

1) From: Nickolas Themelis to WHO Communications Office, Dec 9, 2008

To: Setiogi, Sari; Osseiran, Nada WHO

Sent: Tue Dec 09 03:46:30 2008

Subject: Correction needed in WHO Dioxins "Fact"sheet

Sari Setiogi Telephone: +41 22 791 3576 setiogis@who.int

Nada Osseiran Telephone: +41 22 791 4475 osseirann@who.int

Dear Sari and Nada,

The WHO publication <http://www.who.int/mediacentre/factsheets/fs225/en/index.htm> contains a grossly misleading statement (redlined sentence below) to the effect that

“Dioxins are mainly by products of industrial processes but can also result from natural processes, such as volcanic eruptions and forest fires. Dioxins are unwanted by products of a wide range of manufacturing processes including smelting, chlorine bleaching of paper pulp and the manufacturing of some herbicides and pesticides. In terms of dioxin release into the environment, waste incinerators (solid waste and hospital waste) are often the worst culprits, due to incomplete burning .”

We have studied this matter extensively at Columbia University and an entire thesis has been written on the subject of sources and effects of dioxins from incinerators of municipal solid wastes and all other sources. While it is true that until the late eighties incinerators were a major source of dioxins in the US, implementation of the MACT rules of USEPA by the US waste-to-energy industry (activated carbon injection fabric bag filters, etc.) by 2000 reduced WTE dioxin emissions by a factor over one thousand . The total annual dioxin emissions of all the WTE plants are now less then ten grams TEQ dioxins. The same is true of the EU , Japanese and other modern incinerators.

I see that both of you are responsible for the WHO Environment and Health Communications. Please check the facts (e.g. the thesis I mentioned contains many other references http://www.seas.columbia.edu/earth/wtert/sofos/Deriziotis_thesis_final.pdf) and have the authors of the above WHO report correct the above statement.

Sincerely, Prof. Nickolas Themelis, Columbia University

2) Dr. Angelica Tritscher to Prof. Themelis, 12/12/2008 9:20 AM:

Dear Mr Themelis,

many thanks for your interest in our dioxin fact sheet and your comments.

I would like to comment on this and clarify as follows.

As stated in the Stockholm BAT/BEP guidelines (shortened):

Polychlorinated dibenzo-*p*-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) are unintentionally formed in industrial-chemical processes, such as chemical manufacture, and thermal processes, such as waste incineration. Although the mechanism of formation has been studied extensively in combustion-related processes and to a lesser extent in non-combustion-related chemical processes; even so, the mechanisms and exact formation conditions are not fully resolved. It is clear that the predominant mechanism or pathway can vary from process to process so that different factors become controlling and there is no universal controlling factor.

In thermal processes, carbon, oxygen, hydrogen and chlorine, whether in elemental, organic or inorganic form, are needed. At some point in the synthesis process, whether present in a precursor or generated by a chemical reaction, the carbon must assume an aromatic structure. There are two main pathways by which these compounds can be synthesized: from precursors such as chlorinated phenols or de novo from carbonaceous structures in fly ash, activated carbon, soot or smaller molecule products of incomplete combustion. Under conditions of poor combustion, PCDD/PCDF can be formed in the burning process itself. The mechanism associated with this synthesis can be homogeneous (molecules react all in the gas phase or all in the solid phase) or heterogeneous (involving reactions between gas phase molecules and surfaces). PCDD/PCDF can also be destroyed when incinerated at sufficient temperature with adequate residence time and mixing of combustion gases and waste or fuel feed. Good combustion practices include management of the “3 Ts” – time of residence, temperature and turbulence, and sufficient excess oxygen to allow complete oxidation. Use of a fast temperature quench and other known processes are necessary to prevent reformation.

In industrial-chemical process, as with thermal processes, carbon, hydrogen, oxygen and chlorine are needed. PCDD/PCDF formation in chemical processes is thought to be favoured by one or more of the following conditions: Elevated temperatures (> 150 °C); alkaline conditions; metal catalysts; ultraviolet (UV) radiation or other radical starters.

As you may be aware, UNEP has a program on a global dioxin inventory, and from this one can conclude the following:

From national inventories it can be concluded that in developed countries with dioxin legislation in place, emissions from waste incinerators decreased steadily over the last years; in countries without legislation waste incinerators still contribute quite a lot. However, in these countries, the secondary metal industry is the largest dioxin source. Pulp and paper is not identified as prime sources in any of the economies around the world.

So in summary, and from a worldwide perspective, waste incineration is still an important source for dioxins. Also open household and garden waste burning in open 'backyard fires' have been identified as sometimes important source.

So as such we still believe that the statement in our fact sheet is in principle correct, but we will use the opportunity of this new dioxin incident to update the fact sheet and refine the specific paragraph on the sources.

Many thanks and best regards.

Dr Angelika Tritscher

WHO Joint Secretary to JECFA and JMPR

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3) Prof. Themelis to Dr. Tritscher, WHO Joint Secretary, JECFA and JMPR, Fri, 12 Dec 2008 20:22:14 -0500

Dear Dr. Tritscher,

Many thanks for your thoughtful response and I agree with you that during the incineration of chlorine-containing compounds exist the right conditions for the formation of dioxins and furans. For example, during forest and landfill fires large amounts of dioxins are formed. Here in the U.S., after the implementation of MACT rules (equivalent to BAT regulations in EU), "backyard barrel burning" is identified by USEPA as the major source of dioxin/furan emissions (550 g TEQ out of a total U.S. -excluding forest fires- of about 1100 g TEQ).

Globally, there are about 600 waste-to-energy (WTE) incinerators that use as fuel an estimated 170 million tons of solid wastes. Globally, there are hundreds of thousands and possibly millions of other types of incinerators since biomass remains a major fuel source in the developing world. What is the difference? Nearly all WTE incinerators, with a few exceptions such as some fluid bed operations in China, are equipped with elaborate Air Pollution Control systems that **remove** dioxins and also volatile metals to infinitesimal levels. For example, the E.U. and U.S. limit for dioxins in the exit gases is 0.01 nanograms TEQ per standard cubic meter of stack gas and the plants we have examined, e.g. Brescia in Italy and AEB in Amsterdam, operate well below this level.

The only alternative to WTE incineration is landfilling which entails air and water emissions and also conversion of greenfields to landfills. Therefore, it is being phased out by a 1999 EU Directive as of the year 2015 in many nations. However, despite the enormous advances made in controlling WTE emissions, there are people who are not aware of this and are opposing WTE on the grounds of "dioxin emissions", thus perpetuating landfilling and also the burying of fuel that could reduce the use of fossil fuels and also reduce GHG emissions.

Therefore, I would like to suggest that in the next fact sheet to be published by WHO on dioxin emissions (and also mercury and other volatile metals) you include a statement that modern waste-to-energy incinerators are highly controlled with respect to emissions and that your fact sheet refers to non-controlled types of incinerators. Below I am attaching a letter written by two USEPA administrators on the subject of WTE emission control that is self-explanatory.

Best wishes to all recipients for the coming holidays

Prof. Nickolas Themelis