

HARVEY DEBRIS: EPIDEMIOLOGY

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Hurricane Harvey made landfall in Texas on August 23, 2017, as a category IV hurricane which caused more devastation in Rockport, Texas than in Houston. Currently, Texas is working to move forward and rebuild. The geographic area and the population affected by this horrific flooding is far more significant than Katrina. The cleanup effort in the aftermath of Hurricane Harvey is quite an enormous task that seems to have no end. Piles of debris are the typical site in Houston. Flood-soaked sheetrock, furniture and once cherished belongings are everywhere, and there is no telling how long the piles of trash will be collected. The piles of debris scattered in the affected locations, could potentially post a health hazard to the Houston neighborhoods. So the question is what happens to this waste?

Harvey Debris

Debris is defined as scattered pieces of waste or remains, or the remains of something broken down or destroyed (Dictionary.com). Hurricane Harvey damaged and destroyed countless structures, including 111,884 homes and counting (CITE). The devastation resultant from Hurricane Harvey resulted in vast amounts of debris, but the Texas Commission on Environmental Quality (TCEQ) stated that it is still too early to tell just how much the cost, comparing this hurricane's reach to that of Hurricane Katrina. However, TCEQ, estimates that Hurricane Harvey could create a total of 200 - 300 million cubic yards of waste. This amount of waste, is two to three times as much as the debris left by Katrina (FEMA, Debris Removal Factsheet, accessed at <https://www.fema.gov/media-library-data/1465335317204-387ea71c5b3ae8f55577aaa32baa66ac/FactSheet-DebrisRemoval2016.pdf>



Types of debris

Hazardous waste is a particular category of debris that requires careful handling during the disposal process (EPA.gov). This is due to the dangerous nature of the material, the properties of which may pose a substantial threat to public health or the environment. Common features associated with hazardous waste include toxicity, flammability, radioactivity, and corrosiveness (). Due to the danger posed by these materials, hazardous waste disposal is heavily regulated on the local, state, and federal level to keep it separate from the municipal solid waste stream (CITE).

According to (CITE), there are four categories of hazardous waste which are:

Listed Wastes

Listed wastes are those specific wastes that have been identified by the EPA as being hazardous. These residues include the byproducts of conventional manufacturing and industrial

process, as well as substances used to clean machinery. Wastes produced by specific industries are also covered under this category, such as petroleum refining or chemical manufacturing.

Characteristic Wastes

Characteristic wastes are those not explicitly listed by the EPA as hazardous but are still considered dangerous because they exhibit characteristics of ignitability, corrosivity, reactivity, or toxicity. Some typical examples of ignitable wastes are used oils or solvents, while corrosive waste consists of acids or bases that can destroy their storage containers (barrels or drums).

Reactive residues are materials or substances that are unstable under normal conditions and can create deadly vapors, explosions, or fumes. Toxic waste is fatal if ingested or absorbed by the body and is tightly regulated to ensure that they do not leach into groundwater supplies.

Universal Wastes

Universal wastes are a common type of hazardous waste that the EPA has streamlined collection and disposal regulations for to encourage retailers and municipalities to start their collection programs. Typical examples include fluorescent tubes, mercury-containing thermometers, car batteries, and pesticides.

Mixed Wastes

Mixed wastes classify those materials that contain both hazardous waste and radioactive waste. This category of trash is generated by nuclear power plants, nuclear weapon production, and medical diagnostic services and research. Radioactive waste is regulated by the Department of Energy and the U.S. Nuclear Regulatory Commission, while the EPA regulates the hazardous portion.

Non-hazardous Waste

Non-hazardous waste is split into two main categories, municipal solid waste, and industrial waste. Municipal solid waste is merely trash or garbage. Municipal waste is everything we consume on a daily basis such as coffee cups, soda bottles, food containers, and many of other materials. Industrial waste is a much broader category that consists of construction & demolition materials, mining waste, byproducts of crude oil and natural gas production, and more (CITE) .

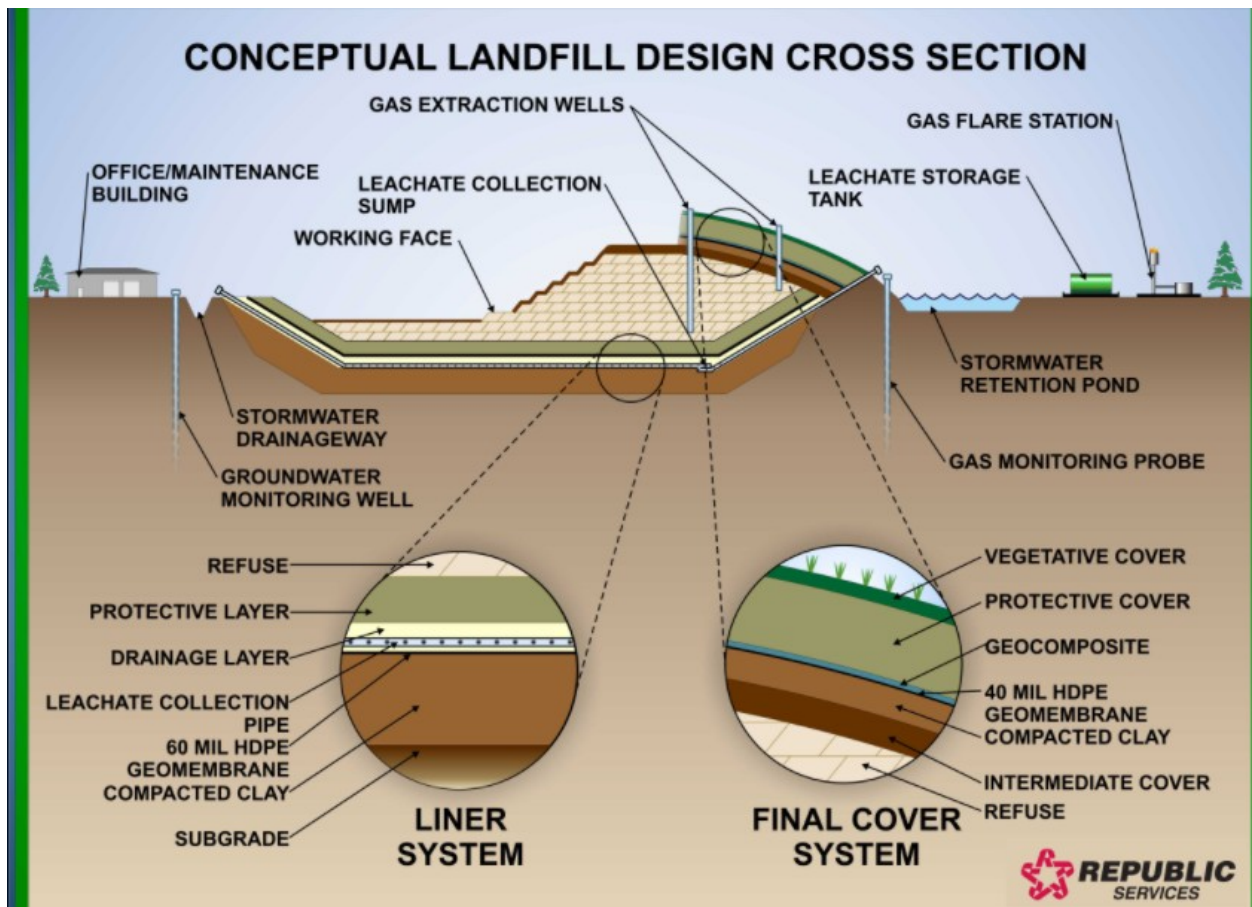
Waste Management and Landfill of Fairbanks North Houston

On February 6, 2018, the opportunity to visit and interview the operations manager Andrew _____ of Waste Management and Landfill located at Fairbanks North Houston, Houston Texas. In a personal communication with Mr. Andrew a tour of the landfill and information regarding the process was granted. The total land area of this site is 118 acres. This site is only permitted to collect type IV municipal solid waste which allows construction and demolition waste, including lumber debris, concrete, and soil. Household waste such as oil, tires, and food items are not allowed. The landfill is a highly engineered system with many layers of environmental protection. The depth of the landfill is currently at 98 feet which is to 250 feet above mean sea level. With the towering stockpiles of debris as a result of Hurricane Harvey, one stack of debris has reached 170 feet. This change is from a height of 70 feet before the hurricane Harvey.

Liner System

Modern-day landfills are designed and constructed with environmental protection systems in mind. A liner system creates an impenetrable barrier between soil and groundwater

and seals and prevents what goes into the landfill. A typical liner starts with a composite liner of clay and synthetic material. Clay is compacted to increase impermeability (meaning that liquids cannot seep through). A high-density plastic liner is placed over the clay, and a drainage layer is installed over the liner. Every 3-5 feet of debris is dumped into the site, where then is covered with soil, followed by trash, then soil until it reaches the maximum of 250 feet wherein a closure is performed. At closing, this is covered with a final liner before compaction with dirt and grass occurs. The liner system must meet all state and federal regulations.





A truck delivering Harvey debris



Waste and trash being compacted



Plastics are separated and will be sent to the recycling division



Check in at the front gate



Andrew and myself touring the landfill

Impact of Harvey Debris

1. Economic, the economic impact to the city of Houston, is approximately \$200M. On the federal level, the fiscal cost can be direct funds (FEMA) or indirect which are private insurances (Deryugina, 2017). Individuals incur repairs and rebuilding costs, higher water bills, permits to restore and housing as these are required by the city. A family member of mine was affected by Hurricane Harvey, and is displaced with a baby and living in hotels. In addition to paying the monthly mortgage, the foods costs incurred from eating in restaurants because the hotel has no kitchen and they are not able to cook are substantial.

2. Health hazard, some former dumps have contaminated groundwater that is used for drinking. Other sites have exposed waste; or fire hazards from seeping landfill gases. Vrijheid (2000) reviewed more than ten research articles on landfill's health hazards. There is an increased prevalence of fatigue, sleepiness, and headache among residents near the sites but there is still insufficient data (CITE). Often, old dumps are minimally covered with soil, and sometimes this land is not maintained. In landfills, uneven settling of the earth can make the ground unstable resulting in injuries due to falls, in addition, the older dump sites do not use liners. Today, the modern landfills are being monitored monthly, and will be monitored for the next 40 years even after their closure (CITE). The closing of landfills will occur when the maximum allowable depth which is 250 feet above mean sea level is reached (CITE). The Texas Commission on Environmental Quality (TCEQ) monitors and reissue permits to landfills annually based on the site inspections.
3. Psychological – Experiencing a combination of personal and personal property damage is consistent for PTSD. Schwartz did a study. et.al. (2017) reports that exposure to hurricane Sandy has an impact on PTSD symptoms over time. Arcaya (2017) also states that PTSD symptoms were at higher odds of experiencing migraine headaches.

NP aftermath Hurricane Harvey

As a member of the Harris Country, Houston community, we have the responsibility to protect our environment from waste and prevent health hazard. Knowing the effects of hurricane

Harvey debris educating the community regarding epidemiological results is crucial. Educating the public regarding strategies for proper disposal of trash is essential. Reminding the community about the health hazards of debris and short and long-term effects must be disseminated. The most reliable predictor of experiencing any mental health symptom after a disaster has anxiety or depression. Psychological evaluation is critical to prevent stress and depression from their property loss (Schwartz, Gillezeau, Liu, Lieberman-Cribbin, & Taioli, 2017). In order to provide appropriate assistance and treatment after future natural disasters, mental health care providers, nurse practitioners, and policymakers must consider long-term effects of hurricane exposure on psychological health especially PTSD and focus on the vulnerable subgroup, those with existing mental health concerns (Schwartz, et al, 2017).

As nurse practitioners, our presence is not to collect Harvey debris but to assess the people's needs in the aftermath of Hurricane Harvey. The need for monitoring mental health issues as well as physical needs is of utmost importance. This is necessary in order to re-build a community to pre hurricane Harvey status.

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