

# Dioxins: some perceptions

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Pollution, MMR, Dioxins - Real or Imaginary Hazards?

*Scientist for Labour* meeting to discuss the perception of risk,

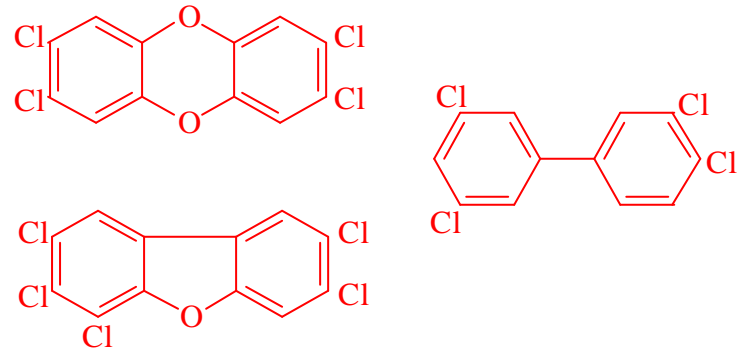
1 Parliament St., Westminster, 7<sup>th</sup> May 2003

- What are they? Where do they come from?
- Health concerns
- Incineration
- Uncontrolled burning
- Belgian Food crisis
- Human exposure
- “Perceptions are Reality”

# Dioxins – the essential chemistry

## What are they?

- Complex mixture of chlorinated aromatic hydrocarbons
- Polychlorinated-
  - Dibenzo-p-dioxins (PCDDs)
  - Dibenzofurans (PCDFs)
  - Biphenyls (PCBs)
- 2,3,7,8 isomers only concern – 8 from 75 PCDDs, 8 from 135 PCDFs & 12 PCBs
- Analysis is complex –
  - Very specialised GC/MS
  - expensive (~£1000 per sample)
  - Femtogramme ( $10^{-15}$  g) quantities using isotopically labelled dioxin standards.
  - Safety of analysts paramount!



## Where are they formed?

- **ALL combustion processes**
  - Little chlorine needed (e.g. methane)
  - Incomplete combustion
  - “De Novo” synthesis from Carbon during flue gas cooling
- **Chemical contamination**
  - Herbicides (Agent Orange)
  - Wood preservatives (PCP)
  - Transformer oils
- **Peaked in 1970s, evidence pre-1850s**

# Health concerns

- 18 May 2000: **Incinerator cancer threat revealed** – *Dioxins from waste burning & industry far more dangerous than was thought - USEPA & German reports suggest ~10% of cancers in industrialised countries may be linked to dioxins.*
- 17 May 2001: **Alarm at increase in liver cancer deaths** – *Double rate of liver tumour deaths since 1970 link to environmental carcinogens*
- 29 Mar 2003: **Spectre Orange** - *650,000 Vietnamase suffer from an array of baffling chronic conditions. Claim links to estimated 170g dioxins sprayed as Agent Orange during Vietnam war*

- *Acute toxin*
  - *1 mg/kg body weight (guinea pigs)*
  - *1 mg/kg (hamsters)*
  - *Related to body fat proportion*
- *Possible Carcinogen – epidemiological data supports animal testing*
- *Causes chloracne*
- *From high exposure groups some evidence of subtle development delay in children & thyroid hormone alterations. A range of other conditions from prolonged excessive exposure following Agent Orange, Seveso & Yusho incidents.*

<b>ADVERSE ANIMAL EFFECTS</b>	<b>LOEL</b>	
<b>Neurotoxicity</b>		
object learning	Monkey	160 pg/kg/day
<b>Reproductive toxicity</b>		
decreased sperm count	Rat	64 ng/kg
vaginal threads	Rat	200 ng/kg
<b>Immunotoxicity</b>		
viral sensitivity	Rat	100 ng/kg
	Mouse	10 ng/kg
<b>Hormonal</b>		
endometriosis	Monkey	160 pg/kg/day

# Incineration

7May2003 unsworth@post.com

13 Feb 2001: **Dioxins in city may be worst case in UK** - Eggs, poultry and vegetables from Newcastle allotments banned after 2,000 tonnes of incinerator ash spread,

22 May 2001: **Incinerator breaches go unpunished** - 10 UK MWIs had 533 breaches in last 2 years, Sheffield the worst

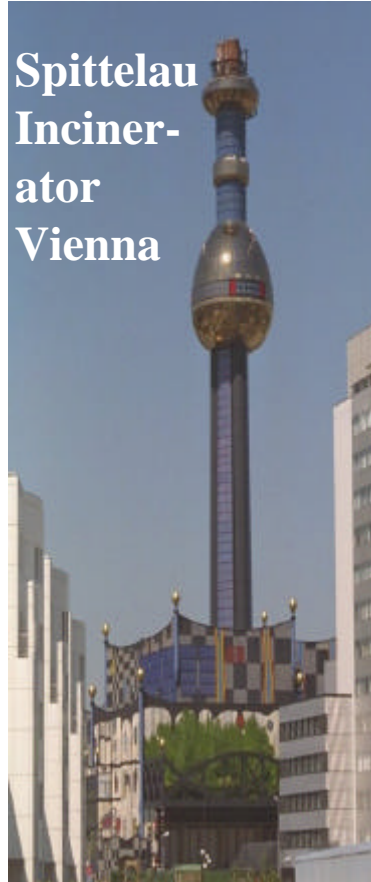
23 May 2001: **Burning issue** - Plan rejected for start of the art incinerator in Kidderminster - EA estimate 69 needed to meet recycling targets.

7 Jul 2001: **Ban on mercury cremation fumes is shelved** - EA not to curb dangerous mercury & dioxin emissions from crematoriums - pollution controls would put up the cost of funerals

22 Nov 2001: **Parliament misled over recycled dioxins** - Recycled incinerator ash for houses & roads contain dioxin levels of 1.2 ppb[Teq] not 20-50 ppt[Teq] stated before

26 Feb 2002: **Protestors close down waste incinerator** - Greenpeace scale chimney & rubbish claws at New Cross Combined Heat & Power plant. Greenpeace oppose use of Cl

Spittelau  
Incinerator  
Vienna



- *Incinerator dioxin emissions are limited to  $<0.1$  ng[Teq]/m<sup>3</sup> but public don't trust operators*
- *Continuous sampling & end-of-pipe solutions exist*
- *Disposal of incinerator ash is governed by heavy metal pollution*
- *Designs to maximise energy recovery also maximise dioxin formation*
- *Dioxin formation depends on Cl concentration only at high Cl levels*
- *British Steel the biggest UK dioxin emitter via steel sintering not waste incineration*

# Uncontrolled burning

- 1 April 2001: **Animal pyres pumping lethal toxins into the air** – *Monitoring of emissions from dead sheep pyres revealed “dangerous” levels of dioxins*
- 26 May 2001: **Food watchdog warns of dioxin threat in milk** – *FSA says slightly elevated risk applies to those buying full-fat milk directly from dairy farms within 2 km of a burning pyre*
- 27 Oct 2001: **Heroes of Ground Zero at risk from breathing toxic cocktail** – *various toxic substances detected at unsafe levels in the air and soil around the site, still burning six weeks after the attacks, include dioxins*
- 15 May 2002: **Dumped on** – *Tyre dump at Knighton, Powys, ignited in 1989 still smoulders away emitting ? dioxins,*
- 5 Nov every year: **Guy Fawkes bonfire night**– *14% annual dioxin emissions estimated from Guy Fawkes' night. 6-fold rise in dioxin emissions mid-Sep to mid-Nov suggests links with domestic heating.*
- 17 Jan 2003: **Government clamps down on emission of dangerous dioxins** – *Meacher claims more dioxins now produced by sources like Guy Fawkes bonfires and burning abandoned cars than by incineration*

- *Short-term source! How accurate are the estimates?*
- *Within 6 weeks to April 6, animal pyres released estimated dioxin emissions of 63 g?! compare 88 g/a released by UK industry (58 g ex steel, 0.65 g from MWIs).*
- *World Trade Center ambient air dioxin levels 11 Oct: 7 pg[Teq]/ m<sup>3</sup> end Oct: 3 pg[Teq]/ m<sup>3</sup> end Nov: 0.15 pg[Teq]/ m<sup>3</sup> to background levels*

# Belgian food crisis, 1999



- Late April: *Belgian ministries in a quandary – chicken fat detected with dioxin levels of almost 1 ppm[Teq] – no measures introduced to restrict it from the food chain*
- June 2: **Ministers quit as new Europe food scandal is exposed** – *Agriculture & Public Health ministers resign following bans on Belgian egg & chicken products contaminated with dioxins introduced by animal feed*
- June 9: **Contaminated food crisis hits Europe** - *worldwide bans of Belgian farm produce, Belgian chocolates and foods cleared from supermarket shelves, Netherlands Agricultural minister & his deputy also resign*
- June 15: **Belgian food crisis costs PM his job** – *Christian democrat Jean-Luc Dehaene resigns after election defeat*
- July 6: **A case of mass hysteria** – *Bad fungicide or CO2 eliminated as cause of widespread illness claims on June 8 - Coca-Cola dumped half a million bottles of soft drink following Government ban on sales.*
- Aug 9: **Belgium balks at scale of EU dioxin tests on exports** - *French officials ban Belgian waffles – new Belgian public health minister insists new EU regulation for testing all food > 20% fat content is impossible*

- **The Dioxin Source:** *Animal fat from a rendering plant near Ghent containing dioxin levels of ~800 ppt[Teq] derived from 100L of PCB-containing oil used as a heating bath oil*
- **The average British diet for a month contains as much dioxins as one day's consumption of contaminated Belgian chicken**

# Human exposure

- 27 Jan 1999: **Throw in the towel** – *Dioxins have been found in some tampon products. They can be introduced during the bleaching process or from cotton.*
- 17 Aug 2000: **A little added extra in your ice cream** - *A tub of Ben & Jerry's contains 80 pg dioxin. "There are no recommended levels for dioxins in food, because it would be impossible to test for them; they are in everything."*
- 7 Jan 2001: **Salmon farmers braced for clampdown on toxins** - *Farmed salmon carry up to 10 times permitted dioxin levels of dioxins. Fish main contributors to dioxin exposure, ahead of dairy & meat products.*
- 26 May 2001: **Milk feared to contain cancer-linked dioxins** - *Milk in farms close to foot and mouth funeral pyres could have become contaminated with dioxins*
- 17 Nov 2002: **Dioxins in babies at 85 times safety limit** – *UK Government admits newborn babies have been taking in 85 times recommended limit of dioxins in their mother's milk*

- *Persistent in environment & accumulate in biological systems*
- *>95% of exposure is via food not local air*
- *UK FSA recommends a tolerable daily intake of 2pg[Teq]/kg body wt*
- *Average intake for UK population 1.8 pg[Teq]/kg body wt: a third probably exceed*
- *Levels in food have dropped by >50% in past decade*
- *EC maximum levels in Teq /g fat established in 2002*
  - *6 pg: liver*
  - *3 pg: milk, eggs & ruminants*
  - *2 pg: fish oil & poultry*
  - *1 pg: pork*
  - *0.75 pg: vegetable oil*

# “Perceptions are Reality”

- Incinerator – “not in my back yard”
  - *Yet exposure is via food & most food is not local*
- Bonfires – “it’s none of your business what I burn on my land”
  - *Yet these are now considered a major dioxin source, much larger than waste incineration*
- Recycled materials & old chemicals - “I don’t need to know where it came from”
  - *Accepting unknown recycled heating oil caused the Belgian food crisis*
  - *Unknown pesticides & wood preservatives may contain 2,4,5-T (Agent Orange) or PCP (pentachlorophenol)*
- Low dioxin diet - “What is safe for me to eat these day?”
  - *There is no simple answer – reducing levels and effective monitoring presents huge challenges & costs*