



Hurricane Sandy made landfall in the highly-populated U.S. Northeast Corridor in October 2012.

Adapting Waste Management for Climate Challenges

by Jacob Shepherd

A primer on how waste management facilities should plan for changing local environmental conditions and some of the challenges created by climate change.

The **Fourth National Climate Assessment (NCA4)** indicates that warming global temperatures are causing an increase in strength and frequency of major coastal storms.¹ Hurricanes such as Hurricane Sandy, which hit the highly-populated U.S. Northeast Corridor in October 2012,² are expected to become more common. In the case of Hurricane Sandy, the debris produced from the billions of dollars in damage needed to be managed and cleared to rebuild the affected communities.³ The construction debris was directed to numerous landfills throughout the Mid-Atlantic and New England area. Not only was this a major influx of debris in the waste stream, but it also increased the sulfur levels in the landfill gas, increasing the risk of emission limit exceedances.

Increased frequency of large coastal storms such as Sandy and the associated debris waste increases are just one of the many predicted challenges for the waste management industry

due to climate change. In the face of these challenges, waste management facilities should plan for changing local environmental conditions, which may increase operational costs, and expect variable region-specific challenges created by climate change to managing waste.

In addition to an increase in major coastal storms, the NCA4 predicts other changes to weather and environmental patterns due to rapid increases in global temperatures. In coastal areas, global sea level rise has accelerated and coastal flooding is becoming more common and widespread. When combined with global sea level rise, storm surges from major coastal storms are becoming more damaging and disrupting to coastal communities. Waste management facilities located near the coast will be increasingly threatened by flooding and damage by coastal storms.

Weather patterns are also changing in other parts of the country, including increasing frequencies of intense precipitation events that produce large amounts of precipitation over a short period of time. Increases in large precipitation events across the country will affect the rate and degree of cap and side slope erosion and will stress liquid management systems at landfills. Increases in annual precipitation will affect the production and subsurface dynamics of landfill gas, improving production rates and quality, but also potentially increasing the risk of lateral gas migration. In contrast, other areas of the country will experience warmer temperatures and stronger, more prolonged droughts. These changes, in turn, increase the risk of large forest fires, presenting additional debris management challenges and potentially disrupting operations and collection routes. Depending on location, facilities will be faced with new or changing site-specific challenges due to climate change in the near future.

The Future Is Now

However, climate change is not only a future challenge, but one that is already affecting the waste management industry. In the western United States, a record warm decade has allowed the mountain pine beetle, which historically has been kept in check every winter by cooler temperatures, to increase in population.⁴ The effects of this in combination with recent droughts and forest fires have been high tree death rates, which have created challenges of wood waste debris management.⁵

Higher temperatures and reduced precipitation amounts have also contributed to an increased risk of forest fires. In December 2017, highly-populated areas of southern California were affected by some of the strongest forest fires seen in recent history due to the combination of unusually strong late-season

continental winds and prolonged dry conditions. While it is uncertain what effects, if any, climate change had on these forest fires, the NCA4 indicates that such large forest fires are increasing due to a warmer climate. These recent environmental events indicate that new challenges have been created because of climate change.

Facilities across the country will need to plan for and adapt to additional or increasing challenges for managing waste as the climate continues to change. In order to prepare for and reduce costs or prevent major damage from increasing climate challenges, it is necessary for waste management facilities to design and implement climate adaptation strategies and solutions.

For example, existing facilities should develop site-specific adaptation plans that identify likely potential issues, such as increased leachate production in landfills or increased risks of natural disasters, and propose solutions to the identified issues. These plans should account for changes in the immediate area of the waste management facility, changes to the collection areas, and potential changes hundreds of miles away that may increase or change the demands on each facility. Existing systems may need to be retrofitted to account for the anticipated future climate challenges.

New facilities must take into account not just the climate of today, but what the climate is expected to be in the future. Taking a proactive approach to solutions will decrease costs associated with environmental changes, increase readiness for predicted climate challenges, and allow waste management facilities to continue to effectively manage waste in the future. **em**

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References

1. Wuebbles, D.J.; Fahey, D.W.; Hibbard, K.A.; Dokken, D.J.; Stewart, B.C.; Maycock, T.K. *Climate Science Special Report*; U.S. Global Change Research Program, Washington, D.C, November, 2017. Retrieved December 1, 2017, from <https://science2017.globalchange.gov/>.
2. Blake, E.S.; Kimberlain, T.B.; Berg, R.J.; Cangialosi, J.P.; Beven, J.L., II. *Tropical Cyclone Report - Hurricane Sandy*; National Oceanic and Atmospheric Administration, National Hurricane Center, February 12, 2013. Retrieved from http://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf.
3. *Sandy Debris Removal Passes 95 Percent in 95 Days*, February 1, 2013. Retrieved December 20, 2017, from <https://www.fema.gov/news-release/2013/02/01/sandy-debris-removal-passes-95-percent-95-days>.
4. United States Forest Service, Climate Change Resource Center. (n.d.). *Bark Beetles and Climate Change in the United States*. Retrieved December 20, 2017, from <https://www.fs.usda.gov/ccrc/topics/bark-beetles-and-climate-change-united-states>.
5. Bolton, N. Landfill Managers Notebook: Tree Mortality: California's Wood Waste Explosion; *MSW Management* **2017** 27 (5), 52-53. Retrieved December 1, 2017, from <https://foresternetwork.com/msw-management-magazine/landfill-managers-notebook/tree-mortality-californias-wood-waste-explosion/>.