

# IMPACTS OF WASTE INCINERATION IN EUROPE

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## 1. Introduction

Waste is a major source of pollution. A key objective of the European Union's (EU) waste policy is to reduce the amount of waste sent to landfill. The overall landfill rate in Europe decreased from 23% to 17% between 2010 and 2022, but the total amount of waste generated continued to increase [1]. An alternative way of managing waste is to incinerate it. However, there are significant concerns regarding the pollutants produced by the incineration of waste. In this paper, we report on the pollutants produced by the incineration of waste in Europe.

## 2. Waste Incineration in Europe

Waste incineration is a recommended option for waste management. Combustion technologies include direct combustion (incineration), pyrolysis and gasification [2,3]. By releasing energy from municipal waste, waste incineration can generate electricity, disinfect hazardous materials and reduce reliance on landfill [2,3]. Waste incineration in the EU increased steadily between 2010 and 2021, with a small decrease in 2022. The amount of municipal waste incinerated in the EU increased by 11% over the same period 2022-2010 (from 53 to 56 million tonnes) [4]. The EU, has adopted measures to prevent or reduce air, water and soil pollution caused by the incineration or co-incineration of waste, as well as the resulting risk to human health. These measures specifically require the issuance of a permit for incineration and co-incineration plants, as well as emission limits for certain pollutants released into the air or water [5].

## 3. Material used

Municipal solid waste (MSW) is an important source of fuel. MSW is a very heterogeneous fuel source and includes organic materials (food and garden waste), recyclable materials (paper, plastics, metals and glass) and other materials (rubber, textiles, construction debris), different from industrial solid waste. MSW is proposed as a sustainable energy source to manage this increase, but its status as a “clean” energy source depends on the composition of the MSW and the technology of waste incineration plants, including adequate greenhouse gas capture and reduction of harmful emissions [6].

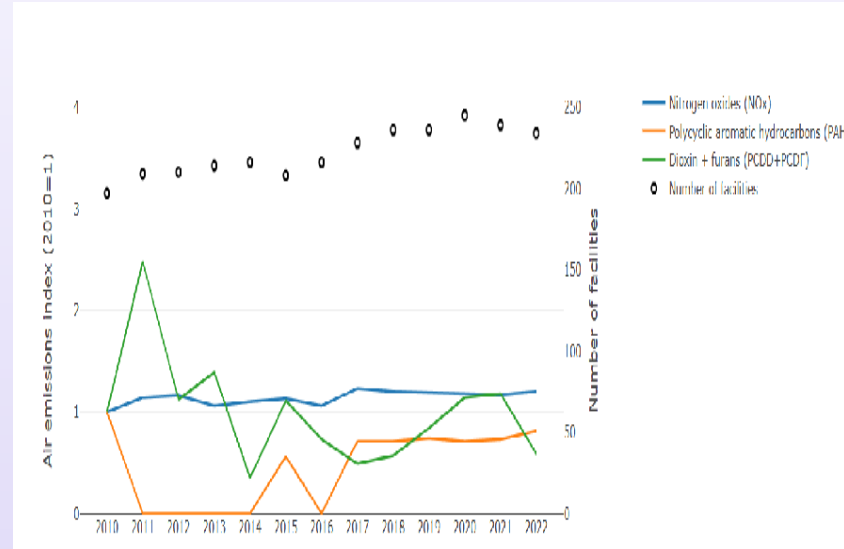


Figure 1. Time evolution (2010-2022) of pollutants produced by waste incineration in European Union

## 4. Impacts of waste incineration

There are concerns about the health, environmental, and economic impacts of incineration. Incineration of both hazardous and non-hazardous wastes can result in emissions of substances that contaminate air, water, and soil and have harmful effects on human health [5]. Incinerators can release toxic airborne chemicals (e.g., dioxins and furans) and solid residues that release pollutants (e.g., heavy metals) into the environment, affecting air quality, groundwater, and climate change. The environmental impacts are complex and difficult to quantify and can lead to human health impacts, both short-term and long-term [6]. The potential impacts are significant given the increasing number of incineration plants [6]. In order to limit these risks, the European Union imposes strict operating conditions and technical requirements on waste incineration and co-incineration plants [5].

## 5. Pollutants Emitted

The changes in emissions of various pollutants to air (Figure 1) from EU incineration plants vary between 2010 and 2022, showing either increasing or decreasing trends. However, a more stable trend has emerged since 2017. This can be attributed to the fact that these plants started to adapt to the best available techniques. Figure 1 shows that nitrogen oxides (NO<sub>x</sub>) production remains stable over the years. On the contrary, dioxins and furans (PCDD-PCDF) start dynamically in 2010, but along the way there are decreasing fluctuations. In recent years, however, from 2018 onwards they have increased significantly. Finally, polycyclic aromatic hydrocarbons (PAHs), although at the beginning they were at zero level, from 2016 onwards there has been a significant increase, which has remained stable over the last five years. All three pollutants, in 2022, are at significant levels, showing that waste incineration, despite all the recommendations and measures that have been taken, constitutes a significant source of produced pollutants.

## 6. Conclusions

Waste incineration, although an important source of energy, is a way of managing waste that provides the European Union with significant quantities of pollutants, which have significant impacts on health and the environment.

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