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THOUGHT LEADERSHIP

PUBLISHED 1Q 2020

Remediation Failures and Extreme Weather Events: What Flooding, Rainfall, and Wildfire Can Do to Your Site

February 27, 2020

Over 18,000 sites and 22 million acres of land include hazardous waste infrastructure in the United States.[1] While much progress has been made in the cleanup of contaminated sites, extreme weather forces have the potential to destroy the integrity of waste site cleanup and remobilize hazardous chemicals in sites that have undergone final remedies. Flooding, extensive rainfall, and coastal storm surges can erode caps and other in situ treatments, complicate or negate delineation and remedial investigation work, erode and damage bulkheading, cause impoundment breaches and failures, and disrupt power supplies needed to operate treatment systems.

The San Jacinto River (TX), American Cyanamid (NJ), and Iron Mountain Mine (CA) are all examples of chemical and mining Superfund sites that have required additional investigation or remedy action after disruption from flooding, extensive rainfall, or wildfire—all of which are occurring at increased frequency and intensity. By taking a forward-looking view of the threats posed by disruptive weather forces, industrial organizations can help protect the investment associated with remediation activities at Superfund, state, and industry-controlled hazardous waste sites.

Recent GAO Findings

In November 2019, the U.S. Government Accountability Office (GAO) published a report that outlined the risks extreme weather events can pose to hazardous waste site integrity and resilience. According to the report, approximately sixty percent of the 1,571 Superfund nonfederal National Priorities List (NPL) sites are located in areas that may be impacted by flooding, storm surge, wildfire, or sea level rise.[2]

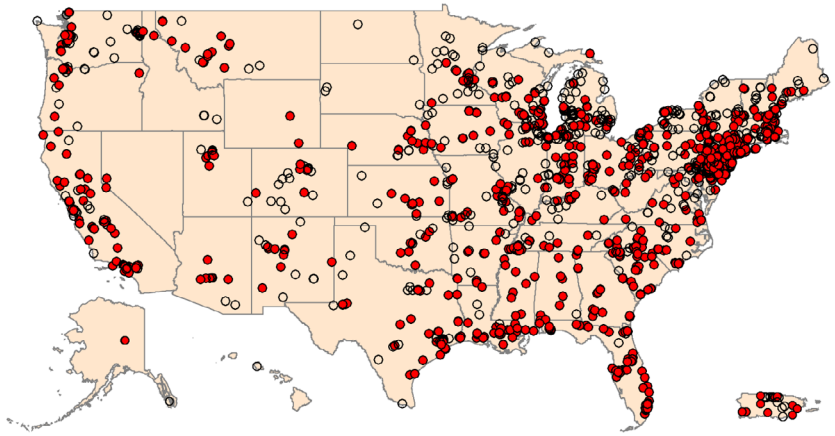

Figure 1. Superfund sites located in areas that may be impacted by flooding, storm surge, wildfires or sea level rise.

[1] https://www.infrastructurereportcard.org/wp-content/uploads/2017/01/Hazardous-Waste-Final.pdf
[2] https://www.gao.gov/products/GAO-20-73

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The GAO report recommends several urgent actions, including the consistent integration of climate change information into site-level risk assessments and risk response decisions. In practice, the lack of an appropriate model for future impacts and the resulting uncertainty prevents the assessment of climate change impacts from being incorporated into the remedy evaluation, selection, and design process. As specific next steps have yet to be determined by federal, state, and industrial stakeholders, many parties have expressed uncertainty about the potential for cleanup disruption and its impact on future operations and liabilities.

Assuring Site Remediation Integrity

Addressing the complex and varied factors involved in understanding, analyzing, and assuring site cleanup integrity requires a multi-disciplinary science and engineering approach. The first step is identifying and prioritizing the sites most vulnerable to extreme weather risks. Our team at Exponent frequently partners with industrial organizations to prioritize sites based on location, actions taken versus not taken, and the extreme weather risks they face. We then identify vulnerabilities within each of the identified sites. In our experience, a site is rarely vulnerable in its entirety. Rather, a specific geographic area or remedial unit is often the most vulnerable to extreme weather forces.

To assess the probabilities and consequences of flooding impact, for example, our team uses probabilistic non-stationary predictions of flooding estimates to map out the probability of site impact. We assess predicted flooding forces with regards to the integrity of sediment caps; the possibility of sediment transport and shoreline erosion; the probability of overtopping or impoundment failures due to erosion; and the disruption of power supply needed to treat wastes and maintain site integrity. We also assess offsite risks by mapping out and assessing ecological and human health risks in areas that may be impacted by remediation disturbances. Throughout this process, our team routinely evaluates the information available and determines additional data collection needs. If needed, we can establish resiliency curves for facilities or parts of facilities to make predictions about the probability of failure in a system. We can then partner with the site owners and regulators to build resiliency plans that help decrease the risk of remediation failures.

Exponent's Expertise

Exponent's multi-disciplinary team of civil engineers, environmental scientists, statisticians, and heath scientists are experts in remediation and extreme weather forces. We can assess the impact of extreme weather events on site cleanup integrity and help sites build plans to improve resiliency.

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