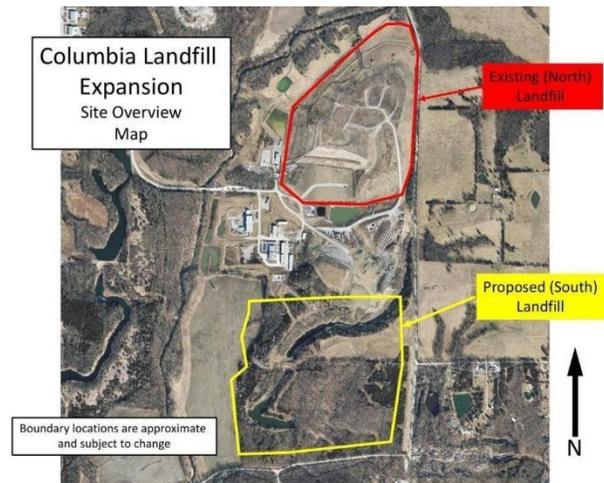


# Proposed Landfill Expansion Columbia, Missouri

## Executive Summary

The City of Columbia, Missouri is proposing a landfill expansion. The new landfill area will be located on the south side of the current landfill operation at 5700 Peabody Road. As of 2019, approximately 27,485 people live in the census tracts within a 2-mile radius of the landfill. Within that radius, 407 households, or 36% of the total households in the landfill's census tract, live below the poverty line.<sup>1</sup> Columbia landfill authorities are seeking public comment on the newly proposed landfill area. All comments must be submitted Sep 3, 2021.



## Highlights

- Landfill is considered an effective method of waste management, primarily due to its low cost and limited technical requirements. However, landfill use may have unintended environmental and socioeconomic consequences if managed improperly.
- Landfills use compacted soil and composite plastic lining technologies to reduce environmental and health impacts of contaminated water leaching into groundwater.
- Landfill gas collection technologies can reduce the amount of pollutants landfill release into the atmosphere.
- Residents living near landfills may experience negative health impacts, such as respiratory ailments, compared to residents living further from the landfills.
- Proximity to a landfill site may decrease residential property values and residents with low socioeconomic status tend to be most impacted by the economic and health consequences of landfills.

## Limitations

- The health effects of living near a landfill are understudied, often rely on self-reported health data, and exclude contributing lifestyle factors that may influence health (e.g., smoking and alcohol consumption).
- Studies often use different ranges for 'proximity' to judge exposure zone size.
- There is no generally accepted method of measuring exposure to particulate matter and gasses potentially released by landfills to surrounding residents.

# Research Background

## Landfill Impacts on the Environment

Landfill is considered an effective method of waste management,<sup>2</sup> primarily due to its low cost and limited technical requirements.<sup>3</sup> However, landfill use may have unintended environmental and socioeconomic consequences. Landfill sites may be used for a limited amount of time and their lifespan depends on the size of the landfill facility, the disposal rate, and the compaction rate.<sup>4</sup> Landfill reclamation is a way to expand landfill capacity and avoid the cost of acquiring additional land for a new landfill.<sup>4</sup>

In concert with limited time use, communities in areas surrounding landfill sites typically oppose land allocation for landfill usage due to pollution and unfavorable odors.<sup>5</sup> The pollutants of greatest concern include water pollutants (leachates and heavy metals) and gas pollutants (hydrogen sulfide and methane). Moisture in the landfill and precipitation cause leachates, or water runoff from a landfill, which contains heavy metals (e.g., zinc, copper, and lead). Leachate may also

contain hazardous chemicals (alcohols, acids, aldehydes, sulfate, chloride, iron, aluminium, and ammonia) that may render ground water sources unusable. Therefore, landfill use is a tradeoff between economical waste disposal and adverse environmental effects (Figure 1).<sup>6</sup>

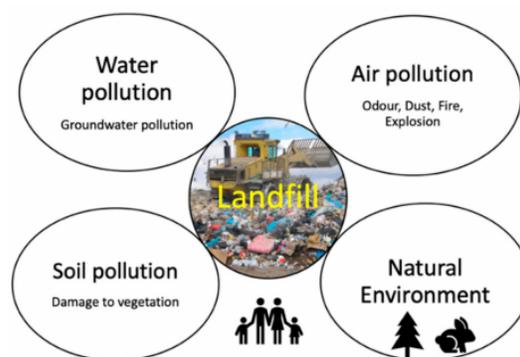


Figure 1. Potential impact of landfills on the environment.

Municipal solid waste landfills employ mitigation strategies meant to reduce or eliminate impacts on the environment. The U.S. Environmental Protection Agency (EPA) requires new landfills to be lined with compacted soil and composite plastic liners to control leachate.<sup>7</sup> The EPA also requires groundwater monitoring systems that can detect the failure of the compacted soil and composite plastic liner system.<sup>7</sup> Landfills also rely on landfill gas (LFG) collection systems to mitigate release of methane and hydrogen sulfide into the atmosphere. Landfill operators are required to install LFG collecting control systems under the Clean Air Act.<sup>8</sup>

## Landfill Impacts on Health

The environmental impacts of landfill sites can affect human health. In 2010, the Bridgeton Sanitary Landfill in St. Louis County, Missouri, experienced a subsurface smoldering event (SSE). An SSE is a heat-producing reaction that causes waste to decompose at higher-than-normal rates in the absence of either smoke or flames. By spring of 2012, residents and businesses in Bridgeton had multiple complaints of foul odors and respiratory health issues

to county health officials.<sup>11</sup> In response, an investigation was conducted in St. Louis County to assess any potential respiratory health risks associated with living near landfill sites. While levels of asthma and COPD were not significantly different from equivalent demographic households not living near a landfill site, there was a significant increase in the incidence of pneumonia, bronchitis, sleep apnea, and shortness of breath.<sup>11</sup> Because this study relied on household surveys, it is subject to self-reporting limitations and lacks individual-level data. Researchers also found that residents near the landfill had a significantly higher perception of odor, suggesting that living near these sites can affect their quality of life.

In contrast to the St. Louis, MO study, a study in the Lazio region of central Italy examined nine solid waste landfill sites and assessed the health outcomes of 240,000 residents living within 5km (3.1 miles) of each site.<sup>11</sup> Exposure to hydrogen sulfide (a common emission from landfill sites) was associated with increased mortality rates from lung cancer and hospitalization for respiratory diseases such as pediatric asthma and Chronic Obstructive Pulmonary Disorder (COPD). This study used hydrogen sulfide as a surrogate for all pollutants from landfills, therefore, it may potentially underestimate exposure to contaminants from the landfill sites. It also did not include lifestyle choices of the residents (e.g., smoking and physical activity) which may confound causes of respiratory problems.

In 2015, a small study assessed the body's immune response via interleukin-6 (IL-6) to particulate matter exposure in children living within 2km (1.2 miles) of a Malaysian landfill site.<sup>12</sup> IL-6 is a substance secreted by the body's immune system that indicates inflammation and immune response to foreign substances in the body. Compared to those children living further than 2km (1.2 miles) away, an increase in particulate matter exposure was associated with increased incidences of watery eyes, coughing with phlegm, and sore throat among children living within 2km from the landfill.<sup>13</sup> However, no increase in IL-6 was observed.<sup>13</sup>

The health effects of living near a landfill are understudied and need more attention from health scientists. Studies often use different ranges for 'proximity,' evidenced by the three studies above using 2, 3.1, and 1.2 miles, respectively, to judge exposure zone size. There also appears to be no generally accepted method of measuring exposure, as evidenced by the differences in the above studies related to exposure to particulate matter vs. gasses emitted by the landfill, such as hydrogen sulfide. Results also vary based on where the study was conducted.

### **Economic Impacts of Landfill Sites**

Republic Services operates 10 landfills in the state of Missouri, creating 2800 direct and indirect jobs as well as citing \$140 million in total labor income, leading to \$21 million in annual tax revenue as well as \$97 million in direct purchases.<sup>14</sup>

U.S. homes situated close to landfills accepting high volumes of waste may experience 13.7% on average in decreased property values, an impact that decreases by ~5.9% per mile from the site.<sup>14</sup> The median home values in Boone County and the City of Columbia are \$212,236 and

\$239,800, respectively.<sup>16</sup> The median home value in Zip Code 65202, where the Columbia landfill is located, is \$191,832,<sup>17</sup> however, there is no evidence to indicate that this correlation with lower home values is directly caused by the landfill location.

In general, people with lower socioeconomic status live in proximity to landfills and may be most adversely affected by health and economic consequences of living near landfills. As of 2019, approximately 27,485 people live in the census tracts within a 2-mile radius of the proposed landfill expansion. Within that radius, 407 households, or 36% of the total households in the landfill's census tract, live below the poverty line.<sup>1</sup>

### **Alternatives to Landfills**

Waste management utilities around the U.S. employ several alternative options to landfills when space is unavailable to build new or larger landfills. Some alternatives, such as recycling and composting, may reduce the amount of solid waste entering landfills, whereas other alternatives, such as pyrolysis and plasma arc gasification, can reduce the emissions and environmental footprint of municipal waste disposal but are more expensive to build and maintain.

- **Recycling** repurposes paper, plastics, and glass into new materials that might otherwise require virgin resources to create.<sup>18</sup>
- Eighty-six facilities in the U.S. utilize **Waste to Energy (WTE) Incineration** to generate electricity from municipal solid waste (MSW). WTE uses the gases produced by MSW or another heat source from waste treatment to produce electricity. WTE is used in many areas where land for new landfills may be scarce or expensive.<sup>19</sup>
- **Pyrolysis** involves superheating MSW in the absence of oxygen. Pyrolysis thermally decomposes MSW materials into combustible gases and charcoal. Gases from pyrolysis can be used as biofuels.<sup>20</sup>
- **Plasma Arc Gasification (PAG)** is a process to catalyze organic matter into synthetic gases and solid waste known as slag. The slag product of PAG can be used as a solid for construction materials. Gasification systems are deployed mainly in rural areas and isolated areas.<sup>21</sup>
- **Anaerobic Digestion (AD)** is a process where organic materials are fermented by bacteria into volatile fatty acids that are consumed by methanogenic bacteria. Organic materials are converted into biogas through AD. Solid materials left over after AD can be used as fertilizer.<sup>22</sup>
- Waste utilities may also **compost** organic waste. The soil created by composting organic waste has been shown to have a positive effect on the growth and yield of many field crops (e.g., maize, sorghum, forage grasses) and vegetables for human consumption (e.g., lettuce, cabbage, beans, potatoes, cucumbers).<sup>23</sup>

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