

Hazardous Waste

Hazardous waste is solid waste with a chemical composition or other property that makes it capable of causing illness, death, or some other harm to humans, plants, animals, and ecosystems when mismanaged or released into the environment. Before the 1976 enactment of the Resource Conservation and Recovery Act (RCRA), uncontrolled dumping of wastes, including hazardous wastes, was commonplace, with numerous entities handling and disposing of these materials. Some of this hazardous waste was co-disposed with non-hazardous waste (e.g., municipal solid waste). Landfills and surface impoundments containing these materials were originally unlined and uncovered, resulting in contaminated ground water, surface water, air, and soil. Even with current tight control of hazardous wastes from generation to disposal, the potential exists for accidents that could result in the release of hazardous wastes and their hazardous constituents into the environment. Through RCRA and the subsequent 1984 Hazardous and Solid Waste Amendments, Congress sought to better control waste management and disposal in such a way that they do not cause harm to human health and the environment, and to conserve valuable materials and energy resources.

Facilities whose industrial processes and other actions create hazardous waste are RCRA hazardous waste generators. Facilities that treat, store, or dispose of hazardous wastes are termed RCRA treatment, storage, and disposal facilities (TSDFs). Some hazardous waste generators treat, store, and dispose of their hazardous waste onsite, while others ship their waste to TSDFs. Most hazardous wastes (excluding hazardous wastewaters) are eventually disposed of in landfills, in surface impoundments, in land application units, or by deep well injection. All hazardous wastes that are land-disposed must meet certain treatment standards required by the RCRA Land Disposal Restrictions before disposal.

Beyond the potential environmental impacts of hazardous waste disposal, patterns in hazardous waste generation reflect a component of the total materials a society creates and uses, which is an important aspect of sustainability. Generally speaking, as a society creates and consumes more materials, it demands more resources (e.g., water, energy, minerals, land) and generates greater quantities of pollutants and waste. In the U.S., more than 90 percent of the raw materials extracted from the environment, transported, and processed are eventually discharged as waste or atmospheric emissions (Fiksel, 2006).

Historically, economic growth and increased prosperity have been correlated with increased material consumption (Fiksel, 2009). An important goal of sustainable development is a reduction in material use—and particularly a reduction in the generation of hazardous wastes—without a reduction in economic well-being. One way to track material use reduction is to look at nationwide “waste material intensity,” which can be measured in terms of waste generation per capita and per dollar of gross domestic product (GDP) (i.e., the total value of all goods and services produced in the U.S.). In the context of hazardous waste, lower measures of intensity imply that people are using raw and hazardous materials more efficiently, switching to less hazardous materials and production processes, or both. By developing more environmentally friendly products and using raw and hazardous materials more efficiently, society at large can realize cost savings and improve ecological and human health.

This indicator examines trends over time in the quantity of RCRA hazardous waste generated and managed (Exhibits 1 and 2), as well as the intensity of hazardous waste generation (Exhibit 3). In partnership with the states, EPA collects extensive data on the RCRA hazardous waste generation and management practices of TSDFs and large quantity generators (i.e., facilities that, in any single calendar month, generate 2,200 pounds or more of RCRA hazardous waste, more than 2.2 pounds of RCRA acute hazardous waste, or more than 220 pounds of spill cleanup material contaminated with RCRA acute hazardous waste). These data have been collected every two years since 2001, following consistent methods. Exhibit 3 compares RCRA hazardous waste generation trends with the official U.S. population and real (inflation-adjusted) GDP. These data are indexed such that 2001 equals 1, which allows all quantities to be plotted on the same scale.

What the Data Show

Over the course of nine reporting cycles (2001-2017), the quantity of RCRA hazardous waste generated in the U.S. ranged from 20.3 to 29.1 million tons (Exhibit 1). Note that, because some wastes can go through multiple management steps, in Exhibit 1, the individual management categories do not sum to the total quantity of RCRA hazardous waste generated. For example, before land disposal, RCRA regulations require that all hazardous waste must be treated to meet technology-based land disposal treatment standards before it is placed in or on the ground, unless it already meets those standards as generated. To minimize double-counting, the quantities of waste stored, bulked, transferred, or disposed of by landfill, land treatment, or land application after treatment are not included in the total quantity generated.

Exhibit 1 also shows that the vast majority of the wastes are disposed of, with smaller proportions sent for material recovery (e.g., metal recovery, solvent recovery); energy recovery; treatment; or stored for future disposal.

From 2001 to 2017, the quantity of RCRA hazardous waste ultimately land-disposed ranged from 16.1 to 25.4 million tons (Exhibit 2). During this time, deep well or underground injection consistently accounted for 90 to 96 percent of all RCRA hazardous wastes disposed of on land. This category also accounted for most of the year-to-year variation in total hazardous waste managed. The proportion disposed of in landfills or surface impoundments that became landfills ranged between 3.7 and 9.9 percent, while the land application and land treatment categories represented a very small percentage of hazardous waste disposed of on land (0.4 percent or less) over the nine reporting cycles.

Between 2001 and 2017, the U.S. economy grew by 36.5 percent as measured by real GDP, and the U.S. population grew by 14.0 percent. Total RCRA hazardous waste generation was 16.4 percent higher in 2017 than in 2001, but with fluctuations in the intervening years. Comparing 2017 with 2001, RCRA hazardous waste generation per capita increased by 2.1 percent, while RCRA hazardous waste generation per dollar of GDP decreased by 14.7 percent (Exhibit 3).

Limitations

- Data are not collected directly from small quantity generators, but some wastes coming from these sources are included in the RCRA hazardous waste management data from TSDFs that receive the wastes.
- Data are limited to wastes referred to as “RCRA hazardous waste,” which are either specifically listed as hazardous or meet specific ignitability, corrosivity, reactivity, or toxicity criteria found in the U.S. Code of Federal Regulations Title 40, Part 261. Materials that are not solid wastes, whether hazardous or not, are not regulated by RCRA, and therefore are not included in the data summarized here. It is important to note that the definition of solid waste is not limited to wastes that are physically solid. Many solid wastes are liquid, semi-solid, or contained gaseous material.
- States have the authority to designate additional wastes as hazardous under RCRA, beyond those designated in the national program. State-designated hazardous wastes are not tracked by EPA or reflected in the aggregated information presented.
- The comparability of year-to-year quantities of RCRA hazardous waste generated and managed can be influenced by factors such as delisting waste streams (i.e., determining that a particular listed waste stream coming from a particular facility is not hazardous) or removing the hazardous characteristic of a waste stream (e.g., treatment of hazardous waste by generators in elementary neutralization units).
- Most hazardous waste generated in the U.S. is in the form of wastewater. Except for hazardous wastewater disposed of using underground injection, this indicator does not include hazardous wastewaters. If treating hazardous wastewaters generates a solid material such as sludge, and if that material is considered “RCRA hazardous waste,” it will be managed under RCRA hazardous waste regulations.
- In developing this RCRA hazardous waste indicator, EPA uses the data reported by facilities in their Hazardous Waste Report Forms (U.S. EPA, 2019). Note, however, that the methods used to analyze the data vary depending on the purpose/objective of the analysis. For example, this RCRA hazardous

waste indicator only includes non-wastewaters (except wastewaters managed by underground injection), while other analyses may include both non-wastewaters and wastewaters. As a result, there are differences in the total quantities of waste presented in different data sources.

- Exhibit 3 does not necessarily indicate the extent to which RCRA hazardous waste is being generated and managed at environmentally “sustainable” levels (i.e., levels that will not adversely affect the environment for future generations).

Data Sources

Exhibits 1 and 2 are based on data collected by EPA in Hazardous Waste Report Forms (also known as Biennial Report or BR forms) for reporting years 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, and 2017. The data were accessed via EPA’s RCRAInfo (U.S. EPA, 2020a), and are publicly available through RCRAInfo Web (U.S. EPA, 2020b). Exhibit 3 incorporates GDP data obtained from the U.S. Bureau of Economic Analysis (BEA, 2019) and population data from the U.S. Census Bureau (2011, 2019).

References

BEA (U.S. Bureau of Economic Analysis). 2019. Current-Dollar and “Real” Gross Domestic Product. <https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2&isuri=1&categories=survey>. Accessed January 9, 2020.

Fiksel, J. 2009. Design for environment: A guide to sustainable product development. New York, NY: McGraw-Hill.

Fiksel, J. 2006. A framework for sustainable materials management. *J. Mater.* 58(8):15-22.

U.S. Census Bureau. 2019. Monthly Population Estimates for the United States: April 1, 2010 to December 1, 2020 (NA-EST2019-01). Released December 2019.

<https://www.census.gov/data/tables/time-series/demo/popest/2010s-national-total.html>.

U.S. Census Bureau. 2011. Intercensal estimates of the resident population by sex and age for the United States: April 1, 2000 to July 1, 2010 (US-EST00INT-01). Released September

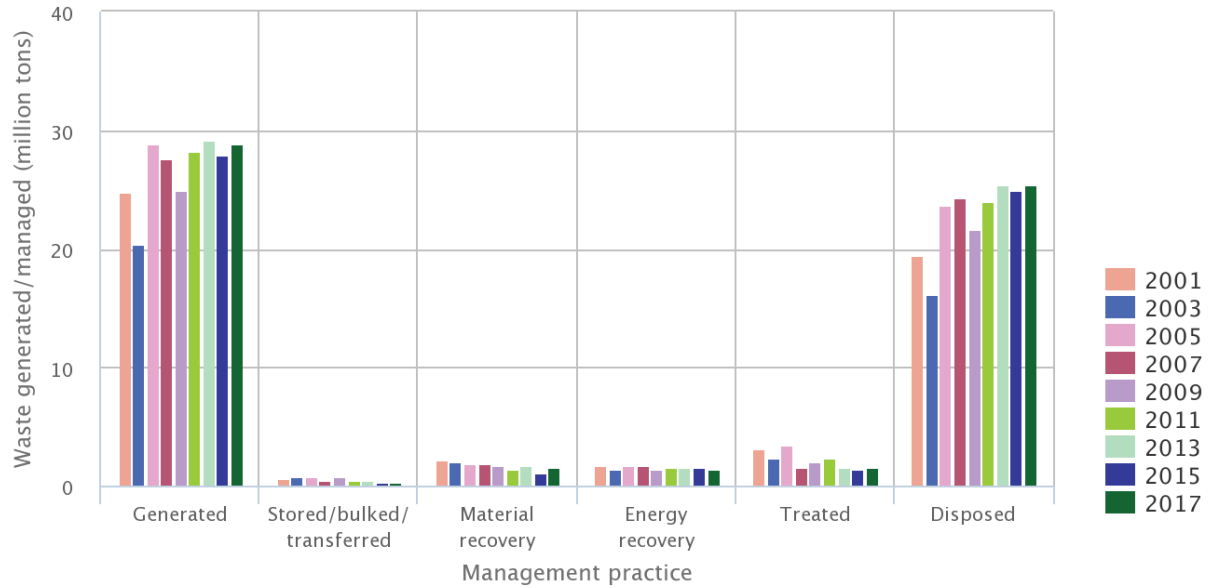
2011. <https://www.census.gov/data/tables/time-series/demo/popest/intercensal-2000-2010-national.html>.

U.S. EPA (U.S. Environmental Protection Agency). 2020a. RCRAInfo, Hazardous Waste Report data, reporting years 2001-2017. Data current as of February 10, 2020. Provided to ERG by EPA Office of Resource Conservation and Recovery (ORCR), within the Office of Land and Emergency Management.

U.S. EPA. 2020b. RCRAInfo Web, Biennial Report data. Available at <https://rcrapublic.epa.gov/rcrainfoweb/action/main-menu/view>.

U.S. EPA. 2019. RCRA Subtitle C Reporting Instructions and Forms. Available at <https://rcrapublic.epa.gov/rcrainfoweb/action/main-menu/view>.

Exhibit 1. RCRA hazardous waste generation and management in the U.S., 2001-2017

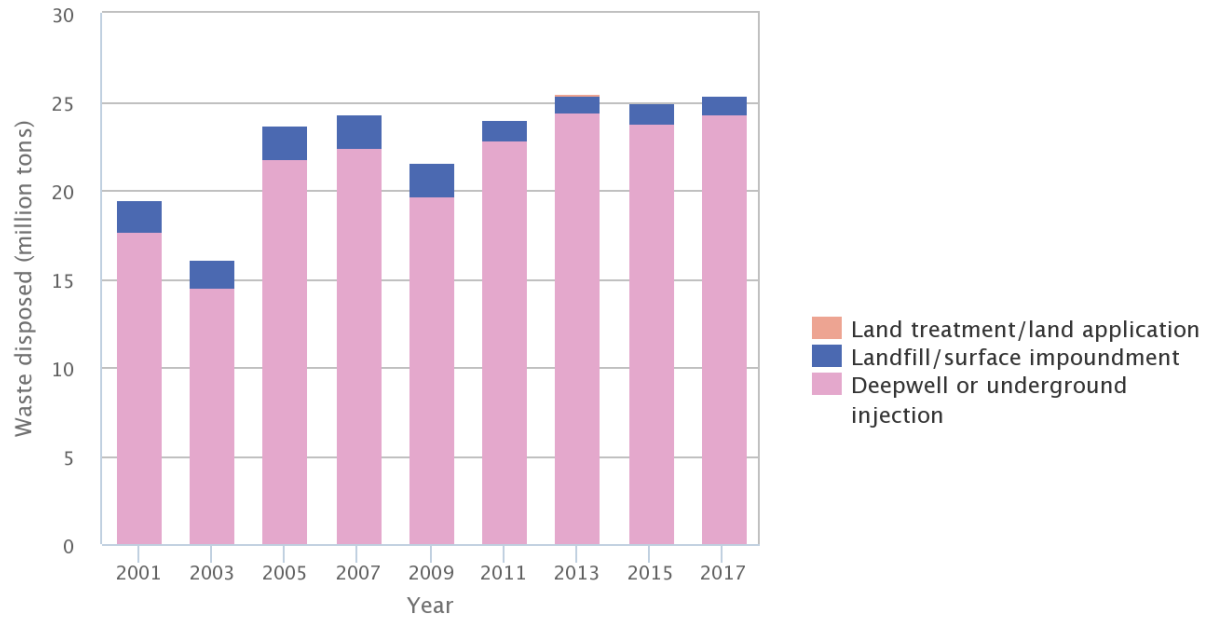


Individual management practice quantities do not add up to the total quantity generated. See text for details.

Information on the statistical significance of the trends in this exhibit is not presented here. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2020a

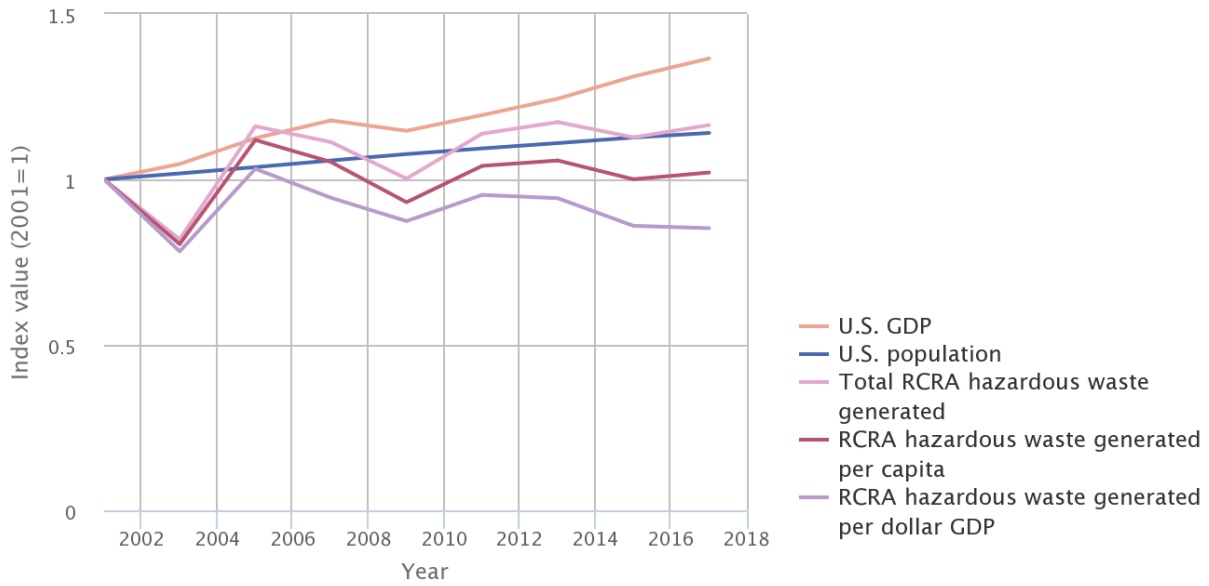
Exhibit 2. RCRA hazardous waste disposal to land in the U.S. by practice, 2001-2017



Information on the statistical significance of the trends in this exhibit is not presented here. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2020a

Exhibit 3. Intensity of U.S. RCRA hazardous waste generation, 2001–2017



Based on real (inflation-adjusted) GDP.

Data plotted at 2-year intervals.

Information on the statistical significance of the trends in this exhibit is not presented here. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2020a; Census Bureau, 2011, 2019; BEA, 2019.