Levels of PCDD/Fs in breast milk of women living in the vicinities of Da Nang AO hot spot and Assessment of infant's daily intake

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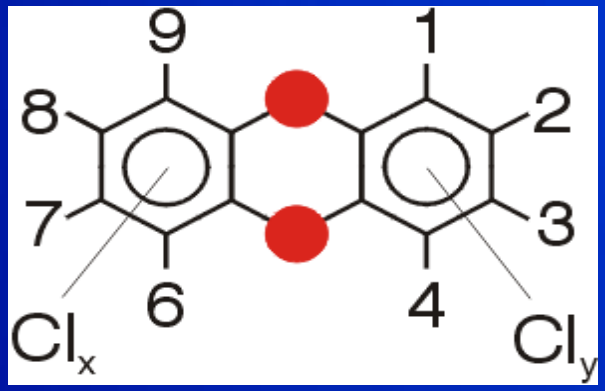
Overview

- **Background Information**
- **Objectives**
- **Materials and Methods**
- **Results and Discussion**
- **Conclusion**

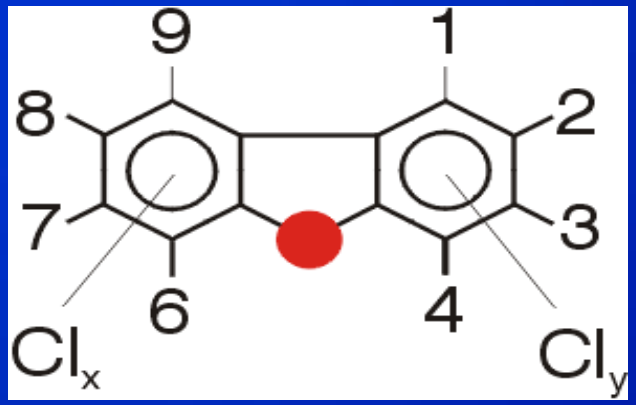
Dioxins and Furans (PCDD/PCDFs)

- **Relevant for Humans:**

  17 toxic congeners with 2,3,7,8- chlorine substitution (7 "dioxin" congeners and 10 "furan" congeners)



Dioxins



Furans

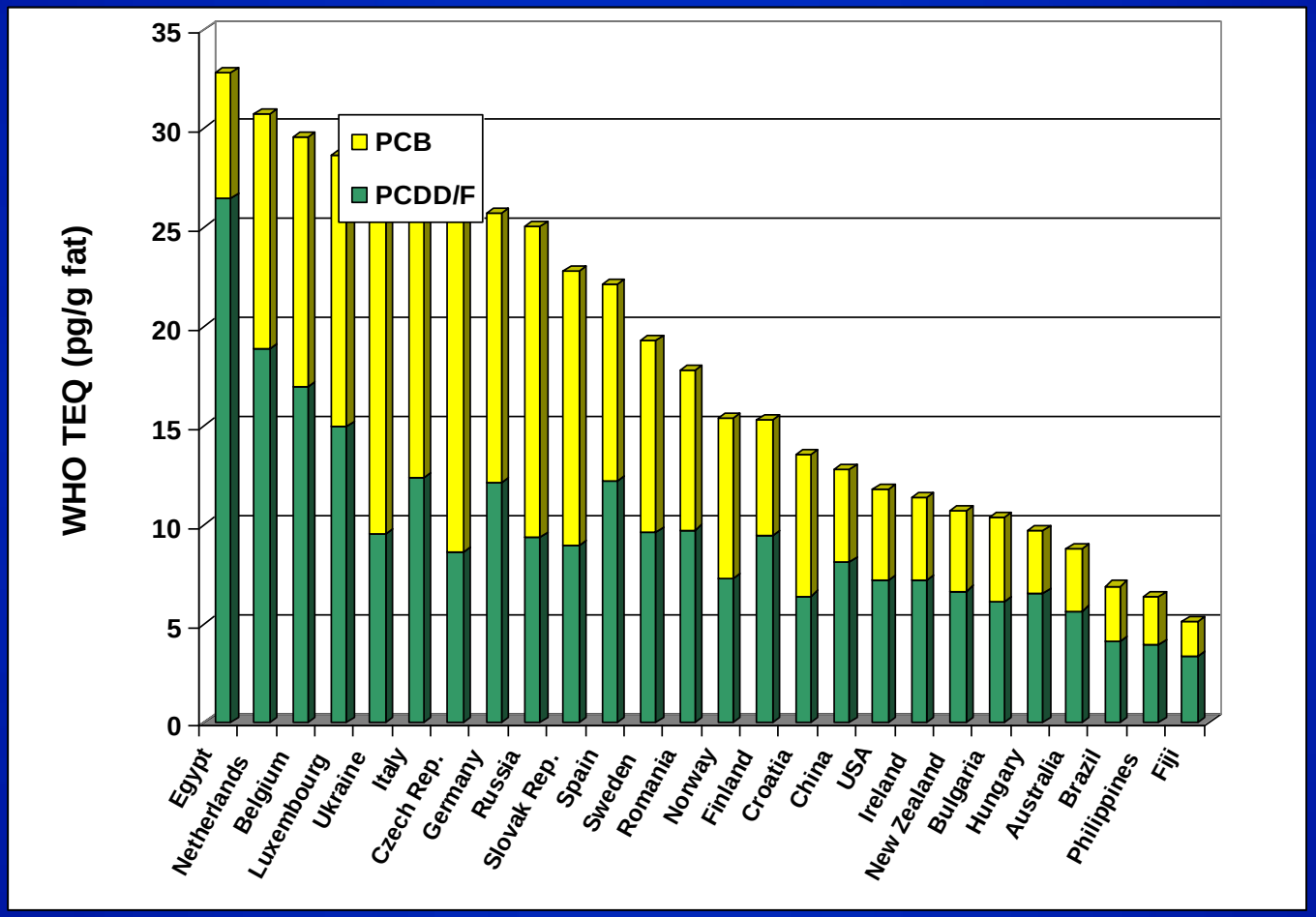
EU-Maximum levels for PCDDs/PCDFs and DL-PCBs in food

Food	*Maximum levels Sum of PCDDs/PCDFs (WHO-TEQ)*	*Maximum levels Sum of PCDDs/PCDFs/DL-PCBs (WHO-TEQ)*
Meat and meat products originating from		
- Ruminants (bovine animals, sheep)	**3,0 pg/g fat**	**4,5 pg/g fat**
- Poultry and farmed game	**2,0 pg/g fat**	**4,0 pg/g fat**
- Pigs	**1,0 pg/g fat**	**1,5 pg/g fat**
Liver and derived products originating from terrestrial animals	**6,0 pg/g fat**	**12,0 pg/g fat**
Muscle meat of fish and fishery products and products thereof	**4,0 pg/g fresh weight**	**8,0 pg/g fresh weight** **eel: 12,0 pg/g fresh weight**
Milk and milk products, including butter fat	**3,0 pg/g fat**	**6,0 pg/g fat**
Hen eggs and hen egg products	**3,0 pg/g fat**	**6,0 pg/g fat**
Oils and fats		
-- Animal fat		
- from ruminants	**3,0 pg/g fat**	**4,5 pg/g fat**
- from poultry and farmed game	**2,0 pg/g fat**	**4,0 pg/g fat**
- from pigs	**1,0 pg/g fat**	**1,5 pg/g fat**
- mixed animal fats	**2,0 pg/g fat**	**3,0 pg/g fat**
-- Vegetable oil and fats	**0,75 pg/g fat**	**1,5 pg/g fat**
-- Marine oil (intended for human consumption)	**2,0 pg/g fat**	**10,0 pg/g fat**

Tolerable Intake for Dioxins and Dioxin-like PCBs

- **World Heath Organization (WHO), 1998:**
  1 – 4 pg TEQ/kg b.w./day
- **Scientific Committee on Food (SCF), 2001:**
  14 pg TEQ/kg b.w./week
- **Joint FAO/WHO Expert Committee on Food Additives (JECFA), 2001:**
  70 pg TEQ/kg b.w./month

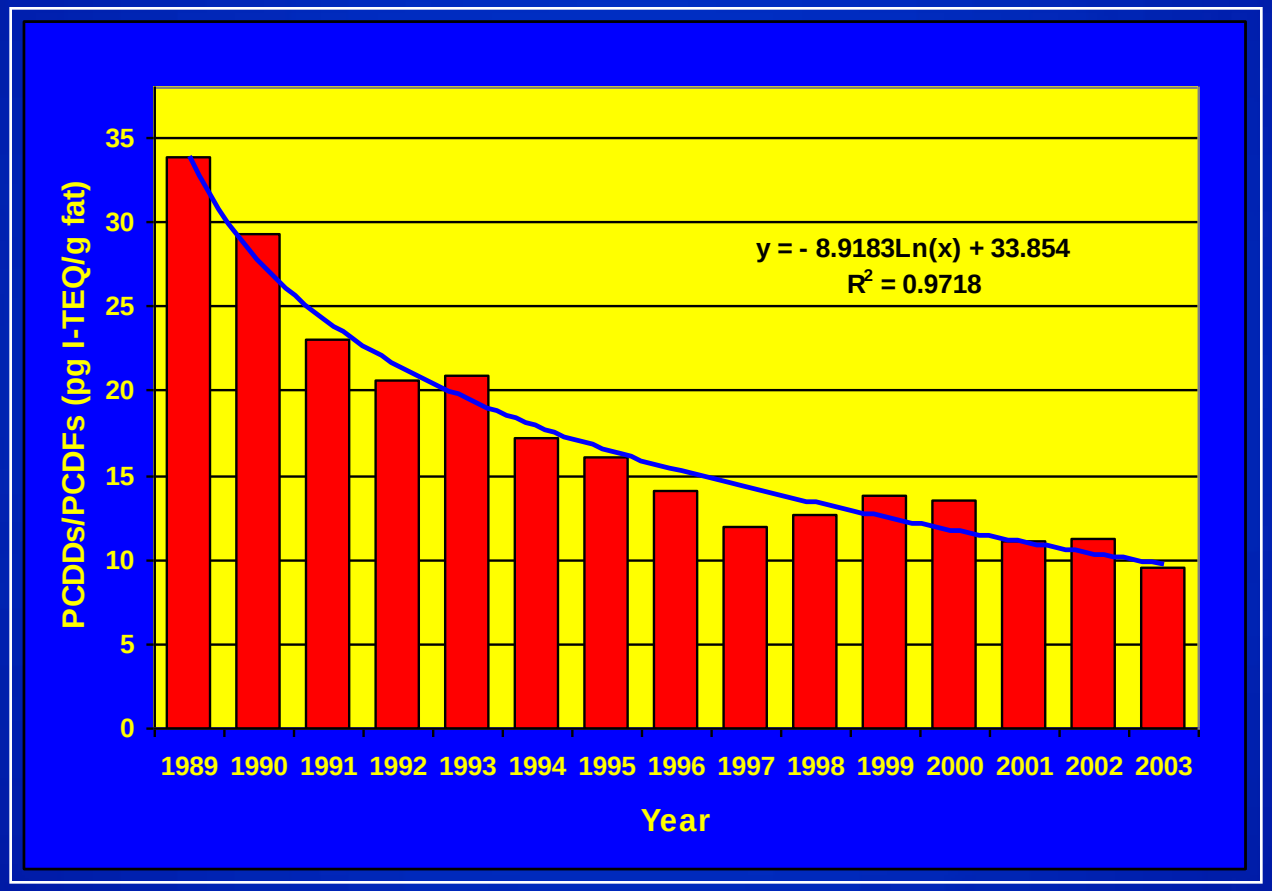
The levels of PCBs, PCDDs and PCDFs in human milk



Dioxin Laboratory Project, VEA

Results of the WHO coordinated exposure study (R. Malisch and R. van Leeuwen, 2003)

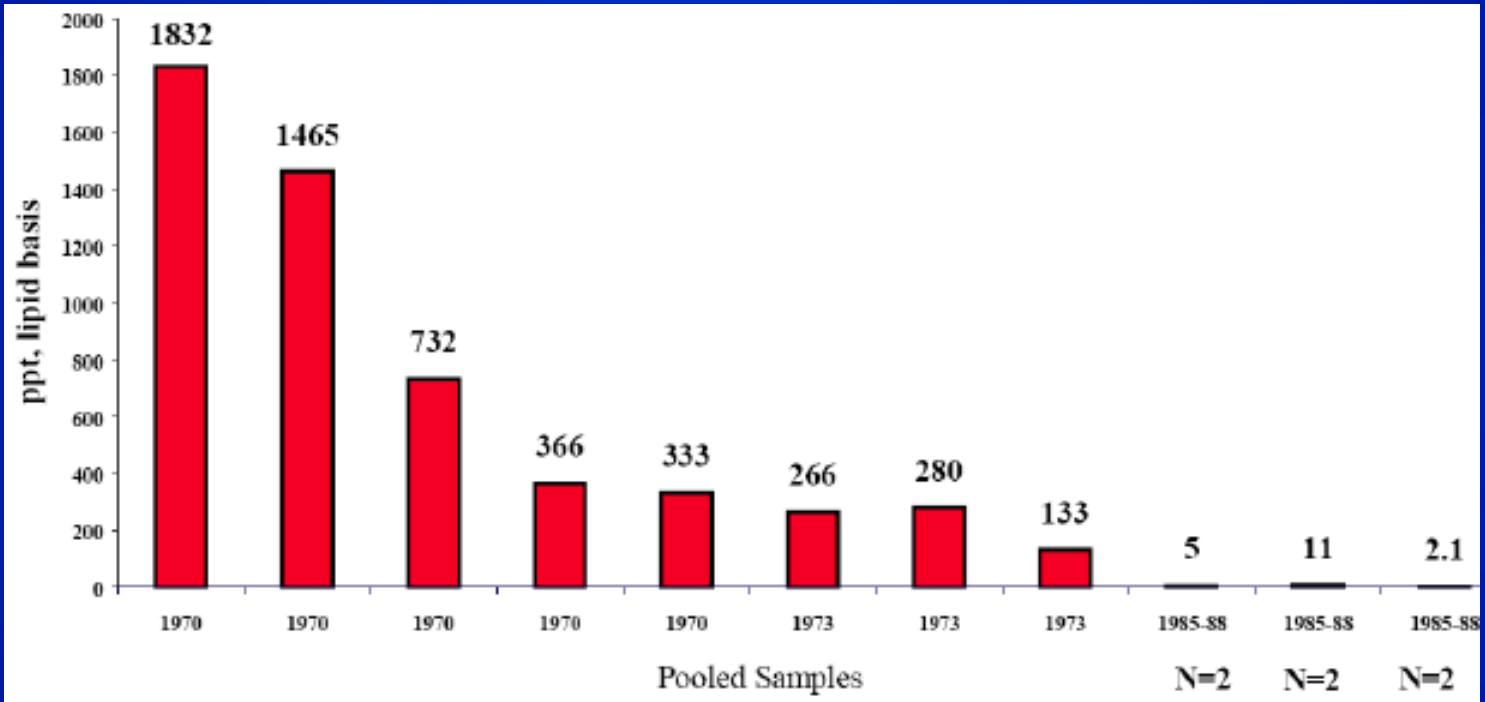
Decrease of dioxins in human milk 1989 - 2003



Dioxin Laboratory Project, VEA

Fürst P., 2004

2,3,7,8-TCDD in human milk from the south of Vietnam, 1970 - 1988



The 1970 and 1973 analyses were from individual samples and were calculated assuming 3% milk lipid.
Collection sites (1970 & 1973): the villages of Tan Uyen, Can Gio, Quang Xuen, Dau Tieng, and Phu Cuong.

Schecter et al., 1995

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Objectives

- **Determine level of PCDD/Fs in human breast milk from the general population in four wards namely Chinh Gian, An Khe, Khue Trung and Hoa Thuan Tay in the vicinities of Da Nang military airbase, Da Nang city.**
- **Identify PCDD/Fs congener profiles in breast milk samples**
- **Estimate the daily intake of PCDD/Fs-TEQ (EDI-TEQ) for the local breast-fed infants**

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Sample collection

27 breast milk samples from four surrounding wards of Da Nang AO hot spot, Da Nang city, Vietnam in 2011:

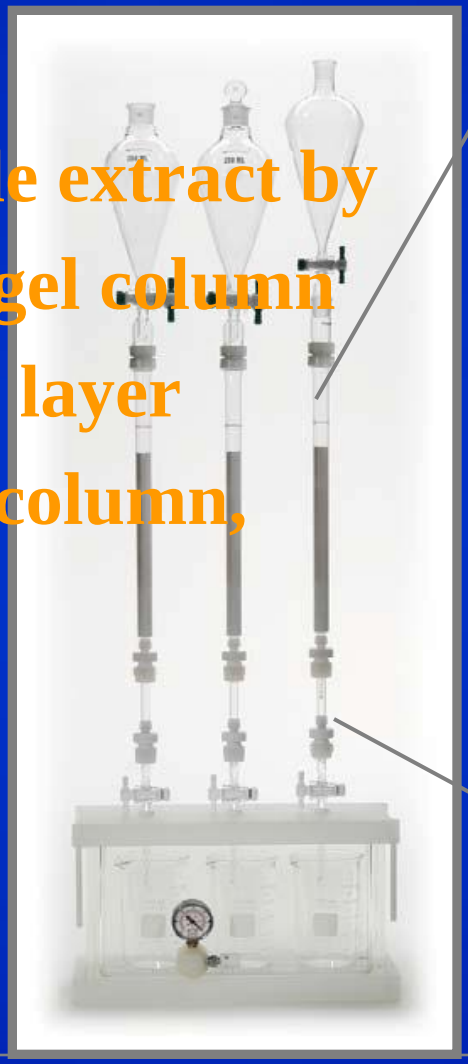
- **Chinh Gian (CG)**
- **An Khe (AK)**
- **Khue Trung (KT)**
- **Hoa Thuan Tay (TT)**

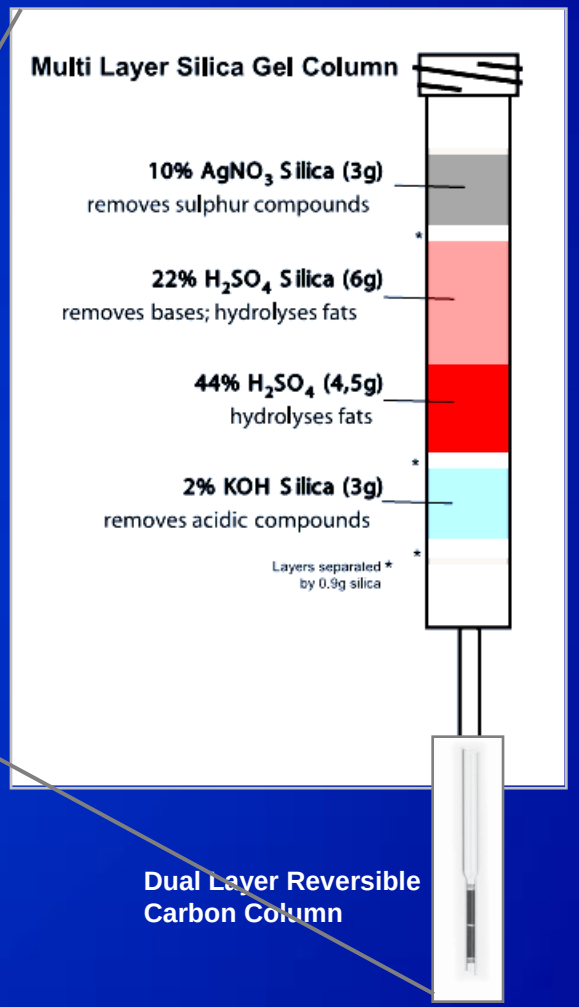
Sample preparation (1)

- **Freeze-dried breast milk sample was extracted by PLE, FMS**

Sample preparation (2)

- Clean-up of sample extract by Multi layer Silica gel column coupled with Dual layer activated Carbon column, Supelco





PCDD/PCDFs analysis by HRGC/HRMS

Micromass Autospec Ultima system (HRMS), Waters

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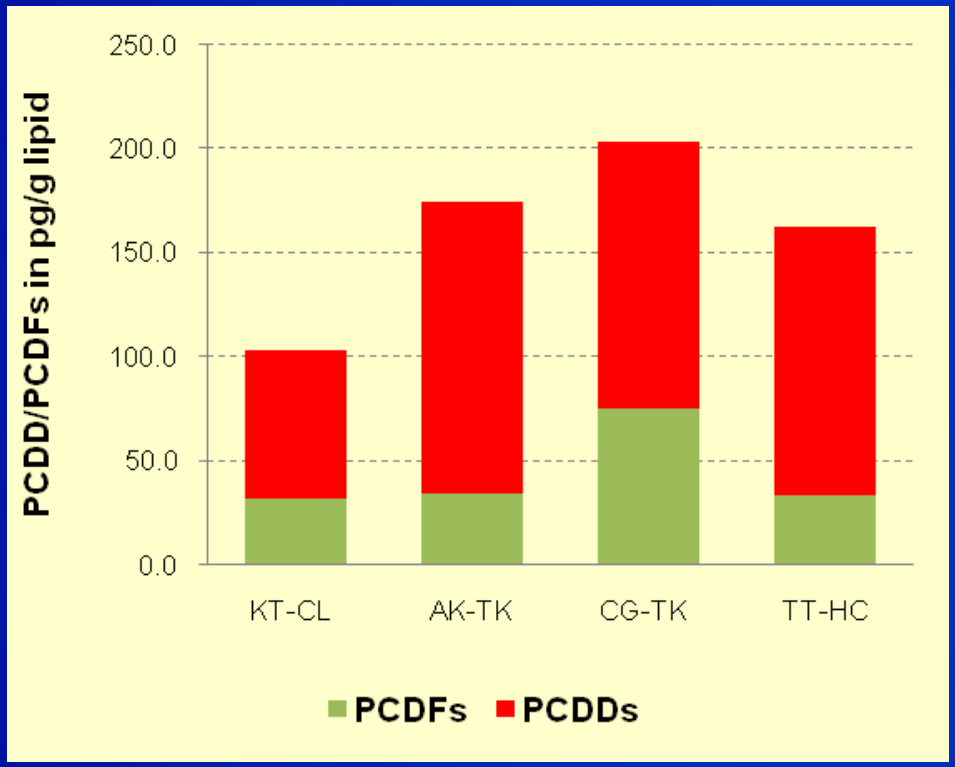
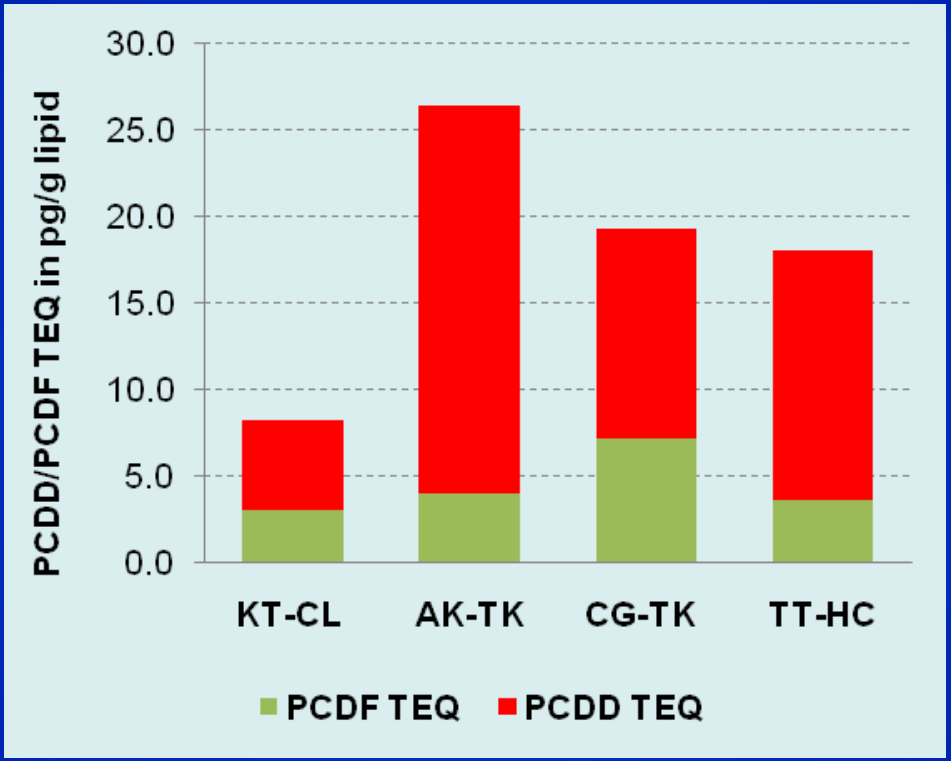
Dioxins and furans in breast milks from the vicinities of Da Nang AO hot spot (1)



PCDD/Fs mass conc. (pg/g lipid):

Khue Trung	103
An Khe	175
Chinh Gian	203
Hoa Thuan Tay	162

Dioxins and furans in breast milks from the vicinities of Da Nang AO hot spot (2)

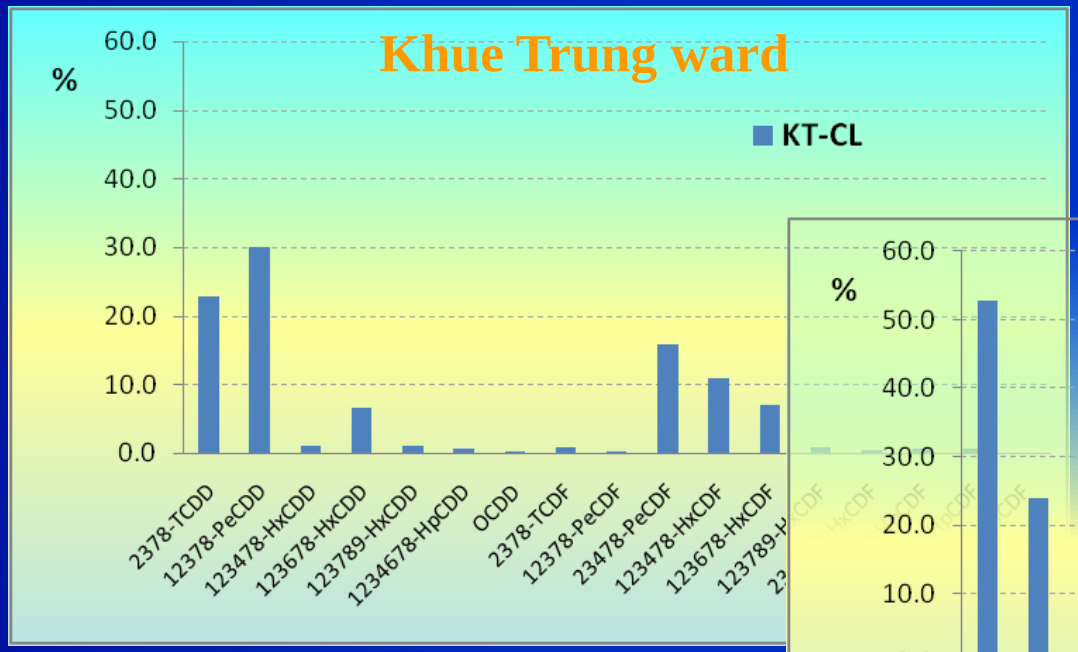


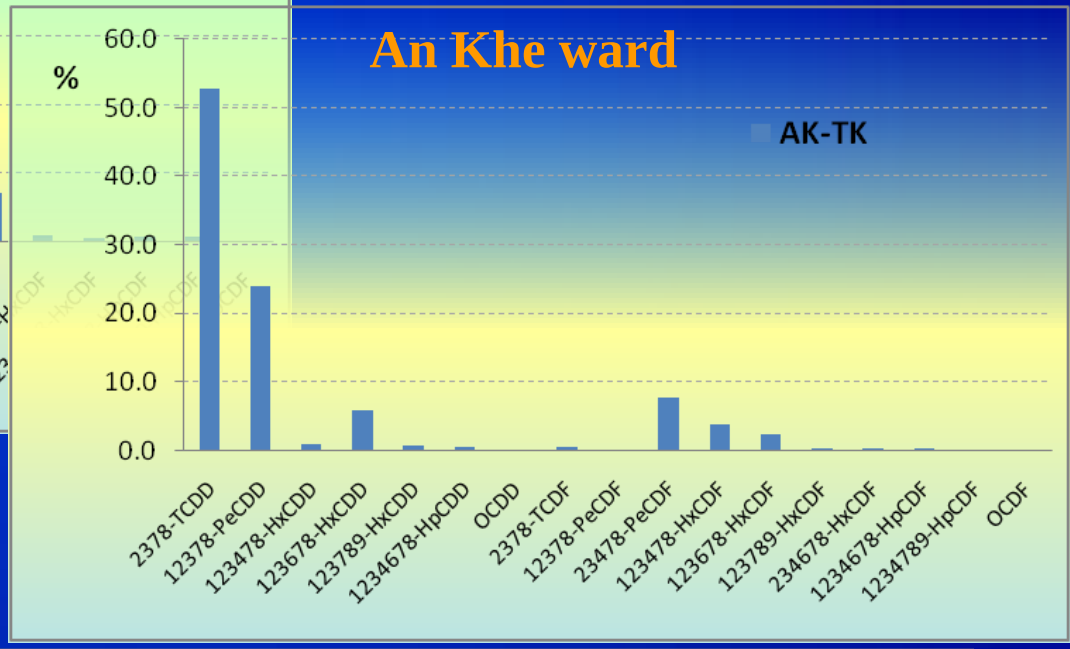
PCDD/Fs TEQ: 8.1 - 26.4 (pg/g lipid)

Khue Trung < Hoa Thuan Tay < Chinh Gian < An Khe

Congener profile for breast milk from the vicinities of Da Nang AO hot spot (1)

Contribution of PCDD, PCDF congeners to TEQ

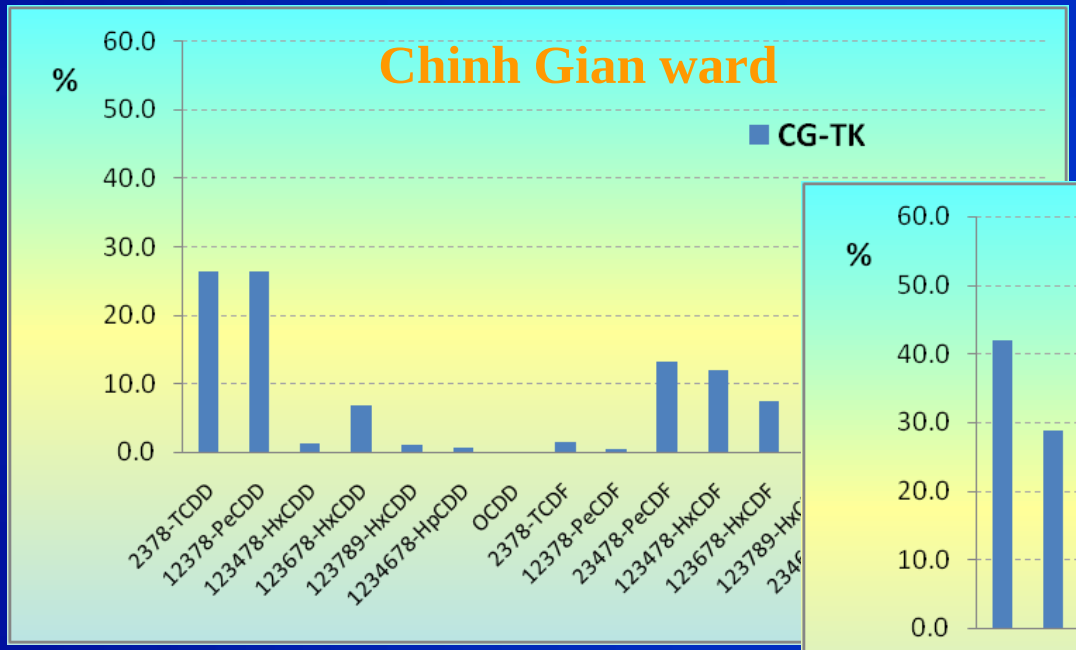




2,3,7,8-TCDD and 1, 2,3,7,8-TCDD are most dominant contributors

Congener profile for breast milk from the vicinities of Da Nang AO hot spot (2)

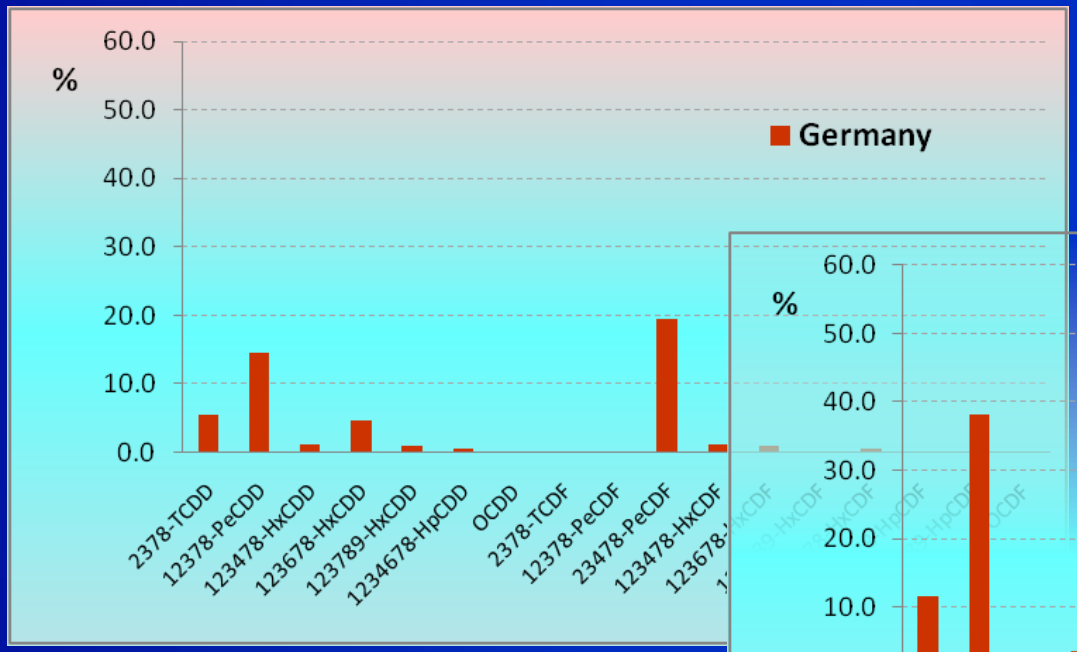
Contribution of PCDD, PCDF congeners to TEQ



2,3,7,8-TCDD and 1, 2,3,7,8-PeCDD are most dominant contributors

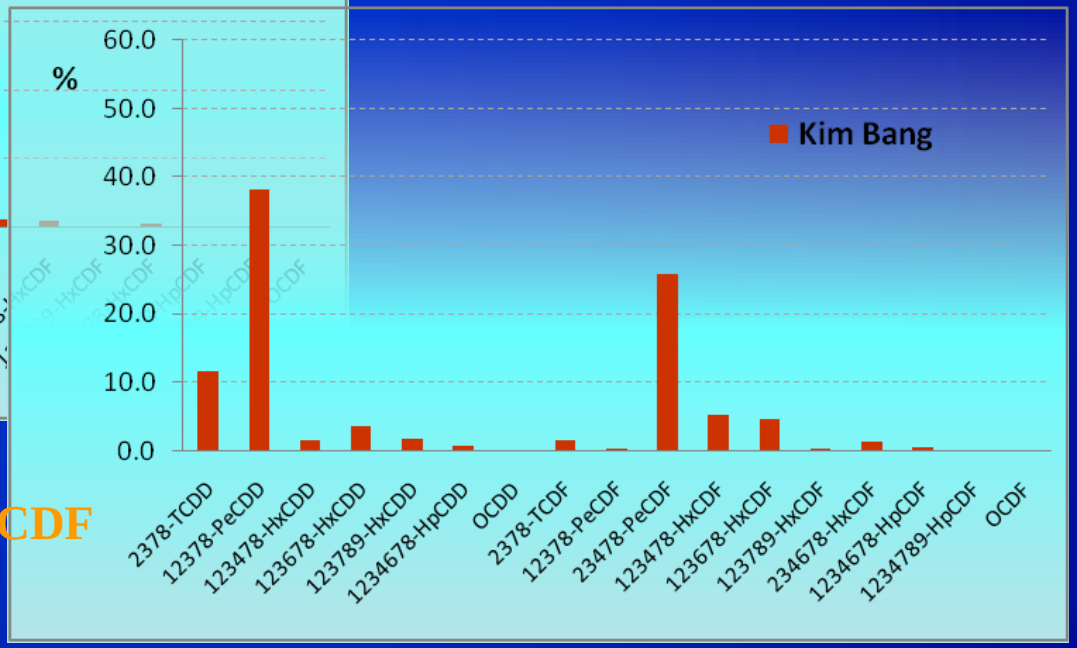
Congener profile for breast milk from non-contaminated sites

Contribution of PCDD, PCDF congeners to TEQ



(Fürst and Päpke, Dioxin 2002)

(Tai TP. et al., 2011)



1,2,3,7,8-PeCDD and 2,3,4,7,8-PeCDF are most dominant contributors

Congener profile for breast milk from the vicinities of Da Nang AO hot spot

- **The PCDD/Fs congener profiles in these locations were different to those from non-contaminated sites;**
- **These PCDD/Fs congener profiles were found consistent and quite specific with relative high portion of 2,3,7,8-TCDD which is linked to influence of the AO/Dioxin contamination in hotspot areas.**

Estimation of the infant's daily intake

EDI-TEQ	mean	min	max
Khue Trung	48	29.9	83.8
An Khe	155.6	71.3	262.8
Chinh Gian	113.6	44.4	228.1
Hoa Thuan Tay	106.5	43.7	324.6

The calculated EDI-TEQ values were much higher than 4 pg TEQ/kg bw/day – the TDI (Tolerable Daily Intake) proposed by WHO.

Conclusions

- **PCDD/Fs-TEQ levels of breast milk samples in these areas were several folds higher than those in the control sites.**
- **The data present in this study provide further evidence and understanding on the PCDD/Fs exposure of local people and to what extent it may pose health risk to the local infants.**
- **The present EDI-TEQ was also much higher compared to the TDI proposed by WHO and thus imply the local residents in the vicinities of Da Nang AO hot spot were continuously exposed to dioxins.**
- **Further studies toward understanding possible links between the exposure and adverse health outcomes in such communities may be necessary in order to provide more effective measures to protect people health.**

Acknowlegments

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Thank you for your attention!