

Atmospheric Effect – A Global Hazard

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ABSTRACT

Carbon dioxide is a natural constituent of atmosphere, but now its concentration is increasing at an alarming rate. According to an estimate, carbon dioxide level rose from 280 ppm to 320 ppm in the troposphere over the period 1870 to 1970. The atmospheric concentration of carbon dioxide has risen by almost 30 per cent since the Industrial Revolution. Both the current concentration of about 379 parts per million (ppm) – compared with 280 ppm in the pre-industrial era - and the current rate of increase is approximately 2 ppm per annum.

Recent evidence revealing on almost a weekly basis to link rises in man-made carbon dioxide in the atmosphere with the real and immediate threat that Global climate change presents to our environment, people and communities. Arctic climate impacts assessment warned that Arctic temperature have risen by almost twice the global average over the past 50 years. This increase looks set to continue, with a further rise of between 4C and 7C possible by 2100AD.

The Greenland ice sheet was retreating at a rate of around one metre a year in 2001, according to NASA study. The latest study indicates it is moving back at about 10 metres a year. If the Greenland ice sheet were to melt, the sea level would rise by between six and seven metres. That would create a major problem for coastal cities.

The time is right for action, and it must be taken quickly. We have the technologies to deal with this or the scope to develop them. Action is affordable. Inaction is not. The Kyoto protocol which was accepted by the 55 developed and developing nations is going to come to force from the month of February 2005 will do much to re-invigorate the international climate change process.

The good news is that we now understand what is happening and therefore what we must do to address this. Recently 196 countries in the world on April 22nd 2015 signed on Paris agreement in UNO to reduce Green house gas emissions drastically.

1. Introduction

In Kyoto, in 1997, for the first time since the climate discussion started, an international and legally binding agreement to reduce emissions of greenhouse gases was signed by most industrialized countries. Its intent was to prevent a rise in global temperature to dangerous levels above the preindustrial era. This agreement ends in 2012. It was hoped that the Dec. 2009 conference in Copenhagen would achieve an extension of the contract and include the remaining industrialized countries (including the U.S.) and important middle income countries. This failed to materialize. In Dec. 2010, in Cancún the complex process of negotiations was restarted and some important agreements were signed. However these agreements fall far short of achieving the goal of the 2°C limit. The climate summit in Durban in Dec. 2011 once more failed to agree on new and binding measures. Its final decision to continue the talks in order to achieve a new agreement by 2015 to be implemented from 2020 onwards for some observers is a sign of hope, for others a complete disappointment. It remains absolutely essential to agree on more decisive reduction measures. Time is running out. Projections need to be revised again and again as it becomes apparent that global warming is occurring more rapidly than previously expected (World Bank 2010 a).

The 4th report of the Intergovernmental Panel on Climate Change (IPCC) specifies health as one of the five areas most likely to be heavily influenced by climate change (IPCC2007).

And the World Development Report of the World Bank 2010 summarizes the most important consequences of climate change above 2°C to be:

- Significant loss from the Greenland and West Antarctic ice sheets and subsequent sea-level rise.
- Increase of floods, droughts, and forest fires in many regions.
- Increase of death and illness from the spread of infectious and diarrhoeal diseases and from extreme heat.
- Extinction of more than a quarter of all known species.
- Significant declines in global food production (World Bank 2010 a).

2. Temperature rise and health

There is no doubt: human health will be influenced all over the world. However, existing and future consequences will depend very much on the social and geographic situation of the population. The consequences will sometimes be only marginal but frequently heavy. Rarely will they be positive.

Often they will be catastrophic. Climate change affects health via a cascade of different mechanisms.

Direct effects are diseases and deaths as a result of extreme weather events like heat, flooding, mud slides, storms and hurricanes. **Indirect** effects are those that result from changes in the ecosystem, such as conditions that facilitate infectious diseases, changes in agricultural production, and the availability of (clean) water. But climate change can also have indirect effects on health from the social and economic turmoil brought on by drought, flooding, famine, epidemics and movement of refugees. Health care delivery systems too can suffer from the consequences of climate change

The impact of climate change on health is quite complex and different factors sometimes act as cause and at other times as effect. Interdependencies are the rule rather than the exception. Therefore even in industrialized countries research needs are still manifold (Portier 2010), and for developing countries they are considerable too (Dube 2009). Therefore, at the moment, predictions of the direction and quantity of climate change induced health consequences involve a degree of uncertainty. The World Health Organisation (WHO) assigns increasing importance to the relation between climate change and health. The 61st World Health Assembly in 2008 dealt with the topic extensively and appealed to all governments in the world to take counteraction (WHO 2008 b). And the director general, Margret Chan, considers climate change to be the most important health challenge of the 21st century (WHO 2010 d). The European Union too increasingly recognizes the relevance of the topic. At their 5th conference the European Ministers for Environment and for Health jointly adopted the "Parma Declaration on Environment and Health" and at the same time launched an action plan: European Regional Framework for Action: "Protecting health in an environment challenged by climate change" (WHO 2010 e).

3. Consequences of climate change in the health sector

Increasingly frequent extreme weather events have already had detrimental effects: the heat waves during the summer of 2003 resulted in an excess mortality of 70 000 lives in Western Europe. In Germany, in spite of a well functioning, country-wide health system, more than 9000 people died as a direct result (Robine 2007) – a fact that has not been sufficiently appreciated by the public. In addition to health consequences which are the direct result of climate change, a number of indirect results are being discussed, partly those that are already discernible, partly those that are expected in the future.

4. The most important ones are

- an increase in allergic reactions as a result of extended flowering periods of relevant plants as well as the prevalence of newly "imported" plants like *Ambrosia artemisiifolia* (Richter-Kuhlmann 2010);

- the rise of the average temperature most likely will result in an expansion of rodents which in turn act as transmitters for viruses, bacteria and parasites (Meerburg 2009);
- survival and reproduction of mosquitoes may increase as a result of global temperature rise. In Sept. 2010 in Nice the first autochthonous Dengue infection was documented (Robert Koch-Institut. 2010). In Ravenna the first case of Chikungunya-fever was diagnosed in 2007 and its transmitter, the *Aedes* mosquito was found near the Lower Rhine in 2007 (Hibbeler 2009).

Additional dangers are being discussed: The spread of ticks as a result of global warming will increase the threat of Borreliosis and Meningoencephalitis; toxic sea algae grow better in warmer temperatures. Although still controversial if climate change results in an increase of UV radiation there will be an increase in skin cancer as well as an earlier and more frequent occurrence of ocular cataracts (US Global change 2011).

5. Protection against short- and long-lived emissions

The Kyoto Convention to reduce greenhouse emissions (in industrial countries) exclusively refers to the anthropogenic gases mainly responsible for the greenhouse effect causing global warming. They are carbon dioxide, methane, nitrous oxide and halocarbons (plus Sulfur hexafluoride. These "long lived" emissions partly remain in the atmosphere for centuries and therefore have long term effects on the climate. For this reason climate specialists almost exclusively deal with the reduction of these emissions. These "classical" greenhouse gases however do not have a direct negative effect on human health. They are not toxic (in atmospheric concentrations).

Together with the origination of "Kyoto-gases", however, other emissions are generated usually. They have much less – or scarcely any – greenhouse effect and therefore hardly any effect on global warming. These – being not covered by the Kyoto protocol – are however the ones which have immediate negative health effects. These short lived emissions – they remain in the atmosphere only for days, weeks or months – are the ones having direct and immediate negative health effects: partly themselves like organic carbon aerosols and sulfate predecessors, partly – like methane and nitrogen oxides – after having been converted into ozone by chemical reactions in the atmosphere. Carbon monoxide and non-methane-volatile-organ-compounds act via both mechanisms. These immediately toxic, short-lived emissions are emitted by the same processes that generate long-lived emissions. Thus a reduction in CO₂-emissions usually results in a reduction of short-lived emissions as well. The contribution to people's health is immediate (Smith 2009).

Short-lived emissions and their effects on health are – simplified – are shown here:

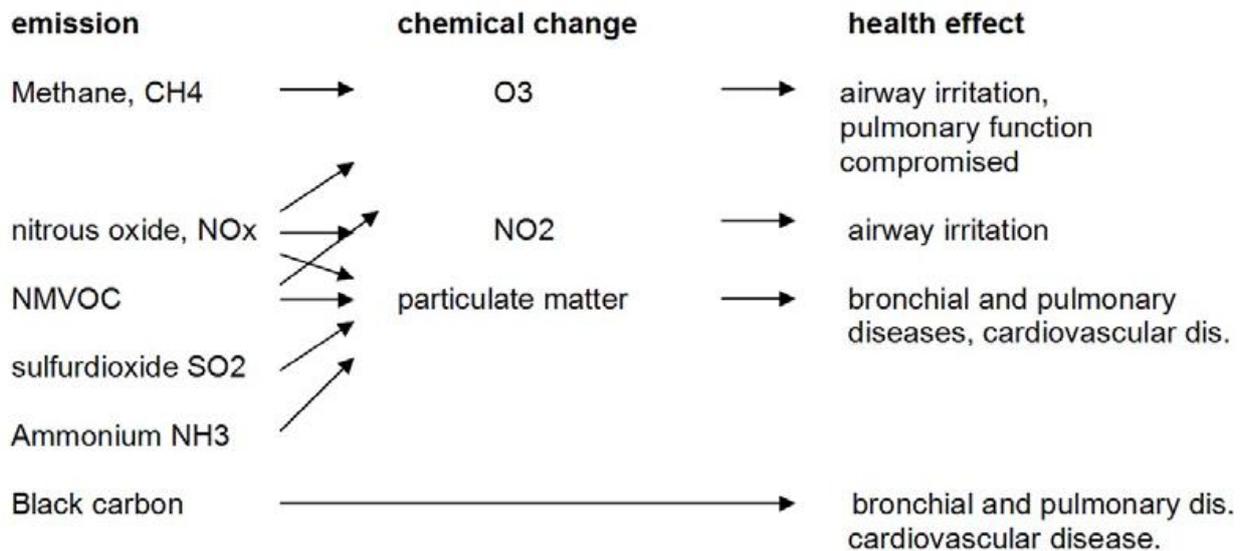


Fig: Chemical changes and health effects of short lived greenhouse emissions (Umweltbundesamt 2009)

6. Health interventions help mitigate climate change

Not only do mitigation interventions frequently have substantial health co-benefits, but health interventions on the other hand can have mitigation benefits. An increase in “active transport” referring to more cycling and walking instead of riding a car or public transport has positive health and climatic effects (Haines 2009); by reducing – for health reasons -the consumption of meat and animal products in England by 30 % heart disease would drop by 15 % (Martin 2010). If consumption dropped by 60 %, 30,000 premature deaths per year could be avoided (Scarborough 2009). Cattle raising and dairy production is responsible for almost 20 % of all greenhouse emissions. Reducing consumption would also lessen the emissions resulting from the fossil fuels utilized in these industries and result in further mitigation (Friends of the Earth 2010). In both of these examples, preventive health measures result in mitigation and climate “co-benefits”. But one could also see these as examples where mitigation produces health “co-benefits.” Another example found in developing countries is the introduction of fuel efficient stoves. The smoke of traditional cooking stoves used currently by about 3 billion people in the world using wood, charcoal, dried dung and other forms of biomass has dire consequences on people’s health. About 1.5 million people around the world die each year from respiratory infections and chronic lung and heart-diseases for which traditional stoves are either the cause or an important cofactor. Most of the victims are children but the figure includes mothers and other adults as well. The introduction of energy efficient stoves therefore can be seen as a health intervention and the attendant reduction of CO₂ and other emissions is a welcome side effect. Better stoves save fuel and therefore reduce the labor required to collect it, reduce workloads, support greater gender equality and diminish poverty. Regardless of the prospect clean and efficient cook stoves are considered under, there are big advantages for users. They should be a high priority. its “100 by 20” campaign (Global alliance for clean cook stoves 2011).

7. Conclusions

1. Internationally Ministries of Health, professional bodies, health institutions and all organisations dealing with health should not only be concerned with adaptation but urgently need to play an important role in promoting mitigation

- because of the immediate health co-benefits of mitigation interventions;
- because the health sector is energy intensive and contributes substantially to global warming;
- because of the negative health effects of global warming for the world population.

2. All international, multilateral and bilateral donors and agencies dealing with development cooperation

- need themselves to be aware of health co-benefits of adaptation and mitigation interventions in developing countries;
- need to emphasize this aspect in the design and implementation of cooperation programs;
- should support developing countries to see this link more clearly;
- need to introduce an environment and climate check in all their programs to make sure this aspect is taken seriously and implemented across board.

3. Overall donor countries need to substantially increase their contributions to funds that assist developing countries, in particular those most vulnerable, in adaptation to climate change, such as the Least Developed Countries Fund, the Adaptation Fund and the Green Climate Fund. Awareness of the health and climate change links should be promoted in this context.

4. The international - health discussion needs more emphasis on climate change mitigation.

- **Climate change mitigation** through the reduction in the use of fossil fuels will have long term effects on

global warming. It will also have immediate and mid-term consequences on health through the reduction of diseases.

- The immediate and mid-term health co-benefits of mitigation mainly materialize in the vicinities where emissions arise. They result from the reduction of short lived emissions along with the reduction of longer-lived greenhouse emissions.
- Long-lived greenhouse emissions are not directly detrimental to health. They develop their negative health affects only indirectly via global warming, but

coincidental short lived emissions produce negative health effects.

- The immediate health co-benefits are in the direct interest of the population. This applies to emission centers in industrialized as well as developing countries. The reduction of these health problems produces substantial cost savings for the health sector. For all these reasons climate change mitigation in industrialized as well as developing countries is urgent.

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