of the decisions that govern the use of hazardous materials rest with the state and federal governments.