





Reduction of Dioxin Emissions from Domestic Sources

- 2009 -

air

EUROPEAN COMMISSION

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Introduction

This brochure summarises major findings of a study launched by the European Commission in 2007 (http://ec.europa.eu/environment/dioxin/pdf/report09) to review current knowledge on domestic sources for dioxin emissions and to compile information on how to achieve emission reductions.

The main tasks of the study were:

1. **to systematically search and review the literature on dioxin emissions from domestic sources**
2. **to establish how Member States determine their national dioxin emission estimates**
3. **to identify measures taken by Member States to reduce dioxin emissions from domestic sources**
4. **to identify good practice in reducing dioxin emissions**
5. **to disseminate the findings of the study**





The findings can serve to stimulate awareness raising, exchange of good practice as well as to encourage development of new solutions and measures.

Dioxin emissions: Increasing contribution from domestic sources

Dioxins are formed unintentionally in industrial and domestic processes and can cause adverse effects on human health and the environment. Industrial emissions of dioxins peaked in the 1980s and active abatement policy has now reduced emissions from industry by up to 90%. In the same period reduction of dioxin emissions from domestic sources has been much lower and consequently domestic sources now account for more than one third of total dioxin emissions. This fraction can be as high as 70% in some regions.

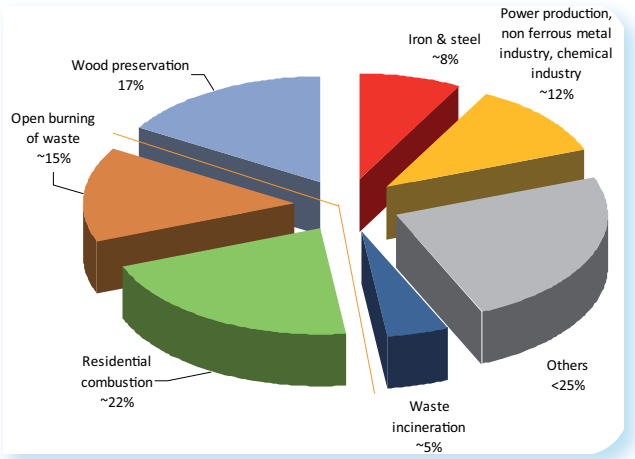


Figure 1:

Major sources for atmospheric dioxin emissions in the European Union in the year 2006 [http://ec.europa.eu/environment/dioxin/reduction.htm]

The main route for human exposure is through the food supply, mainly from products derived from the end of the food chain such as fish, meat and dairy products. Low but chronic exposure to dioxins may cause adverse effects to animal and human health because they accumulate in the body. Risk assessments have been carried out to identify the tolerable intake of dioxins. A considerable portion of the European population has a dioxin intake up to 50% above tolerable levels. Despite the efforts made to reduce dioxin emissions, they continue to pose a threat to public health. Much more thus needs to be done to reduce humans' exposure to dioxins.

Domestic sources for dioxins

Dioxins are created through the combination of heat, chemicals such as chlorine compounds and organic material. In households, dioxins may be formed during activities that involve a combustion process.

Sources with high emission potential:

- Heating and cooking with coal, wood or other biomass such as peat and straw in simple ovens
- Domestic combustion of waste or treated wood
- Backyard waste burning of waste




Sources with low dioxin emission potential:

- Garden machinery
- Barbecues
- Heating with gas and oil
- Automated boilers and stoves

Dioxin emission inventories: Assessing the problem

Inventories for emissions of dioxins are generally not derived from direct measurements but are calculated based on statistical data of fuel consumption (activity rates AR) and emission factors (EFs). EFs indicate the amount of dioxins released when a given amount of fuel goes through the combustion process. Many Member States rely on the EFs published in the UNECE Guidebook and UNEP Toolkit, whereas others apply their own factors.

As illustrated in Figure 2, considerable differences can be observed between the EFs applied by Member States for coal, wood and peat combustion. In some cases, the differences reflect the characteristics of local fuel types and technical standard of combustion devices. In other cases, EFs applied for equivalent fuels differ considerably without obvious rationale.

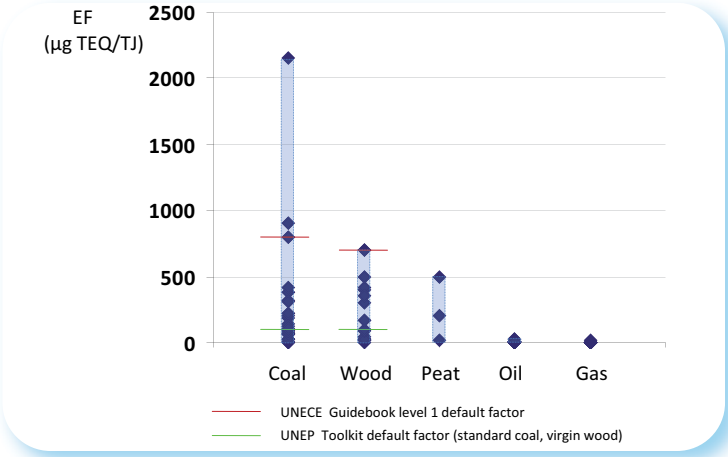


Figure 2:

Ranges of emission factors (EFs, blue dots) applied by European Member States to estimate dioxin emissions into the air from domestic combustion

The comprehensiveness and comparability of national dioxin emission inventories is limited for the following reasons:

- Inconsistent application of EFs.
- Activity rates are based on national energy statistics, and provide reliable consumption data for coal, oil and gas. However, data for wood combustion are elusive because not all wood that is combusted is commercially traded. Data concerning the burning of waste are typically comprised of vague estimates due to the illegal nature of this activity.
- The present level of detail for the reporting of activity rates does not allow for comprehensive assessment of dioxin emissions from all domestic sources. Some Member States try to close this data gap by improving their inventories with the help of other sources such as census data and sales statistics.

Emission Reduction: The current state

Dioxin emissions are affected not only by dioxin specific measures but also by synergies that result from programmes aiming to reduce other types of pollution. The following pages illustrate and discuss measures taken by Member States that result in reductions of domestic dioxin emissions.

Efforts to reduce dioxin emissions from domestic sources are promoted by EU environmental policies:

- Energy efficiency measures resulting from climate change policy
  - Energy Performance of Buildings
  - End-use Energy Efficiency and Energy Services
- Provisions to reduce air pollution
  - Air Quality Directive

National and regional policies that result in the reduction of domestic dioxin emissions:

- Bans on backyard burning and domestic combustion of waste
- Promotion of district heating
- Campaigns on improved heating
- Replacement of fuel

Elimination of domestic waste burning: An essential step for improvement

Open burning of waste is not only a nuisance but it also releases pollutants that are dangerous to human health and the environment. This practice may account for 40% of EU-wide domestic dioxin emissions. A legal ban of domestic waste burning is necessary and needs to be supported by awareness raising campaigns.

One kg of waste openly burned may cause the same amount of dioxin emissions as 10 tonnes of waste burned in a modern incineration plant

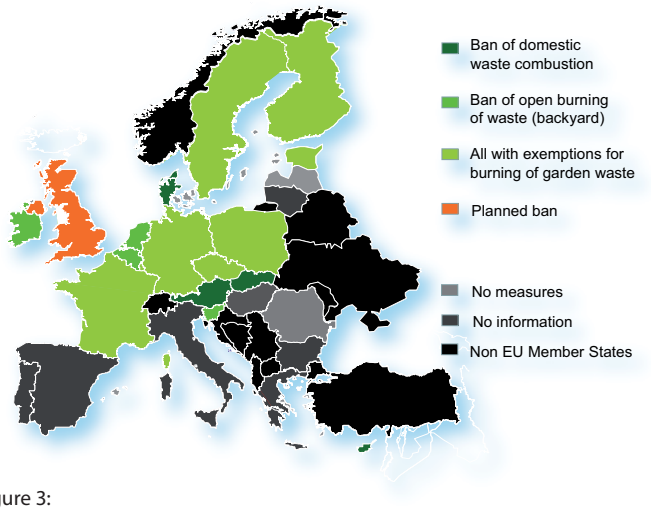


Figure 3:
Bans of domestic waste combustion in European Member States

Elimination of waste burning means the replacement of domestic waste combustion by using regular fuels or, in the case of backyard burning, ensuring waste treatment in dedicated facilities.

As illustrated in Figure 3, the majority of Member States, but not all, have established such bans on domestic waste burning.

Awareness raising is critical for the success of this measure. Campaigns should aim to

- convince the general population that stopping the domestic burning of waste is to the benefit of their health and their local environment
- stress hidden dangers from burning materials such as PCP treated wood pallets
- provide guidance for home composting and the expansion of public waste collection services

Reduction of fuel consumption = reduction of dioxins

In the European Union climate change is a policy priority. Programmes to increase energy efficiency, improve insulation, use solar energy for domestic heating and reduce fossil fuel consumption not only address climate change but also reduce dioxin emissions.




- Improved insulation and temperature regulation of dwellings and solar energy can cause energy savings and thus can reduce emissions by 40-60%.
- Emission reductions can also be achieved by using modern appliances with improved dioxin emission factors and/or lower fuel consumption.
- Increased efficiency and lower emission factors may also be achieved if smallest appliances (< 15 kW) are subject to minimum technical requirements and regular monitoring.

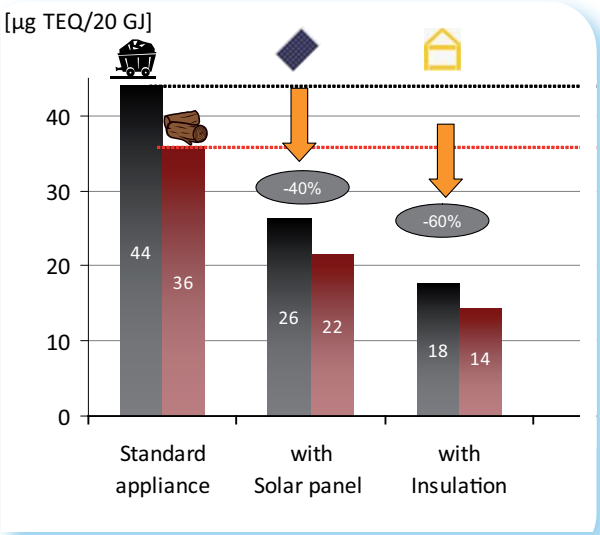


Figure 4:

Dioxin emissions and reduction potential of measures for increased energy efficiency for an average household combusting coal or wood and with a net heat consumption of 20 GJ/a.

Replacement of old appliances: An opportunity for switching fuels

In the domestic sector, the type of fuel and the appliance used for heating are the main determinants for the amounts of dioxins released. Replacing old appliances with new ones offers the possibility of changing fuels which may result in even lower levels of dioxin emissions.

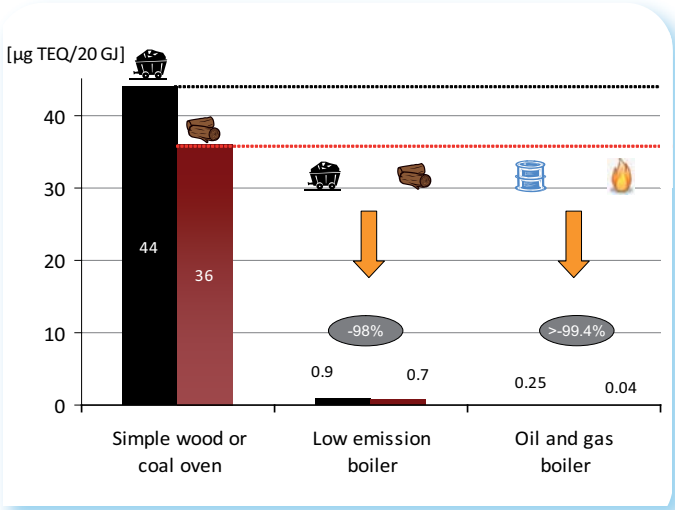


Figure 5:

Dioxin emissions and reduction potential as a function of appliance type and fuel (per average household)

The replacement of a simple wood or coal oven with an advanced boiler fired with the same (solid) fuel results in a reduction of dioxin emissions of more than 95%. A change to a gas or oil fired boiler reduces dioxin emissions further.

Decisions to continue firing with a given fuel or to switch may be guided by overriding considerations:

- Security of energy supply and energy independence
- Use of wood as renewable fuel
- Comfort and ease of operation of a liquid or gas fired appliance

Information campaigns can support the decision process.

District heating: An alternative to conventional appliances

District heating comprises a centralised heat supply to households. Modern combined heat and power plants (CHP) can reduce both industrial as well as domestic dioxin emissions.

Large scale district heating is typically limited to urban areas. Small decentralised heating plants are an option for residential or rural areas. If district heating uses heat that otherwise would be lost, the reduction of dioxin emissions is the result of lowered fuel consumption.

With respect to dioxin emissions, the reduction potential of district heating is a function of the differences of

- the emissions factors that apply
- the energy efficiency of the appliances
- the losses during transport

Replacement of conventional stoves by district heating results in a reduction of dioxin emissions. District heating offers flexibility with regard to the use of fossil and renewable fuels. District heating systems may be supplied with geothermal energy and may also allow for more economically favourable operation of solar energy, thereby contributing to a further reduction of emissions of dioxins and other pollutants.

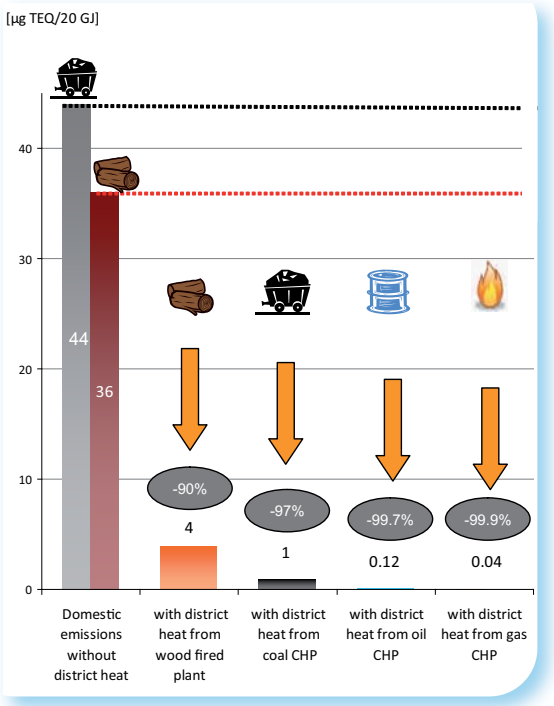


Figure 6:

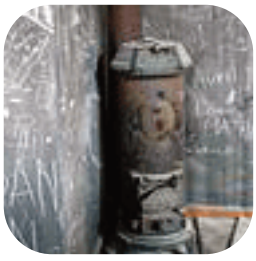
Yearly reduction potential of district heating (in µg TEQ per average household)

Summary

Dioxin emissions continue to pose a threat to human health and domestic sources now account for a significant proportion of such emissions. The study reviewed current knowledge on dioxin emissions from domestic sources and scrutinised a number of measures to tackle dioxin emissions. The main conclusions can be summarised as:

- **The main domestic sources of dioxins are heating and cooking with solid fuels and burning of waste.**
- **Emission reduction potentials are high and even simple measures can reduce emissions by up to 80%.**
- **Reduction of dioxins from domestic sources is achieved by direct measures such as a ban of domestic waste burning. Such a ban would be desirable in all Member States.**
- **Other policies such as those related to climate change and clean air contribute to the reduction of domestic dioxin emissions.**
- **Awareness raising and education on the potential health and environmental effects of dioxins is crucial for public acceptance and application of measures that reduce dioxin emissions.**
- **Information exchange, coordination and harmonisation of emission data in estimating national dioxin emissions are necessary to obtain more reliable and comparable inventories.**

Per capita fuel consumption, fuel type used and climatic conditions vary considerably within the EU. The final report provides detailed information to individually assess the reduction potential for domestic dioxin sources in each Member State.





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