World Health Organization

Frequently Asked Questions

WHO guidelines for indoor air quality: household fuel combustion
November 2014

1. Why have these Guidelines been developed?

Controlling pollution emission rates from household energy use is one of the most effective ways of ensuring cleaner air in the home, as this addresses the problem at source for the nearly 3 billion of the world's poorest people who still rely on solid fuels (wood, animal dung, charcoal, crop wastes and coal) burned in inefficient and highly polluting stoves for cooking and space heating. The resulting household air pollution (HAP) led to more than 4 million premature deaths among children and adults in 2012.

Well over 1 billion people also have no access to electricity (and many more have unreliable supplies), and rely on simple kerosene lamps which are an additional and important source of household air pollution.

The use of traditional fuels for household cooking, heating and lighting also puts household members, particularly children, at high risk of injury (e.g. from falling into fires, spilled fuel, etc.) and poisoning (from ingesting kerosene).

WHO's new indoor air quality guidelines have been developed to inform policy and decision-makers as they design and implement programmes to mitigate the impact of health-damaging household pollutants and fuels. The main focus is on low- and middle-income countries, where the burden of disease is by far the greatest, but consideration is also given to higher income countries where biomass is widely used for heating in mainly rural areas.

2. What are the specific health consequences of exposure to household air pollution?

In poorly ventilated dwellings, emissions of $PM_{2.5}$[1], and other pollutants can be 100 times higher than WHO-recommended levels. Such pollutants inflame the airways and lungs, impairing immune response and reducing the oxygen-carrying capacity of the blood.

Of the 4.3 million people who die annually from exposure to household air pollutants, most perish from stroke (34%), ischaemic heart disease (26%) and chronic obstructive pulmonary disease (22%). Pneumonia and lung cancer account for 12% and 6% of deaths, respectively.

Women and young children, who spend the most time near the domestic hearth, are particularly vulnerable. More than 50% of pneumonia deaths among children under 5 are linked to household air pollution.

[1] PM2.5 particles are air pollutants with a diameter of 2.5 micrometers or less, small enough to invade even the smallest airways.

3. Why are Guidelines being released now?

Access to modern household energy is critical to the achievement of global health, development and environmental (including climate) goals. The release of these new WHO guidelines is timely as the global community transitions toward a more sustainable and equitable future, guided by the post-2015 sustainable development framework. This objective is promoted by a number of initiatives including the UN Secretary-General's Sustainable Energy for All initiative, the UN Foundation Global Alliance for Clean Cookstoves and the Climate and Clean Air Coalition.

4. What is overall objective of the Guidelines?

These guidelines aim to inform and support governments and their partners in the energy, health and development sectors, to transition to modern household energy as quickly and equitably as possible. All household combustion sources are considered, especially those used for cooking, heating and lighting.

Specifically, the guidelines consider the following:

- What fuel emission rates (in home devices for cooking, heating and lighting) are required to meet the WHO air quality guidelines?
- Given the challenges of securing the rapid adoption of low-emission household energy devices and fuels—particularly in low-income settings—what approach should be taken during the transition?
- Should coal and kerosene be used as household fuels? i.e. what are the health implications of continuing to use coal and kerosene for home energy needs?

5. How were the Guidelines developed ?

The guidelines were developed and peer-reviewed by scientists from all over the world. They were informed by a rigorous review of currently available scientific knowledge on this subject, following strict criteria for the evaluation of evidence established by the WHO which are standard for these types of evaluation.

These guidelines provide practical guidance for achieving the safe pollutants levels set forth in the *WHO's 2005 Air quality guidelines: global 2005 update*. They are the third in a set of three WHO indoor air quality guidelines. The first set of indoor air quality guidelines focused on dampness and mould (2009); the second on selected pollutants (2010); and the third (2014) on household fuel combustion.

6. Do the guidelines only address the health impacts from cooking? Or are recommendations on other household energy end uses (e.g. lighting, space heating) included?

These guidelines provide recommendations for **all** household fuels and technologies. The emission rate targets and guidance on specific fuels should apply to all devices and fuels used in the home including those used for space heating, lighting, and cooking.

7. What are the key recommendations ?

The guidelines include four key recommendations and one good practice recommendation.

Recommendation 1: Emissions from household fuel combustion should not exceed

WHO-recommended targets for $PM_{2.5}$ and Carbon Monoxide (CO).

Controlling pollution emission rates from household energy use is one of the most effective ways of ensuring cleaner air in the home, as this addresses the problem at source. It is also a practical approach, as emission rates of different technologies can be tested and certified, allowing both implementers and users to make informed decisions about the cleanliness and safety of the technologies being used in the home.

Recommendation 1 provides emission rate targets (ERT) for this purpose. Given the fact that the great majority of the disease burden from HAP is in LMICs, the ERTs have been designed for housing and device usage conditions typical of those in developing countries, although the approach can be adapted to higher income settings.

Specifically this recommendation specifies that emissions of $PM_{2.5}$ should not exceed 0.23 mg/min when unvented (i.e. without a chimney or hood) and 0.80 mg/min when vented (i.e. with a chimney or hood). ERTs for carbon monoxide should not exceed 0.16 g/min for unvented devices and 0.59 g/min for vented devices. If these targets were achieved, 90% of homes using the devices for all home energy needs (i.e. heating, cooking, lighting) would meet WHO's air quality standards, assuming typical values [as presented in Recommendation 1, Table R1.1] for kitchen (or other room in which device is being used) size, air exchange rates, and duration of use per day obtained from studies carried out in developing countries.

This recommendation is intended to serve as a practical guide. Emission rates test results obtained in laboratory conditions might differ from emission rates in the home, and multiple fuels/technologies need to be taken into consideration. Consequently, evaluation of actual use on homes, and resulting HAP concentrations, is an important complement to application of the ERTs.

Recommendation 2: Governments and their implementing partners should develop strategies to accelerate efforts to meet the emission rate targets of these air quality guidelines.

Evidence reviewed for these guidelines has shown that in order to meet WHO air quality guideline levels, particularly for $PM_{2.5}$, clean fuels need to be prioritized.

Given the challenges in achieving rapid transition to clean fuels in many developing countries, particularly among homes with lower incomes and in more rural areas, it is expected that intermediate steps using improved solid fuel devices will be required. Where this is the case, transition fuels and technologies that offer substantial health benefits should be prioritized, using the ERTs as a guide. (See question 8 for recommended transition fuels).

Recommendation 3: Unprocessed coal should not be used as a household fuel.

Emissions from the household use of coal have been determined by the International Agency for Research on Cancer to be carcinogenic. Furthermore, unprocessed coal often contains toxic elements such as arsenic, fluorine, lead, selenium and mercury which are not destroyed when the fuel is burned, and have been linked to serious adverse health impacts among populations using these fuels.

The incomplete combustion of coal in inefficient stoves and space heaters has been shown, as with other solid fuels, to lead to multiple illnesses and premature death.

Recommendation 4: The household use of kerosene is discouraged while further research into its health impacts is conducted.

The use of kerosene as a household fuel is discouraged amid concerns around high emissions of health-damaging pollutants. Safety is another key concern—the associated risk, for example, of burns, fires and poisoning is high amongst households using kerosene for cooking and heating purposes.

Good practice recommendation: securing health and climate co-benefits

Considering the opportunities for synergy between climate policies and health—including financing—WHO recommends that governments and other agencies developing and implementing policy on climate change mitigation consider action on household energy and carry out relevant assessments to maximize health and climate gains.

8. What are the best alternatives to solid fuels recommended by WHO in low and middle-income settings?

Although there are a only a few studies looking directly at the health impacts of clean fuels like biogas, ethanol, liquefied petroleum gas (LPG), and natural gas, evidence from emissions testing suggest that these fuels along with electricity are the best alternatives to solid fuels in low- and middle-income countries for reaching PM and CO pollutant air quality guidelines levels. Policies for household energy should focus on extending access to clean fuels as widely as possible across communities. Safety should not be assumed, however, and testing and regulation of safety should also be applied to clean fuels as for solid fuel stoves.

In households currently relying on solid fuels and/or kerosene, LPG is the clean fuel alternative most widely available. In urban and peri-urban areas electricity may be the best option, and in other settings biogas and ethanol can make an important contribution. To date, however, there have been relatively few studies evaluating the impact of LPG and other clean fuels on household air pollution and health, and/or their impact on safety.

Improved solid fuel stoves will continue to make an important contribution to the needs of a substantial proportion of lower income and rural homes, where the use of clean fuels may not be feasible for some time to come. Efforts to improve solid fuel stoves should continue in parallel with—but not hinder or displace—efforts to encourage the transition to clean fuels.

The rate of adoption and sustained use of modern, clean and efficient household energy will differ according to socio-economic circumstances, geography and other factors. Assessment of the potential for adoption and market development for the various technology and fuel options within countries is important for policy development.

9. Are there other consequences for development, beyond direct impacts on human health?

Polluting household fuels also endanger the health of the planet: emissions of black carbon and methane from low-efficiency stoves contribute to outdoor air pollution and increase the rate of climate change. Globally, around one quarter of black carbon emissions can be attributed to household biomass use.

In many regions, fuel gathering for traditional stoves consumes considerable time for women and children, limiting other productive activities—such as income generation—and taking children away from school. More efficient cooking stoves and fuels would reduce the

workload for women and children and decrease the demand on scarce natural resources (e.g. forests). This will free time needed for cooking and collecting wood which can be used for education and productive activities, and reduce exposure of women and children to risks of violence while collecting wood.

Modern lighting also offers the opportunity for children to complete school work efficiently and in safety, and for family members to conduct income-generating activities.

10. In which regions of the world/countries is the population exposure to indoor air pollution highest?

Although the scope of the guidelines is global, the focus is on low- and middle- income countries where the disease burden is by far the greatest.

In 2012, there were 18 countries where more than 95% of the population primarily relied on solid fuels for cooking. Most of these countries are in sub-Saharan Africa. In the same year, more than 1 million premature deaths in both India and China can be attributed to household air pollution exposure.

11. Is household air pollution a health issue in high-income countries?

Household air pollution resulting from fuel combustion presents less of a health risk in high-income countries. However, it remains an issue in settings where solid fuels (mainly wood and other biomass) and kerosene are used for space heating, particularly where the devices used are old, leaky and achieve relatively low combustion efficiency. Emission rate targets based on regionally-appropriate input data (room/home volume, air exchange rates, duration of use, and % of total emissions leaking into the home) can be used to ensure that the majority of homes do meet AQG levels for PM2.5 and CO. Recommendation 1 proposes research to obtain such regionally-adapted data, and to develop an interactive version of the emission model which will allow member states (MS) and other users to calculate ERTs suitable for specific settings, technologies, device use and housing type.

The use of solid fuels (mainly biomass, also coal) for space heating does contribute significantly to ambient air pollution in many higher income country settings. Reducing emission rates from such devices, along with encouragement to use cleaner fuels, is an important concern for air quality management, and for climate policy.

12. What challenges will low- and middle-income (LMIC) countries face in implementing the guidelines?

Globally, the reliance on traditional solid fuels is closely linked to poverty. As such, securing a rapid transition to clean, efficient and modern household energy systems for cooking, heating, lighting and other household uses will present challenges, especially for lower-income households.

WHO acknowledges that implementing these recommendations will require a coordinated effort from ministries and other national stakeholders (NGO, public and private sectors), with regular input from international development and finance organizations. WHO will be supporting Member States to develop national strategies which includes identifying needs and potential resources to better ensure that even the poorest households are able to adopt clean energy and improve their health.

13. Emission rate targets are provided. How are countries going to be able to measure the emissions from all the different devices/technologies/fuels used in homes?

Currently, there is a global effort underway to develop international standards for cookstoves. WHO is actively engaged with this International Organization for Standardization (ISO) process to ensure that health and safety are key considerations in the new international cookstove standards.

To facilitate the application of such standards for technologies, regional testing centers are being established to test both the technical performance and safety of different local home energy devices. With this information, local populations and other stakeholders can make more informed and health-wise decisions about the types of home energy solutions used.

14. Have any LMIC countries successfully transitioned from solid to clean fuels?

Many LMIC households have made their own (often incomplete) transition from traditional solid fuel use to more modern home energy—such as liquefied petroleum gas (LPG), natural gas, ethanol and electricity—as their socioeconomic circumstances improved. Globally, between 1980 and 2010, the percentage of homes relying primarily on solid fuels for cooking fell from 60% to 41%. However, with population growth, the actual number of solid fuel users has remained stable at 2.8 billion over the same period.

Some large national programmes have been able to implement or support a transition to cleaner stoves and fuels. For solid fuels, China introduced more than 100 million improved chimney stoves, many of which are still in use, and for which studies have shown evidence of important health benefits. For clean fuels, Indonesia implemented a very large project enabling more than 40 million homes to convert from kerosene use to LPG, leading to economic savings for both government and households due to the higher energy content per unit cost of LPG compared to kerosene. Brazil used targeted financial assistance to support access to LPG for low-income families.

15. How will WHO support this process?

WHO will work closely with countries to support the implementation of these guidelines including through its regional and country offices. Lessons learned from this implementation in countries will inform future revisions of WHO guidelines and tools.

WHO will continue to monitor—on a global scale—the use of household energy fuels and rates of household air pollution. The information is compiled and shared periodically in the following databases:

Household energy: http://www.who.int/indoorair/health_impacts/he_database/en/

Household air pollution: http://www.who.int/indoorair/health_impacts/databases_iap/en/

WHO will also promote research to identify the effectiveness of interventions to improve energy efficiency and fuels on public health, including the sustained adoption of these technologies in the home.

16. Where can I find the new WHO guidelines for indoor air quality: household fuel combustion?

All information related to the guidelines including the full guidelines themselves, the executive summary (translated into Arabic, Chinese, French, Russian and Spanish) and supporting evidence reviews can be found online at: www.who.int/indoorair/guidelines/hhfc.

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