Chapter 15. Hazardous Material Sites

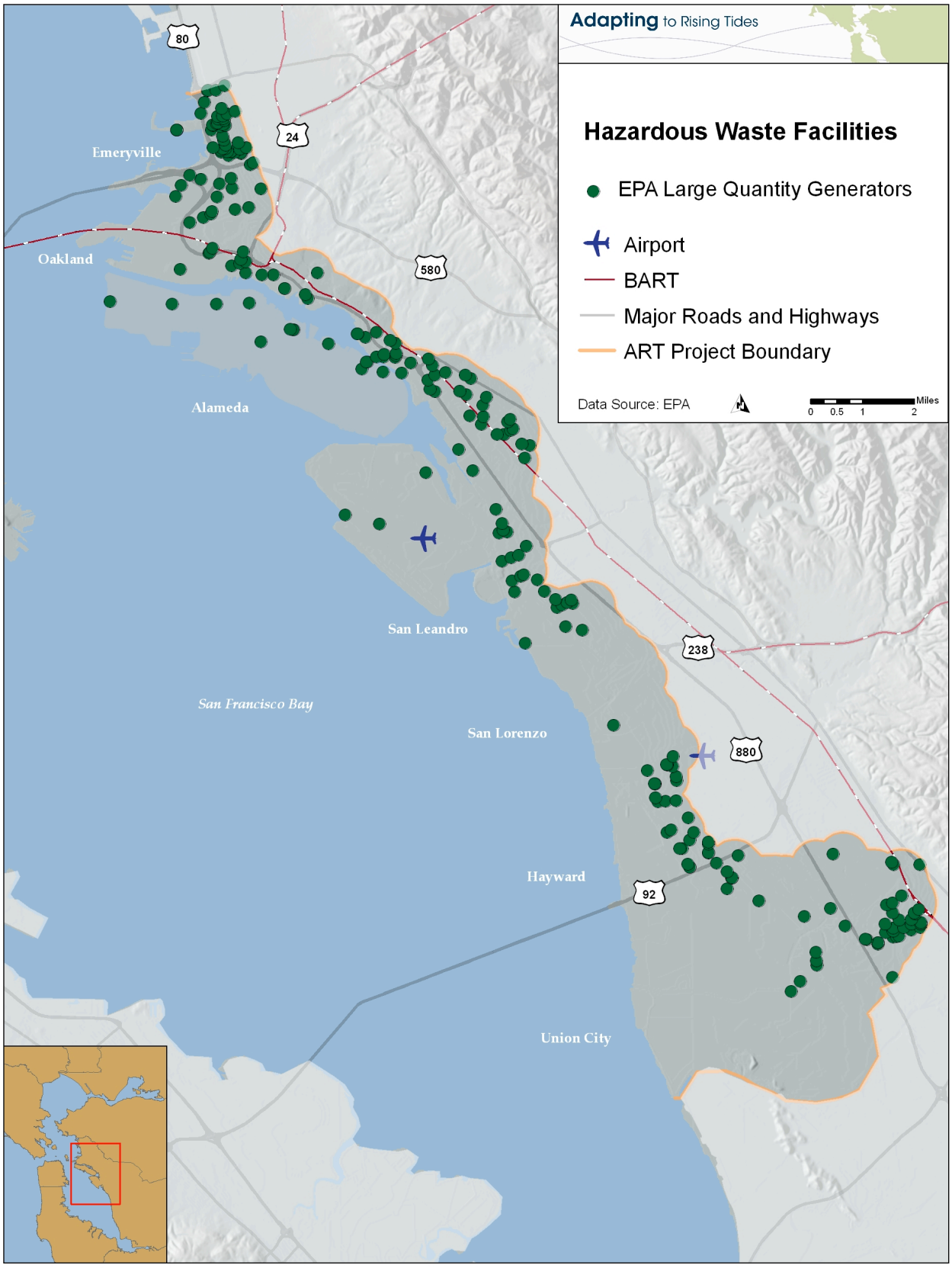
Hazardous materials are substances that pose a risk to human health and the environment. More precisely, a material or waste product is considered hazardous if it appears on certain lists prepared by a federal, state, or local agency, or if it has characteristics defined as hazardous by such an agency. Different levels of government may have different definitions of hazardous materials – for example, California's definition is more stringent than the federal definition. A substance may also be considered hazardous based on chemical and physical properties such as toxicity, ignitability, corrosivity, and reactivity (California Code of Regulations). Hazardous materials can be liquid, solid, sludge, or gas; they may be the byproducts of industrial/manufacturing operations or discarded commercial products such as pesticides and cleaning solvents. The exposure analysis in this report focuses on facilities that generate hazardous waste[1], as defined and tracked by the US EPA.

The ART project area contains a wide variety of hazardous waste sites, ranging from pharmaceutical and other bioscience laboratories to metal processing and other manufacturing facilities (Figure 1). Other sites, such as gas stations, use or store petroleum products, and others are associated with transportation activities, such as Caltrans maintenance and transit operators' facilities. As this partial list indicates, hazardous wastes and their modes of generation and storage vary widely. A pharmaceutical company or medical facility, for example, may store waste in small plastic containers (less than 5 gallons), while a petroleum-associated business could store materials in 55-gallon drums or even larger underground or aboveground storage tanks. Hazardous waste could be stored inside buildings or outdoors, depending on the type of substance and local regulations. Union City's building and fire codes, for example, do not allow the outdoor storage of hazardous waste.

This report addresses hazardous materials primarily from the perspective of emergency response. This is because the most significant impact of sea level rise and storm events on hazardous materials sites will be during a flood emergency, and the vulnerability and risk for the surrounding community will depend largely on responders' ability to contain or manage any hazardous materials that are exposed to flooding. Hazardous materials and hazardous waste sites that are affected by the new daily high tide or rising groundwater would presumably be relocated, as their main function would be difficult to maintain with daily inundation or problems with high groundwater. However, many of these sites, even if they moved their point of operations, could leave behind hazardous waste, either above ground or in the form of contaminated land; the latter is addressed in a separate chapter. Other types of facilities that contain hazardous materials, such as wastewater treatment plants, will be very difficult to move.

[1] The terms "hazardous waste" and "hazardous material" do not refer to the same thing; while all hazardous wastes are hazardous materials, not all hazardous materials are hazardous wastes. However, geographically specific data on hazardous materials sites in the ART project area is not available, while a database of hazardous waste sites is. Therefore, while the discussion of sensitivity, adaptive capacity, and consequences is intended to apply broadly to all types of hazardous materials sites, the exposure analysis and the federal classifications listed in this section apply only to hazardous waste facilities.

Figure 1. Hazardous waste facilities in the ART project area.



The primary federal law that regulates hazardous waste is the Resource Conservation and Recovery Act (RCRA). RCRA applies to the generation, transportation, storage, treatment, and disposal of hazardous waste through its regulation of the following types of facilities (US EPA Hazardous Waste Website):

- "Generators"—individuals or facilities whose processes or actions lead to the creation of hazardous waste.
    - Large Quantity Generators (LQGs) generate 1,000 kilograms[2] per month or more of hazardous waste, or more than 1 kilogram per month of acutely hazardous waste.
    - Small Quantity Generators (SQG) generate more than 100 kilograms, but less than 1,000 kilograms, of hazardous waste per month.
    - Conditionally Exempt SQGs generate 100 kilograms or less per month of hazardous waste, or 1 kilogram or less per month of acutely hazardous waste.
- "Treatment"—facilities that change the physical, chemical, or biological characteristics of a waste to minimize its threat to the public and the environment. These facilities are referred to as treatment, storage, and disposal (TSD) sites.
- "Transporters"—facilities or entities that move waste from one site to another via roadways, rail, water, or air.

RCRA provides guidelines for federal waste management, directs the US Environmental Protection Agency (US EPA) to craft regulations to implement the law, and allows for the US EPA and state and local partners to enforce the regulations. In California, the following State agencies participate directly in hazardous waste management: California Environmental Protection Agency (Cal EPA); the Department of Toxic Substance control (DTSC); the State Water Resources Control Board (SWRCB); the California Emergency Management Agency (Cal EMA); and the State Fire Marshal. These agencies provide support and oversight to the city and county agencies, known as Certified Unified Program Agencies (CUPAs), which are authorized by the State to carry out the Hazardous Materials and Hazardous Waste Program[3] (Unified Program) (See Figure 2). The Unified Program consolidates six required State programs that deal with permitting and managing hazardous materials:

- **Hazardous Materials Release Response Plan and Inventory.** This program requires businesses that handle hazardous materials above 55 gallons, 500 pounds, or 200 cubic feet of gas to develop a business plan which inventories their hazardous materials, create a map, develop an emergency response plan, and implement a training program for employees. CalEMA provides support for this program.
- **California Accidental Release Program (CalARP).** This program aims to prevent the release of substances that can cause harm to the public and the environment. CalARP requires the development of a Risk Management Plan (RMP). CalEMA provides support for this program.
- **Underground Storage Tank Program (UST).** A UST is a tank and connected pipes, used to store hazardous substances, which is beneath the surface of the ground. The purpose of the UST Program is to protect the public and the environment from releases of petroleum and other hazardous substances from tanks. The four program elements are leak prevention, cleanup, enforcement, and tank tester licensing. The SWRCB provides

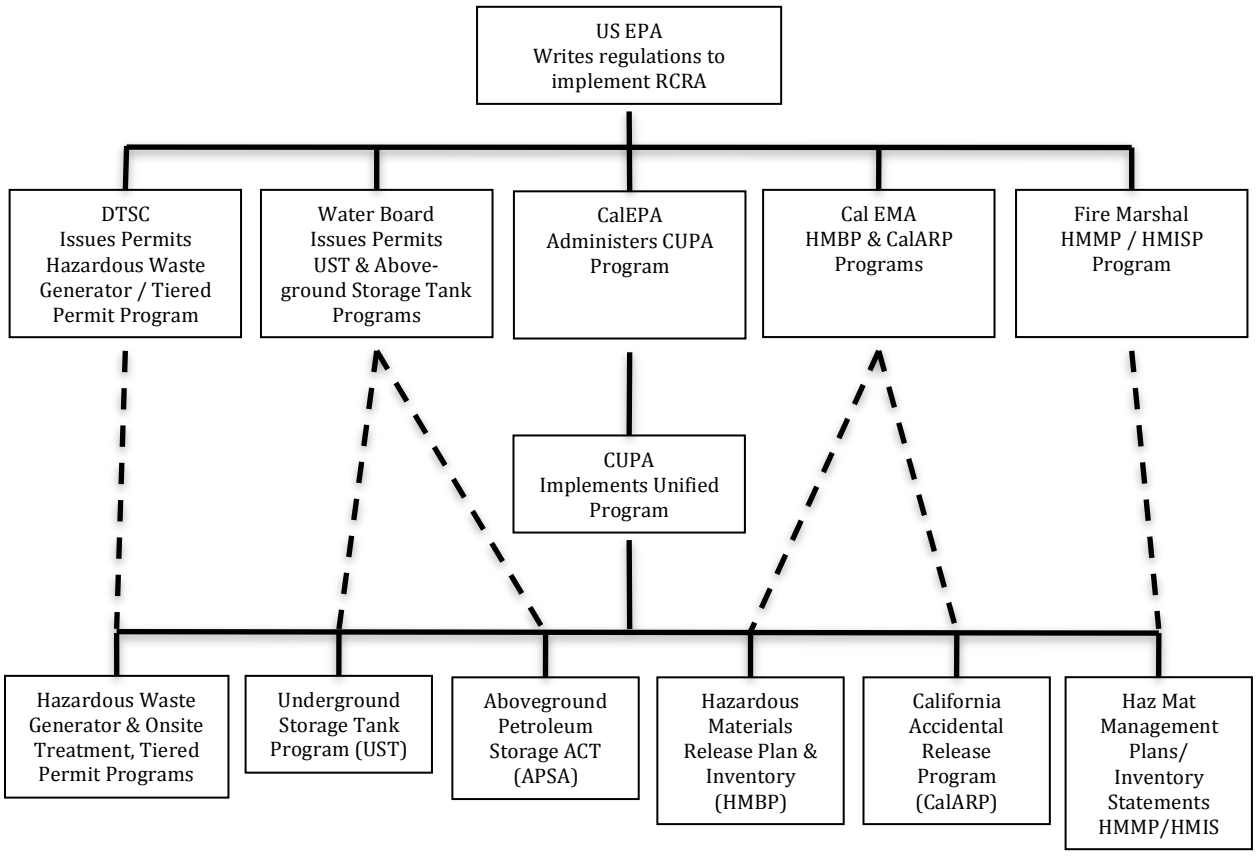
[2] 1 kilogram is approximately 2.2 pounds.

[3] While the RCRA database used in this report's exposure analysis only includes hazardous wastes, CUPAs oversee programs for hazardous waste and non-waste hazardous materials. CUPAs are therefore sources of information about hazardous materials sites in their jurisdiction; however, a complete, geo-referenced dataset of the hazardous materials sites was not available from the CUPAs in the ART project area.

technical assistance and evaluation for the UST program.

- **Aboveground Petroleum Storage Act.** An aboveground storage tank is a tank that stores petroleum above ground. The act requires CUPA staff to inspect tanks with more than 55 gallons of petroleum at least once every three years. In addition, the act requires the owner of any tank with over 1,320 gallons of petroleum to prepare and implement a Spill Prevention Plan consistent with federal regulations. The SWRCB provides technical assistance and evaluation for the aboveground storage tank program.
- **Hazardous Waste Generator and Onsite Hazardous Waste Treatment / Tiered Permitting Programs.** This program establishes a five-tiered program for authorizing hazardous waste treatment at businesses that are required to have a state permit or authorization to do so. The tiers match the burden of regulation to the amount of risk in the hazardous waste activity. DTSC provides technical assistance and evaluation for these programs.
- **California Fire Code: Hazardous Materials Management Plans/ Hazardous Materials Inventory Statements (HMMP/HMIS).** The Plans are similar to the Business Plans and to the extent possible they have been merged. The main goal of the statute and regulations is to increase communication, coordination, and consistency/consolidation. The Office of the State Fire Marshal provides support for this program.

Figure 2. Federal, State, and Local Hazardous Materials Regulatory Agencies.



The purpose of the CUPAs and the Unified Program is to consolidate, coordinate, and make consistent the administrative requirements, permits, inspections, and enforcement activities of the six environmental and emergency response programs. Since the Unified Program was instituted, the Secretary of Cal EPA has certified 83 CUPAs, which carry out the responsibilities

previously handled by approximately 1,300 state and local agencies. Cal EPA reviews the CUPAs annually to ensure that they are properly carrying out the Unified Program, and CUPA leads receive Hazardous Waste Operations and Emergency Response (HAZWOPER) and other relevant training.

The Unified Program helps agencies prevent and respond to an accidental release of hazardous materials. Some program elements provide guidance on the proper handling and storage of materials – to prevent release – while others help responders in the event of a release. For example, the HMBP requires business to keep an inventory on the types and quantities of hazardous materials present, as well as to develop a plan for how to contain the materials in the event of an accident. In addition, each CUPA must prepare and routinely update an Area Plan, which is a contingency plan for agencies that respond to emergencies involving the release of hazardous materials. These documents help guide responders in any emergency that may affect hazardous materials. Fire departments, even where they are not the authorized CUPA, are expected to be familiar with the hazardous materials sites in their jurisdiction, and may be the first responder to an incident involving hazardous materials.

There are five CUPAs in the ART project area:

- Alameda County Environmental Health Department covers the City of Alameda, Emeryville, and San Lorenzo, as well as unincorporated areas and several other cities outside of the ART project area
- Hayward City Fire Department
- Oakland City Fire Department
- City of San Leandro Environmental Services Section
- Union City Environmental Program Division

These CUPAs work with agencies as directed in the Statewide Emergency Response System (SEMS), which provides an organizational framework and guidance for operations at each level of the state's emergency management system. CUPA staff is available 24 hours a day, 7 days a week, to provide information to responders in the event of an emergency, and fire departments have access to their files. If the magnitude of a release and any associated problems are beyond the capacity of the CUPA and other local agencies to respond, SEMS and other frameworks and agreements describe how other agencies at a countywide, regional, state, and even federal level can contribute to resolving the problem. For example, DTSC has an Emergency Response Program (ERP) with officers on duty around the clock to respond to hazardous material releases that pose an acute threat to public health or the environment (DTSC, 2010).

One component of SEMS is the Master Mutual Aid Agreement, which lays out the policies and procedures for sharing resources in the event of an incident beyond local agencies' capacity. The State is divided into Operational Areas (counties) and six Mutual Aid Regions. The ART project area is in Region II, which covers the coastline from the border with Oregon to Monterey County. In the event of an emergency, local agencies may request the assistance of the County and other cities in the County, then other Operational Areas in the region, and then the State. If out-of-state aid is necessary, Cal EMA coordinates the response. Resource sharing across jurisdictional boundaries is quite common, and may not necessarily follow a strict protocol; for example, if an emergency response requires equipment that a city doesn't own, they may call a neighboring jurisdiction to borrow the equipment – this is more efficient then, for example, every city owning a backhoe. However, it could cause problems if a large event occurs and every city needs a backhoe or other equipment that is normally shared.

Another element of the emergency response system is the California Hazardous Materials and Oil Emergency Function (CA-HMO EF-10), an annex to the State of California Emergency Plan

(SEP), which "provides coordination and support to actual or potential discharges and/or uncontrolled release of oil or hazardous materials to save lives, protect health and safety, protect property, and preserve the environment when activated." EF-10 can be activated when a hazardous material incident will have a significant impact or involve multiple agencies, mutual aid regions, a wide geographic area, multiple population centers, or multiple human and environmental targets. Cal EPA is the authorized lead agency for EF-10, although many other agencies may be involved as a primary agency[4] or supporting agency.[5] The location of the release and what is affected – such as the coastal zone, roadways, or other areas – determines which agency serves as the primary. The duties of each agency are defined in Administrative Orders, and each agency must prepare an Emergency Response Plan consistent with its Administrative Orders, which is reviewed and approved by Cal EMA.

Exposure

Exposure is the extent to which an asset, such as a hazardous waste site, experiences a specific climate change impact such as storm event flooding, tidal inundation, or elevated groundwater. This report analyzes the exposure of hazardous materials in the ART project area to two sea level rise projections and three Bay water levels. The two sea level rise projections, 16 inches (40 cm) and 55 inches (140 cm), correlate approximately to mid- and end-of-century. These projections were coupled with three Bay water levels: the highest average daily high tide represented by mean higher high water (MHHW), hereafter "high tide" or "daily high tide;" the 100-year extreme water level, also known as the 100-year stillwater elevation (100-year SWEL), hereafter "100-year storm" or "storm event;" and the 100-year extreme water level coupled with wind-driven waves, hereafter "storm event with wind waves" or "wind waves." These water levels were selected because they represent a reasonable range of potential Bay conditions that will affect flooding and inundation along the shoreline. For more information about sea level rise projections and Bay water levels evaluated see Chapters 1 and 2.

An exposure analysis was conducted for hazardous waste sites found in the EPA's online database of RCRA sites[6]. The exposure of the sites was determined within a circular 164-foot

[4] Primary agencies have jurisdiction to respond to a release. The following agencies may serve as primary agency: Air Resources Board (ARB); California Highway Patrol (CHP); Department of Fish and Game (DFG), Office of Spill Prevention and Response (OSPR); Department of Pesticide Regulation (DPR); Department of Toxic Substances Control (DTSC); State Water Resources Control Board (SWRCB), Regional Water Quality Control Board (RWQCB); Department of Resource Recovery & Recycling (DRRR); Department of Transportation (CalTrans); Office of Environmental Health Hazard Assessment (OEHHA); and, California Department of Public Health, Radiological Health Branch (CDPH/RHB).

[5] Supporting agencies provide technical, policy, and subject matter expertise, and are generally requested by the primary agency, although they may also have jurisdictional oversight. The following agencies may serve as supporting agencies: Attorney General's Office (AG), Department of Justice (DoJ); Bay Conservation & Development Commission (BCDC); Board of Governors, California Community Colleges; California Coastal Commission; California Conservation Corps (CCC); California Department of Public Health (CDPH), Office of Emergency Preparedness; California Energy Commission (CEC); Department of Conservation, Division of Oil, Gas & Geothermal Resources (DOGGR); Department of Food and Agriculture (CDFA); Department of Forestry and Fire Protection (CDF); Department of Housing and Community Development; Department of Industrial Relations (DIR/CAL OSHA); Department of General Services (DGS); Department of Parks & Recreation (DPRec); State and Consumer Services Agency; State Lands Commission (SLC); Public Utilities Commission (PUC)/Rail Operations Safety Branch; and Military Department, California National Guard (CNG).

[6] The EPA online database, Envirofacts (http://www.epa.gov/enviro/facts/rcrainfo/search.html), contains environmental data for many different types of facilities and substances that could pose a threat to the environment. The RCRA sites included in this database, and thus in this exposure analysis, were generators of hazardous waste – both LQGs and SQGs. The exposure analysis was conducted based on facilities in the database as of 2011; however, it is possible that this list is out of date, as facilities are

(50-meter) diameter footprint centered on the point location of the station (see Appendix C). This approach was verified as being representative of the approximate footprint of most assets evaluated in this manner. The exposure of LQG and SQG sites to the daily high tide, storm event flooding, and wind waves was evaluated in a binary, i.e., yes versus no, analysis. Whether each site is within a disconnected low-lying area[7] was also evaluated.

There are a total of 100 LQGs and 52 SQGs in the ART project area, concentrated largely in Oakland and Hayward, which have their own CUPAs, and Emeryville, which is regulated by the Alameda County CUPA. Table 1 shows the number of hazardous waste generators in the ART project area. Additional types of hazardous waste (and hazardous materials) facilities, such as transporters, were not included in the exposure analysis because they were not in the database. Further analysis on which roads, highways, and rail lines are used to transport hazardous waste and materials, and what types of protocols exist to prevent release in the event of flooding, will be useful in advancing understanding of vulnerability in the region.

Table 1. Hazardous waste generator sites in ART project area, by city.

City	LQG	SQG	Total
Alameda	12	2	14
Emeryville	26	6	32
Hayward	52	15	67
Oakland	51	15	66
San Leandro	6	17	23
Union City	2	4	6
Total	**100**	**52**	**152**

Table 2 shows the number of LQG and SQG sites in each city that are exposed to sea level rise impacts with 16 and 55 inches of sea level rise. With 16 inches of sea level rise, only one site – an LQG in Oakland – will be directly exposed to the daily high tide, although two LQG sites are in disconnected low-lying areas that could be exposed to tidal inundation. 13 sites (nine LQGs and four SQGs) are exposed to flooding from a storm event, and seven LQG sites are in disconnected low-lying areas that could be exposed to this impact. An additional 54 sites (44 LQGs and ten SQGs) are exposed only to wind waves. With 55 inches of sea level rise, 31 sites (23 LQGs and eight SQGs) are exposed to the daily high tide, and two LQG sites are in disconnected low-lying areas that could be exposed. 68 sites (53 LQGs and 15 SQGs) are exposed to flooding in a 100-year storm event, and an additional 26 (20 LQGs and six SQGs) are exposed only to wind waves.

responsible for removing themselves from the database if they go out of business or cease producing hazardous waste. Thus, the exposure analysis could overstate the number of sites exposed to climate change impacts. On the other hand, because the database only contains hazardous **waste** generators, the number of hazardous **materials** sites is much larger. That is, while all hazardous waste sites are hazardous materials sites, there could be many facilities that contain hazardous materials that do not generate enough hazardous waste to qualify as an LQG or SQG; likewise, an SQG could have far more hazardous materials on site than is reflected by SQG status. A deeper review, such as those conducted for some of the other asset categories addressed in this report, should consult each CUPA or local fire department for the most inclusive, precise, and up-to-date information.

[7] Disconnected low-lying areas are at the same elevation or are lower than an adjacent inundated area. Assets in these areas are not considered exposed because a topographic feature such as a railroad or road embankment should prevent inundation. However, they could be exposed if the protective feature fails. See Chapter 2 for a more detailed explanation.

Table 2. Number of hazardous waste generators exposed to the daily high tide and storm event flooding with 16 and 55 inches of sea level rise, by city.

	16" SLR			55" SLR		
	Daily high tide	Storm Event		Daily high tide	Storm Event	
City	Number exposed	Number exposed	Number exposed to wind waves only	Number exposed	Number exposed	Number exposed to wind waves only
Alameda						
LQG		3	6	5	9	3
SQG				1	1	
Emeryville						
LQG			7	1	7	5
SQG			1		1	2
Hayward						
LQG		1	13	5	14	5
SQG			1		1	5
Oakland						
LQG	1	3	16	10	19	4
SQG			4	3	4	3
San Leandro						
LQG		1	2	1	3	3
SQG		2	2	3	4	
Union City						
LQG				1	1	
SQG		2	2	2	4	
Total						
LQG	**1**	**9**	**44**	**23**	**53**	**20**
SQG		**4**	**10**	**8**	**15**	**6**

Sensitivity and Adaptive Capacity

The sensitivity and adaptive capacity of hazardous materials sites and the emergency response system in the ART project area were assessed for three potential climate impacts that could occur due to sea level rise and storm events. The three climate impacts considered were:

- More frequent or longer duration flooding during storm events
- Permanent or frequent inundation by the daily high tide
- Elevated groundwater levels and saltwater intrusion

Sensitivity is the degree to which an asset or entire system (e.g., an LQG site, CUPA, fire department, or SEMS) would be physically or functionally impaired if exposed to a climate impact. Adaptive capacity is the ability for an asset or system to accommodate or adjust to a climate impact and maintain or quickly resume its primary function. The sensitivity of hazardous materials sites depends both on the physical characteristics of each site, as well as on each individual facility's compliance with the Unified Program and other regulations, and on the region's emergency management capacity. Likewise, the adaptive capacity of a site depends on the ability to prevent the release of hazardous materials, and on the ability of responders to efficiently and thoroughly address any potential or actual release.

In the event of flooding during a storm event, hazardous materials could be released if their containers are spilled or broken; if floodwaters enter tanks and force out toxic liquids; or if uncontained wastes – in pits or piles – come into contact with floodwaters. Sites where materials are properly stored in watertight containers, especially if elevated above flood levels or easily moved, will be less sensitive than sites with improperly contained materials that are stored at ground level and are difficult to move. Hazardous materials sites could also be sensitive to rising groundwater if any materials are stored below ground.

The ability of any given facility to implement flood protection or flood proofing will contribute to adaptive capacity. Flood protection refers to structures that prevent floodwaters from entering a facility, such as dikes, berms, and floodwalls. Retrofitting facilities with flood protection can be quite costly, so flood proofing may be more realistic. Flood proofing includes features such as grading, fencing, upgrading containers' structural integrity, and elevating containers above flood levels. To the extent that a facility has already invested in such measures, it will have greater adaptive capacity. Sites with safe, elevated places to store materials also have adaptive capacity if materials can be moved in the event of a flood. Temporary measures, such as sand bags or pumps, and emergency plans for the removal of hazardous materials, also contribute to adaptive capacity.

The Unified Program requires hazardous material generators to have inventories of hazardous materials and contingency plans. If these documents are missing, incomplete, or out of date, it could hamper emergency response and cause a site to be more sensitive to sea level rise impacts than it otherwise would be. Adaptive capacity of individual sites and the emergency response system is increased by maintaining thorough, up-to-date documents under the Unified Program, and ensuring that CUPA leads are properly trained. In addition, local knowledge contributes to adaptive capacity if first responders such as fire engine companies are carrying out their duty to inspect and maintain records about hazardous materials' locations.

The layers of regulations and responders discussed above could contribute to both sensitivity and adaptive capacity. While the involvement of multiple agencies increases the resources available to respond to a flood and the potential release of hazardous materials, it could also open the door to confusion and inefficiency if plans are not well laid-out or executed. The potential for widespread flooding could also strain the capacity of emergency responders. While the Mutual Aid Agreement provides a process for agencies from the larger region and

even the State to contribute in the event of an emergency, and agencies are accustomed to coordinating and sharing resources, a large storm on a long stretch of the California coast, coupled with a new high tide, could create so many emergencies – including, but not limited, to hazardous material releases – that an adequate response may not be possible.

Consequences

The potential consequences of the climate impacts on hazardous material sites and emergency response are considered for the ART project area. Consequences are addressed as the magnitude of the economic, social, environmental, and governance effects if an impact occurs. Factors that affect the consequences include the types of materials released, the extent of response required, the size and demographics of the population affected, and the types of natural resources affected.

Economy
The economic consequences of flooding for hazardous materials sites depends on whether or not materials are released into the environment; what types of materials are released; and the degree of emergency response necessary. If a release of non-waste materials occurs, the company will have lost either inputs or products, with consequences for material costs as well as lost profits. Whether or not released materials are waste, a thorough cleanup, with associated costs, will be required. In addition, responding to the actual or potential release of hazardous materials could strain the resources of local agencies such as fire and health departments. If the assistance of other agencies through the Mutual Aid Agreement or activation of EF-10 is necessary, further resources will be expended.

Society
One of the main consequences of a hazardous material release is the potential health effect on the exposed population. Although most floods that cause hazardous material releases do not cause serious outbreaks of chemical poisonings, they can cause sickness in workers and others who come in contact with contaminated floodwaters (OSHA fact sheet). Different chemicals cause different health effects. The signs and symptoms most frequently associated with chemical poisoning are headaches, skin rashes, dizziness, nausea, excitability, weakness, and fatigue. In addition, flooded areas may contain electrical or fire hazards due to downed power lines. Many chemicals and petroleum products are flammable or explosive. If such a material comes into contact with a downed wire, for example, fires and explosions could result. In addition to the effects of any one material, many facilities handle multiple types of wastes, some of which are "incompatible" – that is, if they mix, their hazardous properties such as toxicity and explosiveness increase. Such chemicals, if released during a flood, could come into contact with each other, causing further health and safety risks.

Environment
Flooding that causes a hazardous material release could also harm the environment. Depending on the substances released, they could sicken or kill wildlife and damage habitat. Many hazardous wastes are petroleum-based, so the environmental problems associated with oil spills could occur in the event of a hazardous materials release caused by flooding. Some hazardous materials are highly persistent, lasting for months and even years within an ecosystem. Some materials are also very mobile, meaning they can spread for long distances from their release point. Depending on the materials present, a release due to a climate impact could have a long-lasting, far-reaching effect on the environment.

Governance
In addition to the CUPAs and local responders, more than 25 State agencies are on call to become involved in the event of a hazardous materials release, and local agencies throughout

the county and region could also participate if resources in the immediate area are insufficient. An event over a large region could deplete resources and force agencies to prioritize sites, locations, and types of materials in their response. Despite the many plans at the site, local, State, and even federal level, there is room for confusion and overlap in coordinating and executing a response. In addition, as noted previously, it is difficult to quickly and accurately determine the locations of hazardous materials in the ART project area. There are many different databases addressing different materials, reporting systems, and regulations, some of which are out of date. Determining what might be exposed in the event of a climate impact, therefore, relies on CUPAs and local emergency departments keeping accurate, up-to-date files and making those available to emergency responders.

Key Findings

There are 152 sites that generate hazardous waste in the ART project area, concentrated largely in Oakland, Hayward, and Emeryville. Very few are exposed to the daily high tide or storm event flooding with 16 inches of sea level rise, but over one third are exposed to wind waves. With 55 inches of sea level rise, over 30 sites are exposed to the daily high tide, and nearly 100 sites are exposed to storm event flooding with wind waves.

It is difficult to assess the vulnerability of hazardous waste sites without knowing what types of wastes are exposed, and how they are stored and managed. One challenge is the lack of publicly available information, making it difficult to assess where hazardous materials are located and which sites will warrant a response in the event of a flood hazard or similar emergency. Publicly available, geo-referenced data does not include all hazardous materials sites (only sites that produce a certain quantity of hazardous wastes) or routes used to transport hazardous materials, which could also be exposed to sea level rise and pose a threat to human and environmental health.

Hazardous wastes are regulated by federal and state laws, many of which are implemented locally by Certified Unified Program Agencies (CUPAs). CUPAs keep information about where hazardous materials are stored within their jurisdiction, including types and amounts of materials at each location. While not available in a geo-referenced database, this information is available to emergency responders (and in fact in many cases the CUPA is housed within a fire department). While these regulations contribute to adaptive capacity, emergency responders in some cases may rely on local knowledge of hazardous materials sites, rather than standardized documentation, which could add to sensitivity.

As a category, hazardous materials have moderate vulnerability. Most are not exposed to 16 inches of sea level rise, and a suite of regulations exists to track the types, amounts, and locations of materials. However, this data may not be easily accessible by emergency responders, and the region may be unprepared for a multi-hazard, multi-site emergency involving hazardous materials.

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