

START WITH SCIENCE TO BUILD SAFER COMMUNITIES

Hurricane Sandy Science Plan—Impacts of Environmental Quality and Persisting Contaminant Exposures

“The understanding we gain from these studies will set the stage for better models addressing future hazard scenarios and will help coastal communities be better prepared to withstand and respond to catastrophic storms.”—*Suzette Kimball, U.S. Geological Survey Acting Director*

Meeting the Science Needs of the Nation in the Wake of Hurricane Sandy— A U.S. Geological Survey Science Plan for Support of Restoration and Recovery

Hurricane Sandy devastated some of the most heavily populated eastern coastal areas of the Nation. With a storm surge peaking at more than 19 feet, the powerful landscape-altering destruction of Hurricane Sandy is a stark reminder of why the Nation must become more

resilient to coastal hazards. In response to this natural disaster, the U.S. Geological Survey (USGS) received a total of \$41.2 million in supplemental appropriations from the Department of the Interior (DOI) to support response, recovery, and rebuilding efforts. These funds support a science plan (Buxton and others, 2013) that will provide critical scientific information necessary to inform management decisions for recovery of coastal communities, and aid in preparation for future natural hazards. This science plan is designed to coordinate continuing USGS activities with stakeholders and other agencies to improve data collection and analysis that will guide recovery and restoration efforts. The science plan is split into five distinct themes:

- Coastal topography and bathymetry
- Impacts to coastal beaches and barriers
- Impacts of storm surge, including disturbed estuarine and bay hydrology
- Impacts on environmental quality and persisting contaminant exposures
- Impacts to coastal ecosystems, habitats, and fish and wildlife

This fact sheet focuses on assessing impacts on environmental quality and persisting contaminant exposures.

Theme Stakeholders

The scientific information produced from this work will be used by numerous stakeholders, including the U.S. Environmental Protection Agency Oceans and Coastal Protection Division and National Estuary Program, the National Park Service, the States of New York and New Jersey, and local agencies. USGS will study the possible effects of hazardous chemicals and other contaminants that may have been released into the environment during Hurricane Sandy. Areas affected by floodwaters caused by storm surge are a focus of the study because harmful contaminants can be carried by the water. Stakeholders will learn the success of current (2013) cleanup efforts in removing these contaminants, the current amount of risk associated with them, and how they were introduced into the environment. These studies serve to define pre-storm environmental quality so affected communities will be informed of the health implications of hurricane-induced environmental contamination for future storms. This knowledge will allow decisionmakers to create redevelopment strategies that build community resilience to future storms.



Before-and-after views looking west along the New Jersey shore. Storm waves and surge cut across the barrier island at Mantoloking, New Jersey, eroding a wide beach, destroying houses and roads, and depositing sand that may be contaminated onto the island and into the back-bay.

Environmental Quality Projects

Low-elevation coastal areas impacted by storm-surge or river-floodwater damage are vulnerable to a range of chemical and microbial contamination issues. Contaminants can be mobilized and transported from disturbed sediments and damaged infrastructure and relocated in sediments and waters producing an increased risk of both acute and chronic low-level human and ecological exposure. Other potential contamination sources include combined sewer overflows; debris from buildings, automobiles, and boats; inundated infrastructure such as gas stations, landfills, chemical storage facilities, and hazardous waste sites; and saline water intrusion in estuaries and on shorelines. During Hurricane Sandy numerous wastewater treatment facilities failed for prolonged periods, releasing raw sewage into the environment. Public health agencies advised the public to disinfect water and other materials; however, the persisting effect of such releases is undetermined, including in local recreational waters. Debris from the built environment may release toxic materials over prolonged periods. Alteration of bay and estuarine hydrodynamics can affect salinity levels, fisheries and shellfish habitat, and contaminant exposures. The quality of the substantial amount of disturbed sediments in terms of legacy is undefined.

Characterize Persisting Risk of Ecological Exposure to Storm-Released Contaminants in Coastal and Aquatic Environments

The USGS will test environmental samples from affected coastal areas in New York and New Jersey for toxic contaminants, which may continue to be harmful to the ecosystem long after the immediate aftermath of Hurricane Sandy. Potential sources of these contaminants, including compromised infrastructure related to municipal wastewater treatment, storage of fuels and other chemicals, and inundated residential and industrial areas, are located along coastal areas damaged by Hurricane Sandy, particularly in areas affected by high storm surge. During the storm, these contaminants were released to the environment by collapsed buildings and floating debris.



Cars and debris in a flooded low area in New York City (photo courtesy of European Pressphoto Agency). Background photo shows control measures being taken in the Arthur Kill between Staten Island, New York and New Jersey, in response to an oil release caused by Hurricane Sandy (photo courtesy of John Minchillo, Associated Press).

First responders focused efforts to repair infrastructure, remove debris, and mitigate immediate threats posed by contaminants. USGS scientists are now studying the potential for longer-term ecological consequences of contaminants that could not be mitigated by first responders because the contaminants became trapped in the bottom sediments of estuaries, harbors, and other near-shore environments. Sediment samples will be collected and analyzed for a range of contaminants, and tissue samples will be collected from targeted species of finfish (bluefish) and shellfish (mussels) to test for possible chemical exposure pathways that may lead to health risks such as endocrine disruption and cancer. This also will allow scientists to prioritize the contaminants based on continued threat to biota, to determine their sources, and to pinpoint the highest risk areas. Accurate information regarding the long-term ecological health of areas affected by Hurricane Sandy will then be available, and coastal communities will be better prepared to minimize the release and impacts of contaminants from future storms.

Characterize Persisting Risk of Human Exposure to Storm-Released Chemical and Microbial Contaminants in Built Environment

This project focuses on the potential long-term harmful effects of contaminants on humans. Similar to the ecologically focused study above, this study begins where first responders stopped. In the immediate aftermath of the storm, a range of pathogenic and chemical contaminants posed acute toxicological risk to humans. Therefore, initial response efforts focused on removing these risks in areas frequented by humans such as public parks, beaches, and residential areas. Currently (2013), acute toxicological risk because of contaminant exposures to humans in most of those areas has been controlled. This study will examine the potential for longer-term health risks associated with contaminants that may linger in soils in the built environment and publicly accessible areas such as parks, as well as the poorly understood pathways to the environment such as leaching and chemical transformations of dredge spoils, and compromised infrastructure in residential and industrial areas. This study also will investigate the tissue samples collected in the ecological study above in terms of long-term chemical exposures to humans because of ingestion of finfish and shellfish. This project is the first to study potential human exposure to toxic contaminants released by Hurricane Sandy that were not mitigated by first responders in the immediate aftermath and the following weeks. Together these strategies will help inform the long-term cleanup efforts along the coasts, as well as help communities become better prepared for the future by providing new information to minimize the sources of contaminants that may continue to pose a risk to humans after the storm has passed.

For More Information:

Buxton, H.T., Andersen, M.E., Focazio, M.J., Haines, J.W., Hainly, R.A., Hippe, D.J., and Sugarbaker, L.J., 2013, Meeting the science needs of the Nation in the wake of Hurricane Sandy—A U.S. Geological Survey science plan for support of restoration and recovery: U.S. Geological Survey Circular 1390, 26 p., <http://pubs.usgs.gov/circ/1390/>.

• <http://coastal.er.usgs.gov/hazard-event/sandy/>