

Dioxin exposure and effects on children's health

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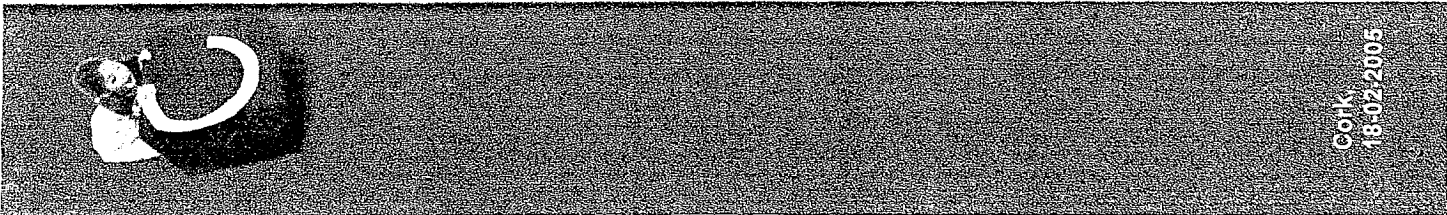


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Overview

Introduction

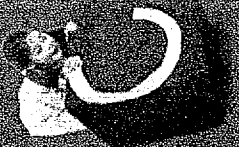
Background exposures

Accidents

Governing bodies

Final thoughts

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Why dioxins?

Numerous chemicals potentially harmful, however ...

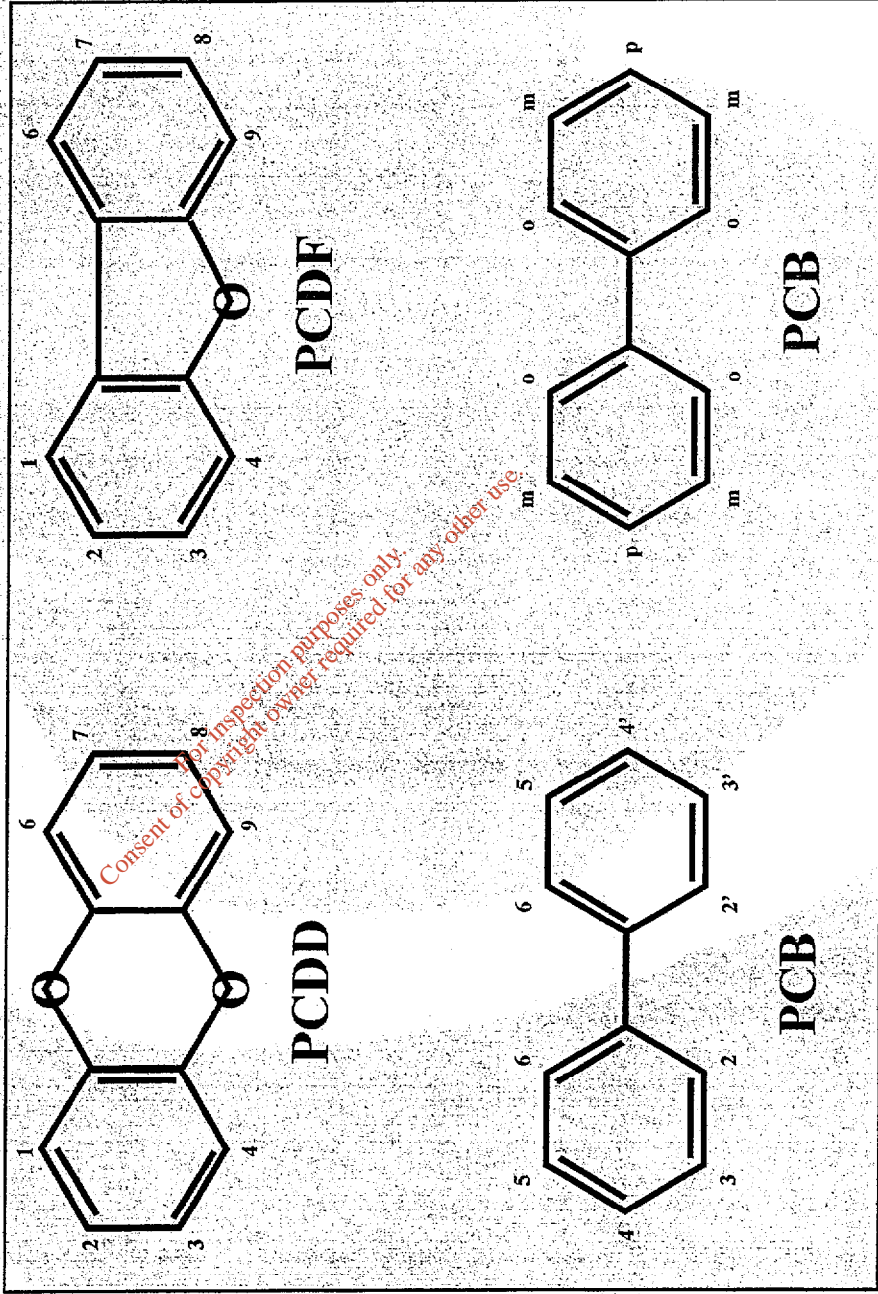
Dioxins are well studied

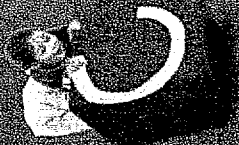
Much data available on health effects

Personal area of experience

Dioxins are almost exclusively waste-products

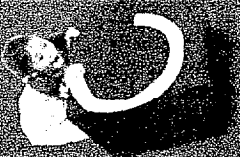
What are Dioxins and PCBs?





Dioxins

- Are of the most toxic substances known
- Colourless crystals or solids in pure form
- Not intentionally produced except for small quantities for research
- Extremely difficult to break down (metabolise), thus accumulating, long half-life
- Stored in fat (adipose) tissue
- Exposure via placenta and breast milk
- Europe has high background exposure levels



What is background exposure?

Concentrations we are exposed to in our daily lives

WHO recommendations as a result of extreme toxicity and potential for enormous health effects

Ireland has relatively low levels, especially compared to many other European countries

What health effects of background exposures have been seen?

Birth Defects

Increase in infant deaths and infant deaths with congenital disorders near solid waste incinerator

Tango et al. J Epidemiol. 2004 May; 14(3): 83-93

Increase in hypospadias, phimosis, cryptorchidism, SGA, spontaneous abortions in polluted part of Russia

Revich et al. Gig Sanit. 2002; (1): 8-13

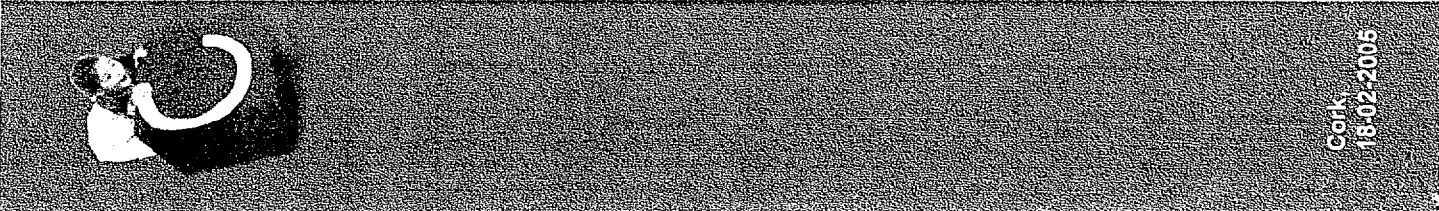
Increased miscarriages and premature birth; 60% congenital malformations after Agent Orange

Le et al. Reprod Health Matters 2001; 9(18): 156-64

Increase in orofacial clefts

ten Tusscher et al. Chemosphere 2000; 40: 1263-70

Other birth defects?



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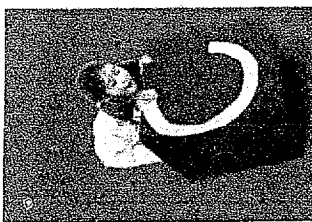
Zeeburg

1960s large scale incinerations of various chemicals in largely unknown quantities in open air

Seven-fold increase in cleft lips/palates

The present increasing incidence of hypospadias in Europe is being blamed on endocrine disrupting chemicals

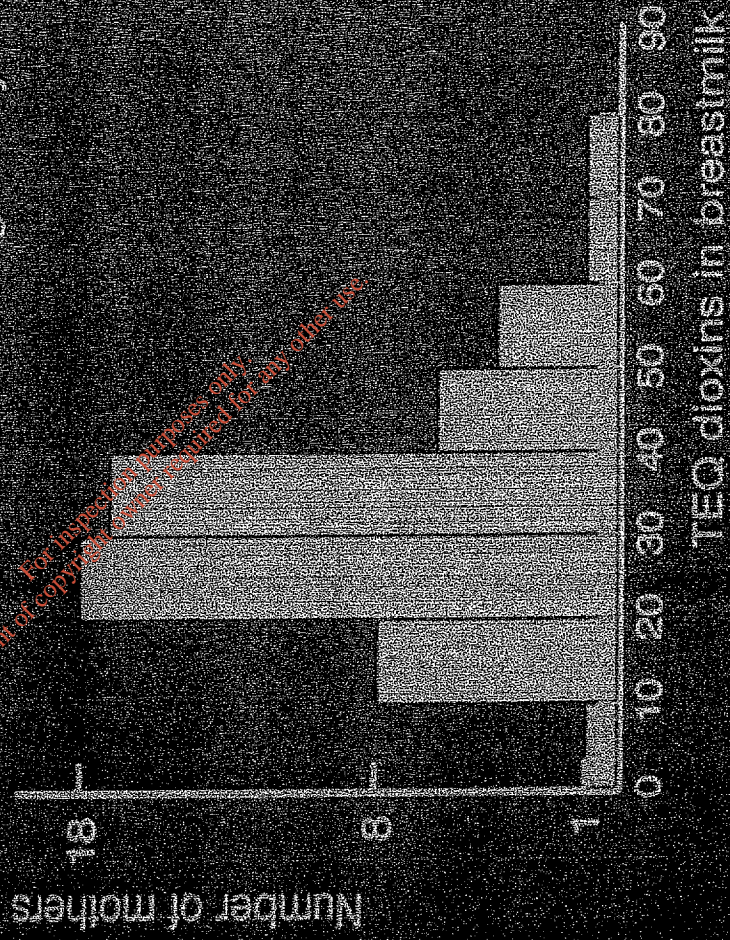
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Amsterdam/Zaandam Cohort

Zaandam-study 1990-1992
Mean age: 29 yrs





Effects seen in the Neonate

- Disregulation of thyroid function

Pluim et al. Lancet 1992; 339: 1303, Environ Health Perspect 1993; 101(6): 504-8

Koopman-Esseboom et al. Pediatr Res 1994; 36(4): 468-73

- Liver damage

Pluim et al. Acta Paediatr 1994; 83(6): 583-7

- Reduced platelet counts (necessary for coagulation)

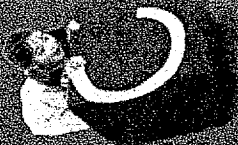
Pluim et al. Acta Paediatr 1994; 83(6): 583-7

- Reduced numbers of immunity cells required for acute infections (granulocytes)

Pluim et al. Acta Paediatr 1994; 83(6): 583-7

Weisglas-Kuperus et al. Pediatric Res 1995; 38(3): 404-10

Nagayama et al. Chemosphere 1998; 37(9-12): 1781-7



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Effects seen in Toddlers and Pre-schoolers

Precocious neuromotor development

Ilsen et al. Chemosphere 1996; 33(7): 1317-26

Chickenpox at a younger age

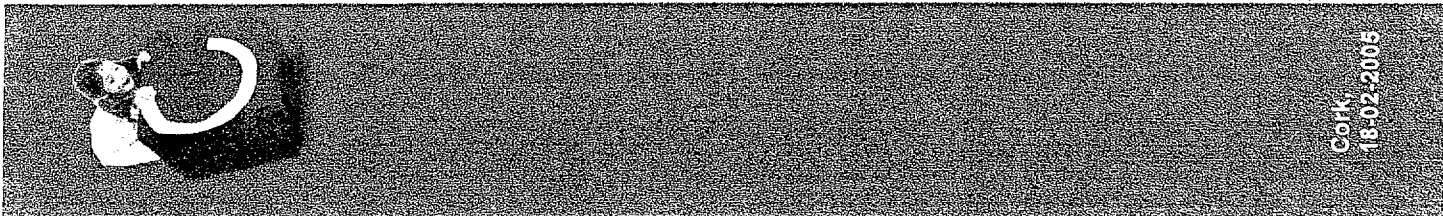
Weisglas-Kuperus et al. Environ Health Perspect 2000; 108(12): 1203-7

More middle-ear infections

Weisglas-Kuperus et al. Environ Health Perspect 2000; 108(12): 1203-7

Less asthma

Weisglas-Kuperus et al. Environ Health Perspect 2000; 108(12): 1203-7



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Effects seen in School Children

More dental defects (caries and enamel)

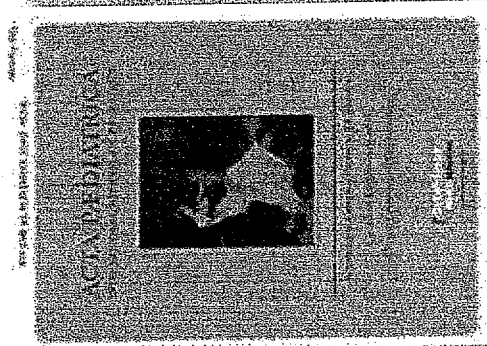
Alaluusua et al. Eur J Oral Sci 1996; 104(5-6): 493-7

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Cork,
18-02-2005



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Decreased lung function associated with perinatal exposure to Dutch background levels of dioxins

Acta Paediatrica 90(11): 1292 - 1298

ten Tusscher, et al.

Lung Function Assessment

41 healthy children (7-12 y, mean 8.2 y)

Prenatal exposure: 8.74 - 88.8 (mean 34.6) ng TEQ dioxin/kg fat, measured in breast milk

Postnatal exposure: 4.34 - 384.51 (mean 75.4) ng TEQ dioxin

Medical history of the children and their families
Spirometry



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Lung Function Results

Decreasing lung function with increasing prenatal exposure ($p=0.045$)



Decreasing lung function with increasing postnatal exposure ($p=0.0002$)



Increase in asthmatic complaints with increasing exposure ($n=4$)

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Persistent Hematologic and Immunologic Disturbances in 8-Year-Old Dutch Children Associated with Perinatal Dioxin Exposure

Environmental Health Perspectives 111 (12): 1519-1523

ten Tusscher, et al.

Immune System Effects

Reduction in allergy with increasing prenatal ($p=0.023$) and postnatal ($p=0.030$) exposure

Increasing CD4⁺ (T-helper) cells with increasing postnatal exposure ($p=0.006$)



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Immune System Effects

Increase in autoimmune disease in rodents – humans?

Holladay. *Env Health Perspect* 1999; 107(5): 687-91

Allergic disease aggravation by enhancing IgE-response

Kimata. *Int J Hyg Environ Health* 2003; 206(6): 601-4



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Haematology Effects

Decreasing numbers of blood platelets with increasing postnatal exposure ($p=0.04$)

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Platelet production problem

Stem cell damage?



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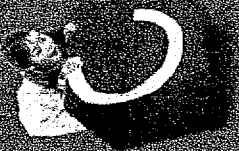
Behavioural Problems

Increase in social problems & aggression in two environments (home and school) with dioxins

ten Tusscher et al. Thesis 2002

In boys less masculine play, in girls more masculine play, with increasing prenatal PCBs

Vreugdenhil et al. Env Health Perspect 2002; 110(10): A593-8



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Brain Development

Ultra modern and sensitive testing (MEG)

Retardation in brain development of on average 3½ y

Possible relation with behavioural problems



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Effects seen in adolescence and adulthood

Increased incidence of non-Hodgkin lymphoma (RR 2.3) in vicinity of municipal solid waste incinerator

Floret et al. Epidemiology 2003; 14(4): 392-8

Delay in genital and breast development in boys and girls with dioxins

Den Hond et al. Health Perspect 2002; 110: 771-6

Possibly increase in endometriosis with dioxins

De Felip et al. Toxicol Lett 2004; 150(2): 203-9

Adolescent colorectal cancer and dioxin?

Pratt et al. Lancet 1987; 2(8562): 803

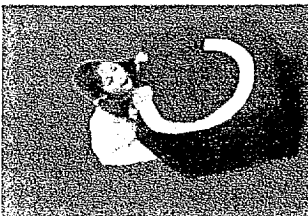


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Accidents may be catastrophic

Often argued that risk of accident in incineration plant is small

The last years have shown numerous accidents at waste incinerators and by-product storage facilities, resulting in high local exposures



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A few examples of waste incinerator accidents

- 1994 Incinerator in Duiven exceeds dioxin emission norm – unclear why or how
- 1996 Fire in waste incinerator in Holland with high dioxin emissions
- 1997 Incinerator in Rotterdam exceeds dioxin emission norm
- 2001 Toxic cloud emission from incinerator
- 2002 Elbe floods its banks and storage depot for dioxins (by-products of incinerations)
- 2004 Dioxin emissions following faulty filters