



# Hazardous Materials

Hazardous materials are materials and solid waste that are harmful to humans, animals, and the environment. Incidents involving hazardous materials can happen at fixed sites, non-point source pollution, or as a result of incidents during material transportation and improper storage.

### CHANGES SINCE 2018

+0

Declared Disasters

2,201

Events

### COUNTIES MOST VULNERABLE



Kaua'i Honolulu Maui Hawai'i

### SOCIALLY VULNERABLE POPULATION

22.3% | 316,257

Of Total Population

Persons

### CLIMATE PROJECTIONS



**Future event-base flooding** will be exacerbated by climate change



**Sites that store hazardous materials** that are at risk from current and future flooding that could cause the release of hazardous materials



**Projected sea level rise** will eventually cause the failure of on-site sewage disposal systems and degrade water quality

### HAZARD RANKING



Low Medium High

### COMMUNITY LIFELINES

1,369

Total

6,095

State Buildings



SQUARE MILES

7,420

Environmental Resources



337

Hawaiian Home Lands



975

Cultural Resources



1,104

Miles of State Road





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## SECTION 4. RISK ASSESSMENT

### 4.7 HAZARDOUS MATERIALS

#### 2023 SHMP Update Changes

- ❖ Hazardous materials incidents that occurred in the State of Hawai'i from January 1, 2018, through December 31, 2022, were researched for this 2023 SHMP Update.
- ❖ The profile and vulnerability assessment have been updated to include the most up-to-date information on the numbers of chemical facilities and Superfund sites, the addition of information on pipelines, and the consideration of both fixed-sites and in-transit hazardous materials.
- ❖ This section now includes a discussion of how hazardous materials impact socially vulnerable populations and community lifelines.

#### 4.7.1 HAZARD PROFILE

##### HAZARD DESCRIPTION

Hazardous materials, as defined by various federal agencies like the Environmental Protection Agency (EPA), are materials and solid waste that are harmful to humans, animals, and the environment. Incidents involving hazardous materials can happen at fixed sites (wastewater treatment plants, solid waste facilities), nonpoint source pollution, or as a result of incidents during material transportation and improper storage. Both can be disastrous if not managed properly.

Natural disasters can cause major damage to hazardous installations, hazardous substance releases, fires, and explosions, resulting in health effects, environmental pollution, and economic losses. Natural hazards that are generally considered minor, such as lightning, have been found to cause significant hazardous materials incidents (OECD n.d.). Natural hazard areas that are considered more severe, such as lava flow zones during an eruption, can amplify a hazardous materials release. Adhering to protocols in emergency response plans in such areas is required to protect the health, safety, and welfare of employees and other persons in the vicinity of a hazardous materials site (Puna Geothermal Venture 2022).

Hazardous materials are stored and transported statewide. The state faces an average of over 300 hazardous materials incidents each year. The majority are minor releases; however, there is always the potential for large and dangerous releases (HI-EMA 2022).

Because relevant legislation uses the term "hazardous substance," but the emergency management and response community typically uses the term "hazardous materials," for the purpose of this hazard profile, "hazardous materials" and "hazardous substances" are used interchangeably.





## Hazardous Substances Defined by the CERCLA

- Any hazardous substance designated under Section 311(b)(2) of the Clean Water Act (CWA), or any toxic pollutant listed under Section 307(a) of the CWA. There are about 400 substances designated as either hazardous or toxic under the CWA.
- Any hazardous waste having the characteristics identified or listed under Section 3001 of the Resource Conservation and Recovery Act (RCRA).
- Any hazardous air pollutant listed under Section 112(b) of the CAA. There are over 200 substances listed as hazardous air pollutants under the CAA.
- Any imminently hazardous chemical substance or mixture which the EPA Administrator has "taken action under" Section 7 of the Toxic Substances Control Act (TSCA).
- CERCLA section 102(a) also gives EPA authority to designate additional hazardous substances not listed under the statutory provisions cited above (U.S. Environmental Protection Agency 2022).

If released or misused, hazardous substances can cause death, serious injury, long-lasting health effects, and damage to structures and other properties as well as the environment. Many products containing hazardous substances are used and stored in homes, and these products are shipped daily on highways, waterways, and pipelines. There are two general types of hazardous material incidents:

- **Fixed-site hazardous substances (materials and waste) incident** is the uncontrolled release of materials from a fixed site capable of posing a risk to health, safety, and property as determined by the Resource Conservation and Recovery Act (RCRA). It is possible to identify and prepare for a fixed-site incident because federal and state laws require those facilities to notify state and local authorities about what is being used or produced at the site. Hazardous materials at fixed sites are regulated by the EPA.

The EPA chooses to specifically list substances as hazardous and extremely hazardous rather than providing objective definitions. Hazardous substances, as listed, are generally materials that, if released into the environment, tend to persist for long periods and pose long-term health hazards for living organisms. Extremely hazardous substances, while also generally toxic materials, represent acute health hazards that, when released, are immediately dangerous to the lives of humans and animals and cause serious damage to the environment. When facilities have these materials in quantities at or above the threshold planning quantity (TPQ), they must submit "Tier II" information to appropriate state and/or local agencies to facilitate emergency planning.

- A **hazardous materials transportation incident** is any event resulting in uncontrolled release of materials during transport that can pose a risk to health, safety, and property as defined by the U.S. Department of Transportation (U.S. DOT) Materials Transport regulations. Transportation incidents are difficult to prepare for because there is little, if any, notice about what materials could be involved should an accident happen. Hazardous materials transportation incidents can occur anywhere within the state. Transportation of hazardous materials on highways involves tanker trucks or trailers and is responsible for the greater number of hazardous substance release incidents. Transportation of hazardous materials, such as imported petroleum products, occurs on navigable waters via ships and barges. Hazardous materials in transit are regulated by the U.S. DOT, and transportation of hazardous waste is regulated by the Hawai'i State Department of Health (DOH).

The U.S. DOT regulations define hazardous materials as a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in





commerce and has designated as hazardous under Section 5103 of federal hazardous materials transportation law (49 U.S. Code [U.S.C.] 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (see 49 Code of Federal Regulations [CFR] 172.101), and materials that meet the defining criteria for hazard classes and divisions. When a substance meets the DOT definition of a hazardous material, it must be transported in accordance with safety regulations providing for appropriate packaging, communication of hazards, and proper shipping controls.

The Emergency Planning and Community Right-to-Know Act (EPCRA) was passed by Congress in 1986 (Title III of Superfund Amendments and Reauthorization Act (SARA)). The EPCRA establishes requirements for federal, state, and local governments; Indian tribes; and industry regarding emergency planning and “Community Right-to-Know” reporting on hazardous and toxic chemicals. The Community Right-to-Know provisions help increase public’s knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. States and communities, working with facilities, can use the information to improve chemical safety and protect public health and the environment.



## Key Provisions to the EPCRA

- **Emergency planning** – Local governments are required to prepare chemical emergency response plans, and to review plans at least annually. State governments are required to oversee and coordinate local planning efforts. Facilities that maintain Extremely Hazardous Substances (EHS) on-site in quantities greater than corresponding threshold planning quantities (TPQs) must also cooperate in preparing emergency plans.
- **Emergency release notification** – Facilities must immediately report accidental releases of EHSs and other hazardous substances, as defined under CERCLA. Any release of these substances in quantities greater than their corresponding reportable quantities must be reported to state and local officials.
- **Hazardous chemical storage reporting requirements** – Facilities handling or storing any hazardous chemicals, as defined under Occupational Safety and Health Administration (OSHA), must submit Safety Data Sheets (SDSs), to state and local officials and fire departments. Facilities must also submit an inventory form for these chemicals to state and local officials and local fire departments.
- **Toxic release inventory (TRI)** – Facilities must complete and submit a toxic chemical release inventory form (Form R) each year. Form R must be submitted for each of the over 600 TRI chemicals that are manufactured or other used above the applicable threshold quantities.

As part of the requirements for hazardous chemical storage reporting, facilities must submit an Emergency and Hazardous Chemical Inventory Form annually to the local emergency planning committee (LEPC), the state emergency response commission (SERC), and the local fire department. Facilities provide either a Tier I or Tier II inventory form; however, most states require Tier II inventory forms. The forms need to be submitted on or before March 1 each year for information on chemicals present at the facility in the previous year.

In 1993, the State of Hawai‘i enacted the Hawai‘i Emergency Planning and Community Right-to-Know Act (HEPCRA) which is modeled after the federal EPCRA. Hawai‘i Administrative Rules for implementing HEPCRA regulations became effective in November 2010. Similar to EPCRA, HEPCRA has four major provisions: (1) emergency response planning, (2) emergency release reporting, (3) hazardous chemical storage and Tier II reporting, and (4) toxic release inventory reporting. The Hawai‘i DOH’s Hazard Evaluation and Emergency Response (HEER) Office carries out the requirements of EPCRA as well as HEPCRA.

In addition to traditional hazardous materials stored or transported, on-site sewage disposal systems (OSDS) that provide wastewater treatment for multiple homeowners need to be maintained properly. The lack of maintenance or a physical





impact to these systems can lead to an environmental release potentially contaminating nearby waterbodies and drinking water sources and compromising public health. The DOH’s Clean Water Branch administers the Nonpoint Source management program, which includes the oversight of OSDs, and develops the State’s Nonpoint Source Management Plan with watershed-specific strategies to control pollution (Hawai’i State Department of Health 2021).

## LOCATION

Hazardous materials are widely stored and transported throughout the State of Hawai’i. An event involving hazardous materials release can occur anywhere; for this reason, the location of a hazardous materials release is classified as either being at a fixed site or in transit. A fixed-site hazardous materials release occurs at facilities that store and/or use hazardous materials and include refineries, warehouses, portside facilities and harbors, and Superfund sites. An in-transit hazardous materials release occurs while a hazardous material is being transported from one location to another along major highways, navigable waters, or via pipelines.

### Fixed-Site Hazardous Materials

Serious hazardous materials incidents—those causing hospitalizations, deaths, and large-scale economic loss and environmental damage—are generally the result of a series of improbable events involving large quantities of material and are, thus, relatively rare and difficult to predict. Tier II reporting reveals the location and identity of large quantities of hazardous materials in storage and use. As of the date of this 2023 SHMP Update, there are 848 Tier II reporting facilities in the State of Hawai’i (Table 4.7-1).

**Table 4.7-1. Hazardous SARA Tier II Reporting Facilities**

County	Tier II Reporting Facilities
County of Kaua’i	81
City and County of Honolulu	406
County of Maui	142
County of Hawai’i	219
<b>Total</b>	<b>848</b>

Source: (Hawai’i State Department of Health 2020)

### Superfund Sites

In response to concerns regarding health and environmental risks, Congress established the Superfund program in 1980 to clean up sites in which hazardous materials were released and ultimately abandoned. The Superfund program is locally administered by the EPA in cooperation with the Hawai’i DOH HEER Office.

Federal regulations, including the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and SARA, required that a National Priorities List (NPL) of sites throughout the United States be maintained and revised at least annually (SARA amended CERCLA on October 17, 1986). The NPL is a list of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation. As of the date of this 2023 SHMP Update, there are three NPL (Superfund) sites in Hawai’i, all located in the City and County of Honolulu (U.S. Environmental Protection Agency 2022). In addition to the federal NPL sites, the Hawai’i DOH Response Program List of Priority Sites presents all sites in the state identified for potential or known non-emergency response actions managed by the HEER Office Site Discovery, Assessment, and Remediation Section Remedial Project Managers (RPMs). Sites are categorized as a potential hazard when sampling data indicate that contaminant concentrations exceed Hawai’i Environmental Action





Levels. The list for the fiscal year 2020 includes 934 sites statewide that are managed within the HEER Office. Of those sites, 67 are listed as high priority, 225 as medium priority, 618 as low priority, and 13 as no further action unrestricted (Hawai'i State Department of Health 2020).

Both Superfund sites and identified high-priority sites increase the State of Hawai'i's risk to impacts from other hazards, such as flooding, storm surge, and erosion, that can cause the migration or spread of hazardous materials throughout the environment. This will adversely impact both public and environmental health and add significant complications to recovery efforts following a disaster that impacts a Superfund site or high-priority site if identified hazardous materials are not properly contained.

### *In-Transit Hazardous Materials*

Incidents involving hazardous substances in transit can occur anywhere in the state. The primary mode of vehicle transportation on island is via the highway network. The State of Hawai'i has a widespread highway network where hazardous materials may be transported.

Hazardous substances can also be transported via ships, barges, and pipeline in Hawai'i. Refinery feedstock and refined petroleum products are imported to the state via navigable waters. There are two crude oil refineries on the leeward coast of O'ahu, in the vicinity of Campbell Industrial Park, that can produce a broad range of refined petroleum products. Because there are no inter-island pipelines to transport these products, refined petroleum products are loaded at Honolulu harbor terminals onto fuel barges for distribution to the other islands (U.S. Energy Information Administration 2022). Two barges transport propane gas from O'ahu to the neighbor islands, and the gas is then routed by truck to various tanks and holders (Department of Commerce and Consumer Affairs 2022).

On the Island of O'ahu, petroleum is transported via pipeline from two crude oil refineries to other locations on the island (U.S. Energy Information Administration 2022). Figure 4.7-1 and Figure 4.7-2 show the gas transmission and hazardous liquids (refined petroleum products) pipelines. In addition, synthetic natural gas is distributed through nearly 1,000 miles of pipeline on O'ahu (U.S. Energy Information Administration 2022).

The Red Hill Bulk Fuel Storage Facility is a military storage facility operated by the U. S. Navy on the Island of O'ahu. It can store up to 250 million gallons of fuel in 20 underground tanks. Three gravity-fed pipelines run 2.5 miles to fueling piers at Pearl Harbor (U.S. Navy 2022). In 2021, about 21,000 gallons of jet fuel spilled, contaminating the underground aquifer and the Joint Base Pearl Harbor Hickam drinking water system, exposing thousands of people to JP-5 jet fuel in their drinking water. In March 2022, the Secretary of Defense announced the decision to defuel and permanently close the facility by 2027.

## EXTENT

The extent of a hazardous substance release will depend on whether it is from a fixed or in-transit (mobile) source, the volume of substance released, duration of the release, the toxicity and properties of the substance, and the environmental conditions (for example, wind and precipitation, terrain, etc.).

Hazardous substance releases can contaminate air, water, and soils, possibly resulting in death and/or injuries and illnesses. Dispersion can take place rapidly when the hazardous substance is transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.





Figure 4.7-1. Petroleum and Gas Transmission Pipelines in the County of Hawai'i

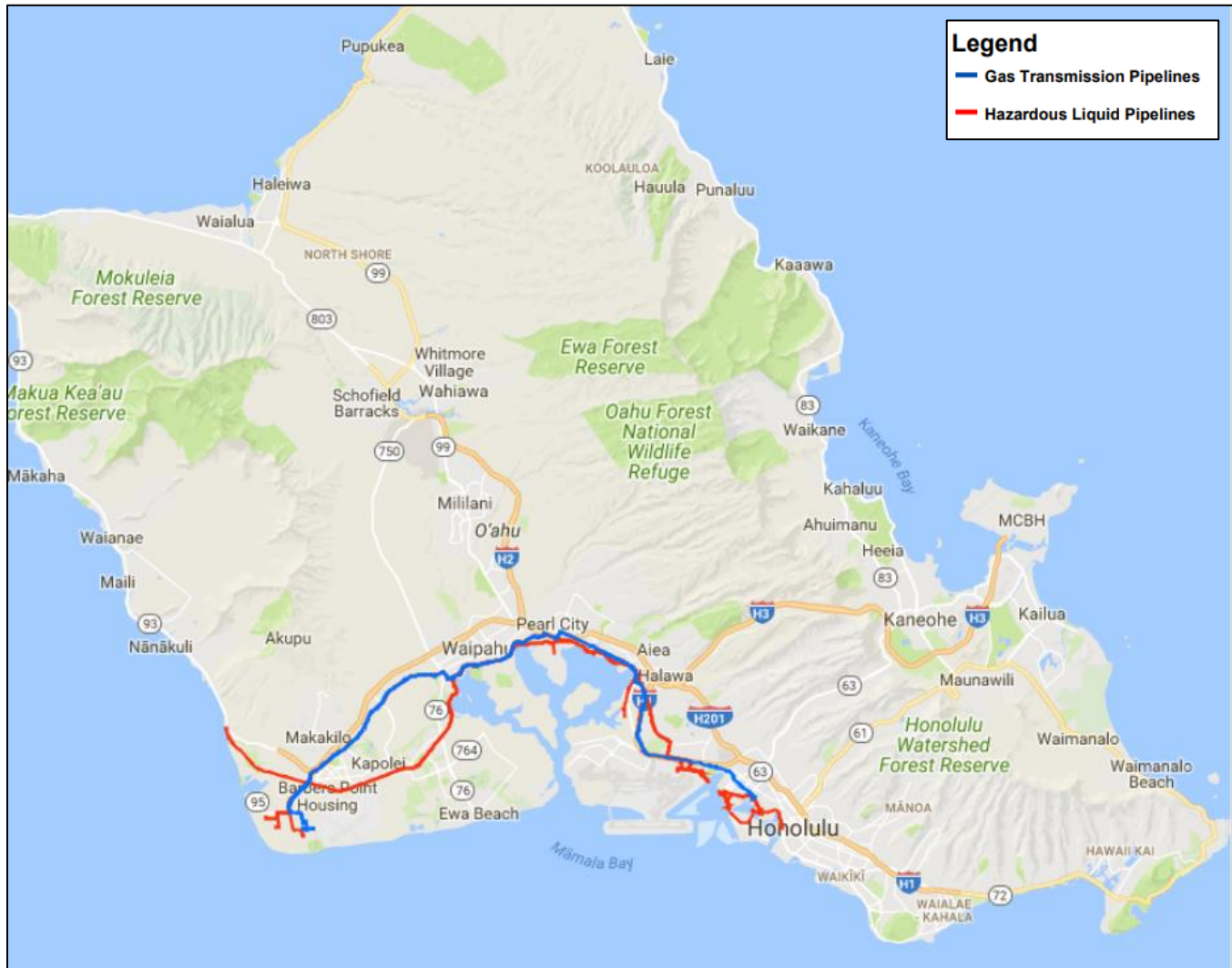


Source: (U.S. Department of Transportation 2022)





Figure 4.7-2. Petroleum and Gas Transmission Pipelines in the City and County of Honolulu



Source: (U.S. Department of Transportation 2022)

With a hazardous substance release, whether accidental or intentional, several potentially exacerbating or mitigating circumstances will affect its severity of impact. Mitigating conditions are precautionary measures taken in advance to reduce the impact a release has on the surrounding environment. Primary and secondary containment or shielding by sheltering-in-place measures protects people and property from the harmful effects of a hazardous substance release. Exacerbating conditions, characteristics that can enhance or magnify the effects of a hazardous substance release, include:

- Weather conditions, which affect how the hazard occurs and develops (such as wind speed and direction)
- Micro-meteorological effects of buildings and terrain, which alters the dispersion of hazardous substances in compliance with applicable codes (such as building or fire codes)
- Mechanical failures (such as fire protection and containment features), which can substantially increase the damage to the facility itself and to surrounding buildings
- Land use, population, and building density, which are factors contributing to the extent of exposure and impacts incurred





The severity of a hazardous material incident is dependent not only on the circumstances described above but also with the type of substance released, distance from the release, and the related response time for emergency response teams to stabilize and contain the release. Generally, areas closest to a release are at the greatest risk due to their exposure to higher concentrations of the substance and the limited warning time before being impacted. However, depending on the substance/material, a release can rapidly travel great distances or remain present in the environment for long periods of time (e.g., centuries to millennia), allowing for greater dispersal and increasing the spatial extent of impact.

### Warning Time

Warning time for a hazardous materials incident can be sudden without any warning (such as an explosion), or may develop slowly (such as a leaking container). Facilities that store extremely hazardous substances are required to notify local officials when an incident occurs. Local emergency responders and emergency management officials determine the need to evacuate the public or whether to advise people to shelter-in-place. Similar to on-site hazardous substances incidents, the amount of warning time for incidents associated with hazardous substances in-transit varies based on the nature and scope of the incident. If an explosion or hazardous materials release does not occur immediately following an accident, there may be time for warning adjacent neighborhoods and enough time to facilitate appropriate protective actions.

## PREVIOUS OCCURRENCES AND LOSSES

The 2018 SHMP discussed hazardous material incidents that occurred in the State of Hawai'i through 2017. For this 2023 SHMP Update, hazardous material incidents (in-transit and fixed site) were summarized between January 1, 2018, through December 31, 2023. For events prior to 2018, please refer to Appendix E (Hazard Profile Supplement). This section is divided into the different forms of hazardous substance releases (fixed-site and in-transit).

### Disaster and Emergency Declarations

No federal, state, or U.S. Department of Agriculture disaster declarations or proclamations for hazardous material-related incidents have been issued relevant to Hawai'i or any of its counties.

### Fixed-Site Hazardous Materials

The release of hazardous materials has occurred frequently throughout the state. Releases are reported to the Hawai'i DOH HEER Office. Table 4.7-2 shows the number of releases reported to the HEER Office in 2018 through 2022. In the five-year period between 2018 and 2022, there have been 2,193 instances of fixed-site hazardous material releases, equating to over one incident per day across the state over a five-year period.

Table 4.7-2. Hazardous Materials Releases Reported to the HEER Office by County, 2018 to 2022

Year	County of Kaua'i	City and County of Honolulu	County of Maui	County of Hawai'i	Total
2018	25	353	48	42	468
2019	26	318	60	42	446
2020	18	249	35	34	336
2021	22	324	40	50	436
2022	18	354	75	60	507
<b>Total</b>	<b>109</b>	<b>1,598</b>	<b>258</b>	<b>228</b>	<b>2,193</b>

Source: (Hawai'i State Department of Health 2022)





## *In-Transit Hazardous Materials*

In-transit hazardous materials releases occur frequently. Most incidents are minor, but others cause significant impacts such as injury, evacuation, environmental damage, and the need for clean-up. Regulations in 49 CFR 171.15 and 171.16 govern situations where hazardous materials are released and the resulting required notifications and reporting. Unless they are properly reported, it is difficult to identify and track past hazardous materials releases that occur in-transit. Between 2018 and 2022, there were eight notable pipeline incidents recorded by government agencies and the news media. There were no large-scale in-transit highway, waterway, or aviation hazardous materials incidents during that timeframe. Further information on these incidents is listed in Table 4.7-3.

## PROBABILITY OF FUTURE HAZARD EVENTS

### *Overall Probability*

Since there have been no federal declarations for hazardous material incidents in the State of Hawai'i, all events reported earlier in this section that occurred between 2018 and 2022 were used to calculate the probability of future occurrences. Based on the extrapolation of data available on the occurrence of previous events, the State of Hawai'i experiences over 300 hazardous material incidents each year. Therefore, there is a 100 percent chance of a hazardous material incident occurring in any given year in the state. However, as was the case for historical events in the state, the magnitude of the incidents expected to occur will vary widely from very minor releases to the potential for major events in which thousands of gallons of hazardous materials may be released and large populations of people are affected.

### *Climate Change Impacts*

As discussed in Section 4.2 (Climate Change and Sea Level Rise) and Section 4.6 (Flood), it is highly likely that changing future conditions will exacerbate current conditions and increase future event-based flood risk. Sites that store hazardous materials that are at risk from current flooding will become more vulnerable with climate change and sea level rise. Flooding during a storm event could cause releases of hazardous materials if they are not properly stored or contained. The release of these hazardous materials may expose the nearby population and harm water quality and the overall environmental and economic health of the area.

In terms of sea level rise, septic tanks, cesspools, and other OSDS as well as other hazard materials/waste storage and disposal sites are located along the coast. The projected rise in sea level will eventually result in the failure of the OSDS. Unable to operate properly, they will contribute to the degradation of nearshore water quality. Additionally, a release from OSDS could change disease risk for coral reefs and negatively impact nearby coral and coastal resources. Refer to Section 4.2 (Climate Change and Sea Level Rise) regarding the sea level rise projections for the State of Hawai'i (Hawai'i Climate Change Mitigation and Adaptation Commission 2017).

## 4.7.2 VULNERABILITY ASSESSMENT

Overall, it is difficult to quantify potential losses due to hazardous material incidents because of the many variables that must be considered, including but not limited to the specific hazardous substance, quantity, location, time of day, meteorological conditions, surrounding environment and emergency response and clean-up capabilities. Potential impacts may be local, regional, or statewide depending on the magnitude of the event and level of service disruptions. A qualitative assessment is discussed below.





Table 4.7-3. In-Transit Hazardous Material Incidents from 2018 to 2022

Date of Incident	Event Type	Counties Affected	Impacts
January 9, 2018	Corrosion (pipeline)	Honolulu	74 barrels of refined petroleum spilled; \$460,500 in damages
July 8, 2019	Corrosion (pipeline)	Honolulu	\$82,602 in damages
August 11, 2019	Corrosion (pipeline)	Honolulu	1 barrel hazardous liquid spilled; \$20,084 in damages
March 17 and June 2, 2020	Oil Release (pipeline)	Honolulu	About 7,700 gallons of fuel collected from the soil and water
January 26, 2021	Equipment Failure	Honolulu	12 barrels hazardous liquid spilled; \$27,420 in damages
May 6–7, 2021	Operator Error (pipeline)	Honolulu	21,000 gallons of jet fuel spilled into a fire suppression line and additional jet fuel spilled into the environment
November 20–21, 2021	Pipeline Rupture	Honolulu	21,000 gallons of jet fuel released from fire suppression line; contaminated public water supply
November 29, 2022	Routine Maintenance Operation (pipeline)	Honolulu	1,300 gallons of Aqueous Film Forming Foam (AFFF) concentrate was released; \$1.5 million in damages to date

Source: (US DOT Pipeline and Hazardous Materials Safety Administration 2022, U.S. Environmental Protection Agency 2022, Jedra 2022, McCullough 2022)

Figure 4.7-3. Naval Employees Relocate Soil Contaminated by Aqueous Film Forming Foam (AFFF) Concentrate in 2022



Credit: Spc. Matthew Mackintosh





## ASSESSMENT OF STATE VULNERABILITY AND POTENTIAL LOSSES

This section discusses statewide vulnerability of exposed state assets (state buildings and roads) community lifelines, and critical facilities to hazardous material incidents.

### *State Assets*

Potential losses to state buildings caused by a hazardous materials release is difficult to monetize. The degree of damages to the asset depends on the scale of the incident. Generally speaking, all 6,095 State buildings are potentially vulnerable to a hazardous materials release. State assets proximate to Tier II facilities or NPL sites or transportation corridors that permit the transport of hazardous materials have an increased risk of exposure. Depending upon the incident, state employees may need to evacuate the building if exposure may impact human health. This may result in loss of productivity that can be measured by days and dollar equivalency. In terms of building-related and property damage, damage may include but is not limited to damage to heating, ventilation and air conditioning (HVAC) systems due to the corrosive effects of some chemicals and/or contaminated soil, groundwater, and nearby waterbodies.

All state roads that permit the transport of hazardous materials are potentially at risk of an incident. Transportation carriers must have response plans in place to address accidents; otherwise, the local emergency response team will step in to secure and restore the area. Quick response minimizes the volume and concentration of hazardous materials that disperse through air, water, and soil. Hazardous material releases may lead to road closures until response and clean-up efforts are completed. This may impact access to communities, commuting to work, and impact the ability to deliver goods and services efficiently.

### *Community Lifelines and Critical Facilities*

Similar to state assets, potential losses to community lifelines and critical facilities caused by a hazardous materials release are difficult to monetize. The degree of damages to the asset depends on the scale of the incident. Critical facilities need to remain in operation before, during, and after disaster events. Loss of use will impact the services they provide to the state, which may have public safety and economic implications. Ports and harbors are critical points of entry that need to remain open and operational to maintain the vital just-in-time shipping logistics required to sustain each island. In the event of a large-scale hazardous materials release resulting in port closures, there will be cascading impacts statewide.

## ASSESSMENT OF LOCAL VULNERABILITY AND POTENTIAL LOSSES

This section provides a summary of vulnerability and potential losses to population, general building stock, and environmental resources and cultural assets. Each county's vulnerability and potential loss will vary greatly depending not only on the type and intensity of the release. The local HMPs were reviewed, and their discussion of hazardous material incidents is summarized below:

- **County of Kaua'i**—In the 2021 Kaua'i County Multi-Hazard Mitigation and Resilience Plan, hazardous materials are briefly discussed in the individual hazards section (Kaua'i Emergency Management Agency 2021). The County of Kaua'i has 77 Tier II facilities.
- **City and County of Honolulu**—The 2020 City and County of Honolulu Multi-Hazard Pre-Disaster Mitigation Plan addresses hazardous materials as a stand-alone hazard (City and County of Honolulu 2020). The City and County of Honolulu has the greatest number of Tier II facilities compared to the other counties (406 facilities). The three NPL sites in the State of Hawai'i are located in the City and County of Honolulu. In addition, the oil refineries and pipelines are on the island.
- **County of Maui**—In the 2020 Maui County HMP, the hazardous materials hazard was addressed with a qualitative analysis as a stand-alone hazard in the plan. According to the plan, Maui County has 12 EPA-designated Toxic Release





Inventory (TRI) facilities that are considered critical infrastructure operations (Maui Emergency Management Agency 2020). Maui County has 139 Tier II facilities.

- **County of Hawai'i**—The 2020 Hawai'i County Multi-Hazard Mitigation Plan discusses hazardous materials in the individual hazard sections. In addition, there are 215 Tier II facilities on the County of Hawai'i.

## *Socially Vulnerable and Total Populations*

All counties in the State of Hawai'i have Tier II facilities. For the purposes of this assessment, the entire population is exposed and could potentially be impacted by a hazardous materials release—a fixed-site hazardous material release, in-transit hazardous material release, or both. When hazardous substances are released in the air, water, or on land they may contaminate the environment and pose greater danger to human health. The general population may be exposed to a hazardous substances release through inhalation, ingestion, or dermal exposure. Exposure may be either acute or chronic, depending upon the nature of the substance and extent of release and concentration. The populations considered most vulnerable include the elderly (persons over the age of 65), the young, pregnant women and people who are ill or immunocompromised. Vulnerable communities nearest to hazardous materials sites are often composed of lower housing values, incomes, and education levels than the national average. These vulnerable communities have the least time to react in the event of a catastrophic hazardous material release (Orum, et al. 2014). Cascading events from a disaster are more likely to amplify and compound vulnerabilities.

Populations exposed to environmental contamination from hazardous materials may experience chronic stress for various reasons (e.g., health concerns, uncertainty, and community conflict). This can be compounded when socially vulnerable populations do not have the resources to move to another location or seek medical help. Some may feel exploited, dismissed, powerless, unheard, or unsupported (Agency for Toxic Substances and Disease Registry 2021).

Populations living and/or working near facilities that produce, store, or transport hazardous substances are at higher risk to exposure. In particular, populations downstream, downwind, and downhill of a released substance are particularly vulnerable. Depending on the type of release and environmental conditions, people may be evacuated as a precaution or instructed to shelter-in-place. Section 4.16 (Windstorm) discusses the unique terrain in the state and how this impacts wind effects and speeds in each county, which can play a role in the dispersion of airborne chemical releases.

Populations living and/or working near major transportation routes (such as Interstates H1, H2, H3, and H201) are more vulnerable to a hazardous materials release because of the potential for chemicals to be transported on these major thoroughfares. Hazardous substances can also be transported via pipeline. There are petroleum and gas transmission lines on the City and County of Honolulu, and the County of Hawai'i (Figure 4.7-2 and Figure 4.7-2). The closure of waterways, ports, harbors, airports, highways, or refineries as a result of a hazardous materials release has the potential to impact the ability to deliver goods and services efficiently and could have cascading economic impacts to other islands.

Overall, the entire population of the State of Hawai'i is exposed and vulnerable to hazardous material releases.

## *General Building Stock*

Hazardous material releases can damage and destroy public, commercial, and private property. Losses include both direct and indirect costs. Direct costs can be defined as:

- The cost of materials
- Property damage
- Response cost
- Remediation/clean-up cost for a specific release





All other costs and losses from hazardous material releases are indirect. Indirect costs include:

- Loss of productivity as a result of damage to land, facilities, or interruption of services
- Loss of access to recreation lands and facilities
- Cost of lost human productivity due to injury and death
- Damages to ecosystems
- The cost of litigation as a consequence of the release

Damages to transportation infrastructure and their closure is not uncommon following a hazardous materials release. Similar to the fixed-site hazardous materials release, the greatest risk to population and the built environment would be from an explosion from hazardous materials in transport. Proximity, intensity and the structural integrity of the building itself are all factors in the subsequent vulnerability and expected damage.

### ***Environmental Resources***

A hazardous substance release, whether fixed-site or in-transit, can negatively impact the natural environment. Depending on the nature and amount of the substance, the release may contaminate the air, water, or soil, potentially causing concern for direct human and animal exposure, recreational usage, crop irrigation, and fish and wildlife consumption.

Water contamination, whether surface water, groundwater, or marine, is an immediate concern from a hazardous materials release potentially impacting potable water supplies. Wildlife and recreational activities may also be impacted. Hazardous material releases could also significantly impact soils, including agricultural lands. Depending on the characteristic of the hazardous material and/or the volume of product involved, the affected area can be as small as several square feet or as large as many square miles that require soil remediation. Such environmental damage can linger for decades and result in extensive remediation costs.

Coral reef ecosystems are fragile and extremely vulnerable to environmental stresses, including runoff and oil spills. Runoff from land-based pollution sources may include hazardous materials that carry sediment, high levels of nutrients from agricultural areas, sewage outflows, or pollutants such as petroleum products and pesticides. The degree of damage will depend upon the coral species, life stage, and exposure. Impacts can result in bleaching, which can damage or kill coral depending upon the severity and duration of the environmental stress (National Oceanic and Atmospheric Association 2022, National Oceanic and Atmospheric Association 2022).

### ***Cultural Assets***

Loss of and harm to native species and ecosystems as a result of a hazardous materials release will adversely impact the Hawaiian cultural traditions and practices, which are closely tied to the natural environment. Hawaiian fishponds may be impacted by a hazardous materials release. Depending on the material, the release may kill the fish species, or the bioaccumulation of pollutants can affect animals high on the food chain long after a release. Additionally, site remediation efforts following a hazardous material release can result in adverse impacts to archeological resources and sensitive cultural areas in the attempt to remove and/or excavate contaminated sediments from an affected area.

## **FUTURE CHANGES THAT MAY IMPACT STATE VULNERABILITY**

Understanding future changes that impact vulnerability in the state can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The state considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development





- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

As development continues and populations increase, the risk for a hazardous material release and the potential impacts to the population, infrastructure, and environmental and cultural resources will increase as well. The number and types of hazardous chemicals stored in and transported through the state will likely continue to increase. As the population grows, the number of people vulnerable to the impacts of hazardous materials spills and transportation incidents will increase. Population and business growth along major transportation corridors increases the vulnerability to transportation-related hazardous material spills. Growth increasing commercial and residential density near fixed-site hazardous materials facilities will also increase vulnerability.

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