



An Introduction to Superfund Sites

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Introduction

In this paper we will examine the roots of the Comprehensive Environmental Response, Compensation and Liability Act, now commonly known as “Superfund.” The long-term impacts of designated Superfund sites have been apparent for decades and will continue to be seen, even as the clean-up and restoration process is underway. This paper will provide an introduction to what a Superfund site designation means, the subsequent legal requirements, and the effects that may be seen over time or are already observed.

Purpose

In the late seventies, toxic waste dumps such as Love Canal and Valley of the Drums received media attention as much of the public began to learn about the risks to human health and the environment posed by contaminated sites. Prior to this increase in attention, thousands of contaminated sites existed nationally as a result of hazardous waste being dumped, left out in the open, or otherwise improperly managed mainly by corporate industry to include the military. These sites include manufacturing facilities, processing plants, landfills, and mining sites. In response to a national outcry, Congress established the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) in 1980.^{1,2,3}

CERCLA has become commonly known today as “Superfund”. A Superfund site has been defined as “a location contaminated by hazardous waste that has been designated by the U.S. Environmental Protection Agency (EPA) for management and cleanup”. CERCLA allows the EPA to clean up contaminated sites. The primary purpose of a Superfund is to protect human health and the environment by cleaning up contaminated sites. Throughout the process the EPA seeks to involve communities in that effort. The EPA also has the authority to impose liability, which empowers the agency to hold responsible those parties needing to pay for all cleanup work needed to help restore a healthy environment. When there is no viable responsible party, Superfund gives EPA the necessary funds and authority to clean up those contaminated sites.^{4,5}

Other related responsibilities of the EPA include recording Superfund sites into the National Priorities List (NPL). The agency has been maintaining this list since 1983. The program itself identifies and quantifies all risks to health from exposure to conditions, chemicals, and threats from contaminated sites. Those toxic sites are then placed on a NPL to determine when they will receive further investigation and long-term clean up actions. The first NPL ever announced had 406 priority sites identified. According to data researched by the Department of Environmental & Occupational Health Sciences at the University of Washington, in 2020 the number of active sites reached 1,335, while a further 424 had been completed and delisted.⁶

Legal History

Since its signing in 1980, CERCLA has been amended twice. One of these amendments, called the Superfund Amendments and Reauthorization Act (SARA), was passed on October 17, 1986, and was created to help address the problems of hazardous-waste sites. SARA not only provided states' residents with the resources needed to clean up hazardous waste sites, but it also required emergency plans be made and followed in case of a dangerous substance release.⁷

Another key historical amendment is the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986. It was created to help local communities plan for any chemical emergencies and require industry to report on the storage, use and releases of hazardous substances to all federal, state, and local governments. EPCRA further required state, local, and tribal governments to use information gained to better prepare and protect communities from potential risks.⁸

As a federal agency, the EPA administers the Superfund program in conjunction with state, local, and tribal governments. Generally, those on tribal lands and less affluent communities have been disproportionately impacted by environmental contamination. Another historical legal landmark occurred in 1994 when President Bill Clinton signed into law the creation of the OSWER Environmental Justice Task Force, aiming to address concerns over the unequal distribution of environmental threats in disadvantaged and minority communities within the EPA's waste programs. The program aims to create a framework to better protect human health and the environment from the dangers of hazardous waste through regulations. Since its inception, renewed focus has been placed on the unregulated dumping of toxic waste by the military and corporate industry, actions detrimental to public health.^{9,10}

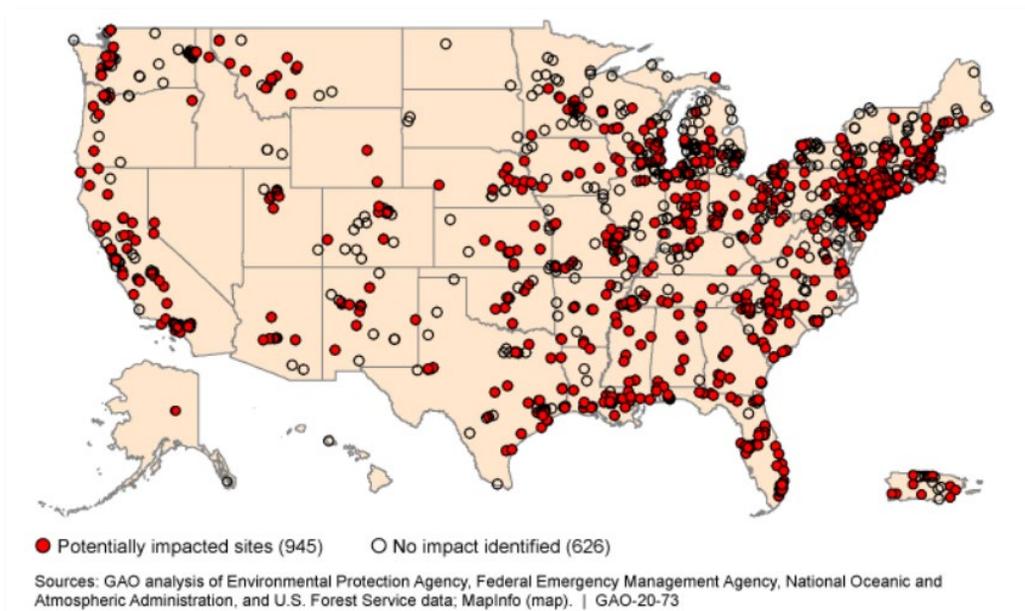
Congress has also continued its efforts to address the hazards of contaminated sites to public health by creating the Agency for Toxic Substances and Disease Registry (ATSDR). As a government agency, ATSDR is directed by congressional mandate to perform public health assessments of waste sites, health consultations concerning specific hazardous substances, health surveillance and registries, response to emergency releases of hazardous substances, applied research in support of public health assessments, information development and dissemination, and education and training concerning hazardous substances.^{11,12}

The EPA's current requirements ensure the agency will act in a regulatory capacity and continue with issuing policy and guidance documents to assist the public and regulated entities. These also include providing regulations that explain the technical, operational, and legal details necessary to implement laws. Finally, the EPA also helps regulated entities meet federal requirements and holds entities legally accountable for environmental violations.¹³

Impacts on Health and the Environment

Open-source studies indicate that hazardous substances on Superfund sites have caused harmful environmental impacts. Contaminants from Superfund sites, such as arsenic, lead, mercury, and polychlorinated biphenyls, could seep into surface water, groundwater, soil, and air. Furthermore, contaminants from manufacturing facilities, processing plants, landfills, and mining sites, could impact various wildlife, including species of fish and birds. Studies also have recorded the presence of chemicals in reptiles, invertebrates, and marine mammals near contaminated sites.^{14,15,16}

Natural hazards and processes may exacerbate the release of harmful chemicals from Superfund sites into various ecosystems. For instance, erosion could increase the transmission of wasteful substances from Superfund sites to nearby reservoirs and waterways. Furthermore, research suggests that the increasing frequency and intensity of natural disasters could damage Superfund sites and cause the release of chemicals. According to federal data, approximately 60% of nonfederal National Priorities List (NPL) sites are in areas that could be affected by natural hazards exacerbated by climate change, including flooding, storm surge, wildfires, and sea level rise.¹⁷



Superfund Sites Located in Areas that Could be Impacted by Flooding, Storm Surge, Wildfires, or Sea Level Rise¹⁷

The spread of hazardous substances on Superfund sites also could impact public health. For example, an open-source study found that the release of hazardous and toxic contaminants on Superfund sites, and the potential acute and chronic exposure to the pollutants in that area, could affect mortality rates. The study's data suggested that the presence of a Superfund site may decrease the life expectancy of those living nearby, and this damaging effect may be amplified by flooding or a lack of cleanup strategy.¹⁸

In addition, studies have found an association between cancer rates and proximity to Superfund sites. Open-source research indicates that across the contiguous U.S., geographic areas with more Superfund sites tend to have elevated cancer risk among their demographics. One study investigating Superfund sites in Kentucky found that as the distance to Superfund sites increased, the average cumulative incidence of non-Hodgkin's lymphoma (NHL) decreased.¹⁹

Some common contaminants on Superfund sites include lead, asbestos, and dioxin. Exposure to lead may cause behavior and learning problems, lower IQ, slowed growth, hearing problems, and anemia in children, as well as cardiovascular effects, decreased kidney function, and reproductive problems in adults. Furthermore, if exposed to asbestos, mineral fibers found in some building construction materials for insulation, the risks of developing lung cancer, mesothelioma, and asbestosis could increase. Lastly, potential health effects from dioxins, highly toxic persistent organic pollutants that could be produced from waste incineration or burning fuels, include cancer, reproductive and developmental problems, immune system damage, and hormone effects.^{20,21,22,23}

Case Study: U.S. Marine Corps Base Camp Lejeune

From the 1950s through the 1980s, individuals residing and working on Marine Corps Base (MCB) Camp Lejeune, NC, were potentially exposed to contaminants in the drinking water. As a result, in October 1989, the EPA included Camp Lejeune on the National Priorities List, and the Agency for Toxic Substances and Disease Registry (ATSDR) began to conduct public health assessments of the site. According to the ATSDR, three (3) of the eight (8) distribution systems that supplied drinking water to facilities on Camp Lejeune—the Tarawa Terrace, Hadnot Point, and Holcomb Boulevard water systems—were contaminated with volatile organic compounds (VOCs).²⁴

The ATSDR reported that the water from the Tarawa Terrace treatment plant was primarily contaminated by PCE (perchloroethylene or tetrachloroethylene) due to the waste disposal practices at an off-base drycleaner. While the current limit for PCE in drinking water is five (5) parts per billion (ppb), reports note that the maximum PCE level detected was 215 ppb in February 1985. Furthermore, researchers found that the historical base operations and disposal practices at Camp Lejeune led to the contamination of groundwater and drinking water supplies in the Hadnot Point-Holcomb Boulevard study area. Reports indicate that trichloroethylene (TCE) was the primary contaminant at Hadnot Point, which served most of the barracks and workplaces at Camp Lejeune. While the current limit for TCE in drinking water is five (5) ppb, the maximum TCE recorded in the drinking water was 1,400 ppb in May 1982.²⁴

According to the 2017 ATSDR Public Health Assessment of Camp Lejeune's drinking water, exposures to contaminants in the drinking water, such as TCE, PCE, vinyl chloride, and other chemicals, likely increased the risk of cancers, adverse birth outcomes, and additional health effects of individuals living and working on Camp Lejeune. For instance, one study recorded elevated mortality rates among Marine and naval personnel stationed at Camp Lejeune, compared with MCB Camp Pendleton personnel, for several causes of death including

multiple myeloma, Hodgkin lymphoma, and cancers of the kidney, liver, esophagus, and cervix. Another study found elevated mortality ratios for kidney, leukemias, multiple myelomas, rectal cancer, oral cavity cancer, and Parkinson's disease among civilians who worked at Camp Lejeune from 1973 to 1985. In addition, research suggests that there are possible associations between the chemicals in the Camp Lejeune drinking water and male breast cancer.²⁵

In February 1991, the EPA, Navy, and North Carolina Department of Environmental Quality (NCDEQ) formed a Federal Facility Agreement (FFA) for site cleanup activities. The FFA specifies that the Navy is responsible for engaging in cleanup activities under CERCLA, while the EPA and NCDEQ are the oversight regulators. Furthermore, the FFA provides updated annual schedules and milestones for cleanup activities. According to the EPA, Camp Lejeune's cleanup has incorporated strategies to reduce environmental effects during remediation, such as using a solar-powered subgrade biogeochemical reactor to limit landfill waste and greenhouse gas emissions.²⁶

Outlook

As discussed in this paper, what are informally known as Superfund sites can be found across the United States. While at different stages of clean-up and restoration, each site must be closely monitored considering the negative impacts that may be seen on individuals and the environment. Furthermore, extreme weather event such as wildfires or floods may trigger the further spread of contaminated areas, exacerbating issues. There are numerous factors that impact the severity and status of a Superfund site, including the wide range of potential hazardous materials spilled, scale of release, length of time over which the contamination occurred, and location relative to things such as homes, water systems, etc. The EPA serves as administrator to this program and clean up continues at locations across the country.

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