Environmental Protection Agency

Dioxin Levels in the Irish Environment: Ninth Assessment (Summer 2011)

Based on levels in Cows milk

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Environmental Protection Agency

The Environmental Protection Agency (EPA) is a statutory body responsible for protecting the environment in Ireland. We regulate and police activities that might otherwise cause pollution. We ensure there is solid information on environmental trends so that necessary actions are taken. Our priorities are protecting the Irish environment and ensuring that development is sustainable.

The EPA is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Community and Local Government.

OUR RESPONSIBILITIES

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We license the following to ensure that their emissions do not endanger human health or harm the environment:

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- large scale industrial activities (e.g., pharmaceutical manufacturing, cement manufacturing, power plants);
- intensive agriculture;
- the contained use and controlled release of Genetically Modified Organisms (GMOs);
- large petrol storage facilities;
- waste water discharges.

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- Working with local authorities and the Gardaí to stamp out illegal waste activity by co-ordinating a national enforcement network, targeting offenders, conducting investigations and overseeing remediation.
- Prosecuting those who flout environmental law and damage the environment as a result of their actions.

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- Quantifying Ireland's emissions of greenhouse gases in the context of our Kyoto commitments.
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- Enforcing Regulations such as Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) and substances that deplete the ozone layer.
- Developing a National Hazardous Waste Management Plan to prevent and manage hazardous waste.

MANAGEMENT AND STRUCTURE OF THE EPA

The organisation is managed by a full time Board, consisting of a Director General and four Directors.

The work of the EPA is carried out across four offices:

- Office of Climate, Licensing and Resource Use
- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet several times a year to discuss issues of concern and offer advice to the Board.

Dioxin Levels in the Irish Environment

Ninth Assessment
(Summer 2011)

Based on Levels in Cows' Milk

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November 2012

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DIOXIN LEVELS IN THE IRISH ENVIRONMENT

Ninth Assessment
(Summer 2011)

Based on Levels in Cows' Milk

Published by the Environmental Protection Agency, Ireland

ISBN 978-1-84095-475-3

Acknowledgements

The EPA wishes to acknowledge the assistance of Mr. George Kearns, Irish Co-operative Organisation Society Ltd. and to the management and staff of the individual co-operatives and dairies without whose co-operation this survey would not have been possible.

Particular thanks are due to Dr. John McBride of the State Laboratory and Dr Dieter Stegemann of Gesellschaft für Arbeitsplatz und Umweltanalytik (GfA) in Münster, Germany and to their respective staff members for carrying out the sample analysis and for much expert advice during the survey.

Finally, the author wishes to thank the staff of the individual regional inspectorates of the Environmental Protection Agency who took the samples and also those other colleagues who advised and assisted in the preparation of this report.

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EXECUTIVE SUMMARY

Background

Dioxins have, in recent years, continued to generate environmental concerns that capture public attention. In order to maintain surveillance of dioxins, furans and other related pollutants, the Environmental Protection Agency has carried out a number of almost identical surveys based on levels found in cows' milk. Examination of the time series trends from these studies provides much valuable information. This report describes the study carried out in Summer 2011 and is a follow-up survey to eight earlier studies carried out between 1995 and 2009. (EPA 1996, EPA 2001, EPA 2005, EPA 2008 (1) and (2), EPA 2009, EPA 2010, EPA 2011). These studies have shown that concentrations of dioxins and the other pollutants remain at a consistently low level in the Irish Environment.

"Dioxins" is a collective term for the category of 75 polychlorinated dibenzo-para-dioxin compounds (PCDDs) and 135 polychlorinated dibenzofuran compounds (PCDFs). Seventeen PCDD and PCDF compounds are considered to be of toxicological significance. The most toxic of these is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). The toxic responses include skin effects, immunotoxicity and carcinogenicity, as well as reproductive and developmental toxicity. These compounds, or congeners, arise mainly as unintentional by-products of incomplete or poorly controlled combustion and from certain chemical processes.

Given that the primary mechanism for dioxins entering the food chain is through atmospheric deposition, cows' milk is considered to be a particularly suitable matrix for assessing their presence in the environment, since cows tend to graze over relatively large areas and these compounds will, if present, concentrate in the fat content of the milk.

Since some Polychlorinated biphenyls (PCBs) have dioxin-like properties, testing for dioxin-like PCBs was included for each sample, in accordance with international practice.

In view of increased international awareness of the issue of the presence in the environment of brominated flame retardants (BFRs) and brominated dioxins, it was decided to repeat the 2006 2007, 2008, 2009 and 2010 sampling for these substances at the same time as the dioxin survey. Five samples, representative of different regions, were analysed. Each sample consisted of three pooled samples from the dioxin survey.

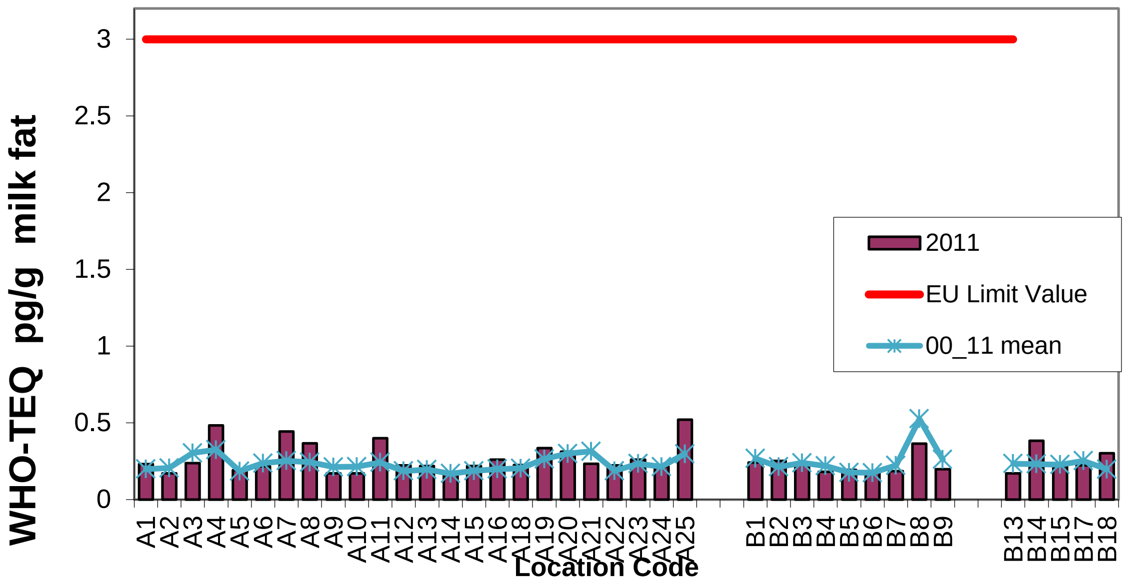
Sources of Dioxins

Although PCDDs and PCDFs are not produced intentionally except for research and analysis purposes, their formation is often a by-product of many anthropogenic and natural activities. According to a study in the context of the Stockholm Convention http://ec.europa.eu/environment/dioxin/sources.htm, the main sources for emissions of dioxins to air in EU-25 are

- Residential combustion
- Open burning of waste (backyard burning)
- Wood preservation (~15%)
- Iron and steel industry
- Power production, non-ferrous metals, chemical industry
- Traffic

The dominant sources of dioxin emissions in Ireland are from non-industrial activities

Figure 1 Dioxins/Furans
2011 Data Compared with 2000-2011 Averages



Dioxin Sampling and Results

Two types of sampling stations were chosen:

Type A	background stations covering the entire country (24 samples)
Type B	potential impact stations in areas of perceived potential risk (14 samples)

The reported ranges for dioxins in milk fat (38 samples) were 0.169 to 0.520 pg WHO-TEQ/g[1] with a mean of 0.261 pg WHO-TEQ/g. It can be seen from Figure 1 that these results, in line with the historical data from earlier surveys, are well below the EU limit of 3.0 pg WHO-TEQ/g. For dioxin-like PCBs, the mean value was 0.184 pg WHO-TEQ/g with a range of 0.120 to 0.395 pg WHO-TEQ/g.

The range for the sum of Dioxins & PCBs is 0.299 to 0.826 pg WHO-TEQ/g with a mean of 0.445 pg WHO-TEQ/g.

Brominated Flame Retardants

Brominated Flame Retardants (BFRs) replaced PCB as the major chemical flame retardant in the late 1970s and are commonly used in furniture, fabrics and electronic products as a means of reducing the flammability of combustible organic materials. The use of PBDEs have been restricted for some time and certain PBDEs are listed as persistent organic pollutants (POPs) which are subject to international control under the Stockholm Convention on POPs. There are many types of BFRs but only Polybrominated diphenyl ethers (PBDEs) were found in any appreciable quantities in the survey samples. The range for Σ−PBDEs (N=5) was 60 to 134 ng/kg fat with a mean of 95 ng/kg fat which are low by international norms.

[1] See Glossary for explanation of terms

Conclusions

1. The levels of dioxins found in the 2011 surveys are well below the EU limit in milk and milk products of 3.0 pg WHO-TEQ/g for dioxins only (Figure 1), and 6.0 pg WHO-TEQ/g for dioxins and PCBs combined. The results are also in line with earlier similar EPA surveys[2] .

2. All dioxin levels recorded in this survey compare favourably with those taken from a random selection of similar studies in EU and other countries.

3. The dioxin levels were in line with FSAI breast milk study of 2010 which confirmed low levels of exposure to the Irish population.

[2] *See Figure 1.*

1. INTRODUCTION

Background

"Dioxins" is a collective term for the category of 75 polychlorinated dibenzo-para-dioxin compounds (PCDDs) and 135 polychlorinated dibenzofuran compounds (PCDFs). These compounds or congeners arise mainly as unintentional by-products of incomplete or poorly controlled combustion and from certain chemical processes.

Dioxins, furans, and polychlorinated biphenyls (PCBs) are classified as persistent organic pollutants (POPs) under a global convention known as the Stockholm Convention on POPs which has as its objective the protection of human health and the environment from POPs. Such POPs are also controlled under legislation such as the EU POPs Regulation (EU 2004) and national POPs regulations (DECLG 2010).

In line with the Environmental Protection Agency's intention to maintain surveillance of dioxins, furans (collectively known as PCDD/F) and other micro pollutants, the Agency carried out a follow-up survey to the 1995, 2000, 2004, 2006, 2007, 2008, 2009 and 2010 surveys of dioxin in cows' milk (EPA 1996, EPA 2001, EPA 2005, EPA 2008 (1) and (2), EPA 2009, EPA 2010 and EPA 2011) in Summer 2011. 38 samples were taken and the sample locations were nominally the same as for the earlier surveys. Sometimes, for various technical and logistical reasons (EPA 2005) it was not always possible to sample in exactly the same location as previously, so that direct comparison of individual sampling points should be made with caution. As in earlier surveys, testing for dioxin-like PCBs was also included in this programme.

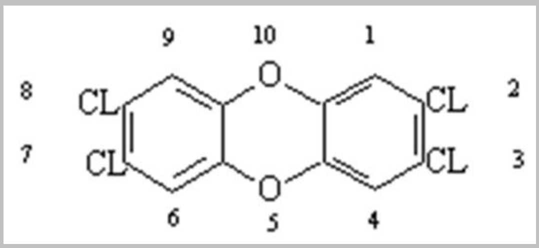
Dioxin levels in milk samples taken during the grazing season can be used as indicators for the actual average local dioxin exposure by atmospheric deposition. This is described more fully in earlier reports (EPA 2010)

In view of increased international awareness of the issue of the presence in the environment of brominated flame retardants (BFRs) and brominated dioxins and furans (PBDD/F), sampling for these substances was undertaken at the same time as the dioxin survey. Five samples, representative of different regions, were analysed. Each sample consisted of three pooled sub-samples from the dioxin survey.

Samples were taken between June and early August 2011 when the cows could be expected to be grazing outdoors. Details are given in Tables 1 and 2.

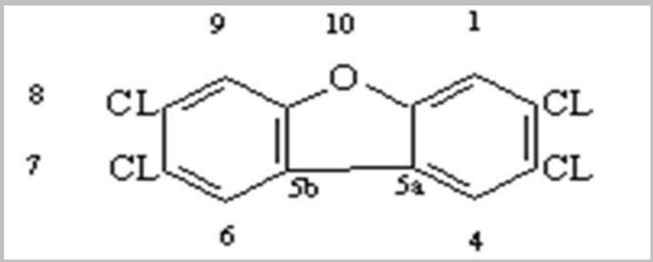
Toxicity of Dioxins

The toxicity of individual dioxin and dibenzofuran compounds (or congeners) varies considerably. PCDDs have two benzene rings connected by two oxygen atoms; in the PCDFs the two rings are connected by one oxygen atom. The PCDD and PCDF congeners which are likely to be of toxicological significance are those 17 congeners with chlorine atoms at the 2,3,7 and 8 positions. The most toxic dioxin is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD).



2,3,7,8-TCDD

The most toxic dibenzofuran is 2,3,7,8-tetrachloro-dibenzofuran (2,3,7,8-TCDF) which is similar in toxicity to 2,3,7,8-TCDD.



2,3,7,8-TCDF

The toxic responses include dermal effects, immunotoxicity and carcinogenicity, as well as reproductive and developmental toxicity.

Mechanism of Toxicological Action

A broad variety of data, primarily on TCDD but also on other members of the class of dioxin-like compounds, has shown the importance of the Aryl hydrocarbon Ah (dioxin) receptor in mediating the biological effects of dioxin. These data have been collected using many experimental models in multiple species and also from studies on human exposure.

Sources of Dioxins

PCDDs and PCDFs are not produced intentionally except for research and analysis purposes, but their formation is often a by-product of many anthropogenic activities.

The manufacture of some chlorinated compounds is known to result in the formation of PCDDs and PCDFs as unwanted by-products. However the manufacture and usage of many such substances, mainly chlorinated pesticides with significant dioxin contamination, is now banned. Internationally the main sources of dioxins in recent years have been identified as a wide range of combustion processes where they may be formed when organic materials and chlorine compounds are burned together**.** According to a study in the context of the Stockholm Convention, the main sources for emissions of dioxins to air in EU-25 are from non-industrial sources, with approximately 30 % of emissions across the EU-25 being as a result of residential combustion, with 15 % from backyard burning. http://ec.europa.eu/environment/dioxin/sources.htm Industrial emissions of dioxins and furans are highly controlled and it is estimated that industrial emissions of dioxins and furans in Europe has reduced by approximately 80 % over the last two decades as a result of more stringent legislative requirements. These processes can be more efficient if the precursor[3] chemicals are already present in a form that is close to that found in dioxins and dioxin-like PCBs. For example, organic chlorine may be more readily converted to dioxins and dioxin-like PCBs than inorganic chlorine. Aromatic[3] chemicals are more readily converted to dioxins and dioxin-like PCBs than aliphatic[3] substances.

Across the EU-25 countries the main sources of dioxin emissions are reported as:

- Residential combustion (~ 30%)
- Open burning of waste (backyard burning) (~15%)
- Wood preservation (~15%)
- Iron and steel industry (~ 8%)
- Power production, non-ferrous metals, chemical industry (~ 5% each)

It should be noted that there is no longer any iron and steel manufacturing in Ireland, with the vast majority of dioxin emissions to atmosphere estimated to be from uncontrolled combustion activities and power and heat generation (including residential).

Potential industrial sources can include incineration of all types of wastes, metallurgical operations such as smelting and scrap metal recovery furnaces and the burning of fuels such as coal, wood (especially where the wood contains preservatives) and petroleum products.
Other sources are motor vehicle emissions especially heavy diesel trucks (U.S. EPA 2006) and emissions from both accidental and natural fires and volcanoes. Emissions from leaded fuels, which were significant in the past, have almost disappeared. Sources such as bonfires and illegal or uncontrolled burning of domestic waste, according to research conducted in the UK (Dyke and Coleman, 1997) and by U.S. EPA (Gullett et al, 2000) are also significant although obviously difficult to quantify.

For many countries in Europe the main source of dioxins in the past was emissions from poorly controlled municipal solid waste (MSW) incinerators. However, the introduction of strict controls on emissions has resulted in the closure of many old incinerators which could not be upgraded. In the UK for example, total emissions from MSW incineration plants, which were the major source of dioxin emissions in 1990 at 600 g I-TEQ, were reduced to around 2 g I-TEQ by 1999, corresponding to less than 1% of all UK releases (DEFRA 2001). A recent report from the UK

[3] *See Glossary for explanation of terms*

Health Protection Agency (HPA) reviewed research on the links between emissions from municipal waste incinerators and effects on health. It concluded that modern and well managed municipal waste incinerators make only a very small contribution to local concentrations of air pollutants and any potential damage to the health of those living close-by is likely to be very small, if detectable (HPA 2009). At present there are five facilities in Ireland which are now licensed by the EPA to commercially accept, amongst other waste types, MSW or fractions of MSW for combustion, four of which are now operational.

Domestic coal fires are also believed to be a relatively significant source of dioxin emissions, particularly when domestic waste, plastic or treated wood is used on these fires. The burning of damp fuel, including unseasoned logs, and of salt-laden wood from coastal areas can give rise to increased dioxin emissions (DEFRA 2006). Dioxins are also found in paper products arising from the bleaching with chlorine of naturally occurring phenols present in wood pulp and in the manufacture of some chlorinated compounds. Forest fires are also a significant source of dioxins.

A well-known example of an accident involving release of dioxins was the explosion in 1976 at Seveso, Italy, where some of the contents of a 2,4,5-trichlorophenol manufacturing plant were released into the atmosphere causing severe local contamination with trichlorophenol and 2,3,7,8- TCDD. Dioxins also attracted particular attention during the Vietnam War where they were found to be present as a contaminant in the defoliant Agent Orange, a mixture of 2,4,5-T and 2,4-D. High levels of dioxins were found in poultry and eggs from Belgium in 1999. The cause of the contamination is thought to have been contamination of animal feed. In July 2007, the European Commission issued a health warning to its Member States after high levels of dioxins were detected in a food additive - guar gum, produced from the seeds of the guar bean, - used as thickener in small quantities in meat, dairy, dessert or delicatessen products. The source was traced to a shipment of guar gum from India that was contaminated with pentachlorophenol (PCP), a pesticide subject to severe restrictions in EU countries. PCP generally contains dioxins as a contaminant. (EC 2008). A more recent incident occurred in Ireland in late 2008 where routine testing of the food chain found pig feed and pork tainted with PCBs and dioxins. The Irish government, as a result, ordered a recall of all domestically produced pork products from the market. The incident was traced to the burning of PCB contaminated oil at a single pig feed manufacturing plant. Uncontrolled burning of some common PCB mixtures can give rise to the efficient formation of certain dibenzofuran compounds. Even more recently, in late 2010 in Germany, as a result of contaminated vegetable feed fed to hens, higher levels of dioxins than those permitted by EU law were found in poultry meat and eggs. This contaminated feed which was intended for technical purposes originated from a biodiesel plant.

Dioxin compounds have no commercial value and have never been intentionally synthesised other than for laboratory use. Monitoring data for dioxins date only from the 1970s as the analytical capabilities for their detection did not exist before then due to the extremely low concentrations at which they were present in the environment. However, there can be little doubt that dioxins formed from anthropogenic activities have existed, at least to some extent, as long as there has been fire.

An EPA commissioned desk study to provide an estimate of dioxin emissions to air, land and water (Hayes & Marnane 2002) estimated that in 2000, notwithstanding the inherent uncertainties of the calculations, more than half of all air emissions could be attributed to domestic burning of waste. A more recent Air Emissions Inventory, prepared by the EPA for the UN/ECE Convention, (EPA 2012) showed a 41 per cent reduction in 2010 compared with 1990 levels for Dioxin and Furan emission levels. Again, the main contribution to the inventory was the Other Waste sector, which includes the residential burning of waste, accounting for 47.0 per cent of the national air total emissions in 2010. In a nationwide investigation by the EPA it was estimated that 287,000 tonnes of household waste, representing

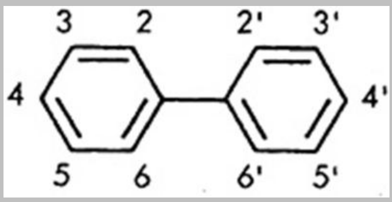
700,000 persons, was uncollected in 2003. This figure reduced to 203,000 tonnes in 2005 and 128,000 tonnes in 2009. In addition 80% of Local Authorities have identified backyard burning as a significant issue, especially in rural areas where a local waste collection may not be available (EPA 2005b, EPA 2006, EPA 2010b). Hayes & Marnane also identified building fires, household heating, cooking with fossil fuel and iron and steel production as the main other sources of dioxin emissions in 2000. The sole iron and steel production facility in the State has since closed.

Considerable efforts have been made in recent times to minimise illegal waste and backyard burning. These include the Department of Environment's Race against Waste campaign, the EPA media campaigns on backyard burning and illegal waste collection, the "Dump the Dumpers" and the "See Something, Say Something" phone hotlines.
These measures were highlighted as examples of good practice in waste minimisation at a EU "Expert Workshop on Dioxin Emissions from Domestic Sources" (http://www.bipro.de/dioxin-domestic/sub/meetings.htm. This meeting also emphasised the importance of awareness programmes in Member States regarding appropriate fuel and appliance use and issues such as dioxin release from backyard burning were also highlighted. More recently these initiatives were enhanced by the Waste Management Regulations which make more explicit the offence of disposal of waste by uncontrolled or unregulated burning, including backyard burning of household waste. (DOEHLG 2009)

It may also be anticipated that measures to improve energy efficiency put in place through the National Climate Change Strategy 2007-2012, with an increased focus on wasteful fuel consumption and waste management and consequent emphasis on non-combustion energy alternatives, will also tend to have a positive impact on dioxin levels in the future. The Air Quality Regulations 2011 (DOEHLG 2011) is another example of a synergistic effect on dioxin emissions from a related piece of legislation. The recently published National Energy Efficiency Action Plan 2009 – 2020 which aims to achieve by 2020 a 20% reduction in energy demand across the economy, should also have a similar impact (DCENR, 2011).

Toxicity of PCBs

Polychlorinated biphenyls (PCBs) are chlorinated hydrocarbons which were synthesised by direct chlorination of biphenyl but whose production has now been discontinued. PCBs consist of a biphenyl (two benzene rings with a carbon to carbon bond between carbon 1 on one ring and carbon 1' on the second ring) with a varying number of chlorine atoms substituting for hydrogen atoms on the biphenyl rings.



Basic PCB structure

Depending on the number and location of the chlorine atom substituents, there are 209 possible PCB congeners. Some PCB congeners have a "coplanar" structure with the two biphenyl rings lying in the same plane. Of these, there are 12 mono-ortho (chlorine in 2 or 6 position in structure above) and non-ortho substituted PCBs which show similar toxicological properties to dioxins and are often termed "dioxin-like PCBs".

Unlike dioxins, PCBs have found widespread use in a number of commercial open and closed applications, due to their physical and chemical properties, such as non-flammability, chemical inertness, high boiling points and high dielectric constants. Typical open applications have been their use in pigments, sealants, rubber products and carbonless copy paper. Closed applications have included use of PCBs in hydraulic and heat transfer systems, transformers and capacitors. The production and use of PCBs has been discontinued for some years but because of their persistent qualities they remain in electrical equipment, buildings and the environment. Dioxins and furans are often found in appreciable quantities as contaminants in PCBs. In Ireland the Waste Management (Hazardous Waste) Regulations 1998 were brought into force to implement provisions of the PCB Directive which set out the requirements in terms of the disposal of PCBs and registering holdings of PCBs.

Persistent Organic Pollutants (POPs) & the Stockholm Convention

Dioxins and PCBs are two of the substances listed as POPs in the Stockholm Convention. In keeping with its obligations under the Convention, the Environmental Protection Agency as competent authority under the national POPs regulations, has prepared a National Implementation Plan on POPs which details the measures put in place to protect human health and the environment from the POPs that are listed under the Convention, including dioxins and PCBs.
http://www.epa.ie/downloads/pubs/waste/haz/name,33981,en.html
The plan sets out further priority actions to support the control of POPs showing how it plans to limit and control POPs.

Toxic Equivalency Factors (TEFs) for Assessing Mixtures of Dioxins and Dioxin-like Compounds

Because real samples containing dioxins are made up of complex mixtures, a system of Toxic Equivalents has been developed in order to address the problem of reporting of differing toxicities and environmental behaviour of these substances. This procedure uses a scheme of weighting factors which expresses the toxicity of each individual PCDD and PCDF in terms of an equivalent amount of the congener 2,3,7,8-TCDD. This weighting factor, called a toxic equivalent factor (TEF), is multiplied by the concentration of the individual compounds in a mixture to give a 2,3,7,8-TCDD toxic equivalent, (TEQ) which is the sum of the concentrations of the individual congeners multiplied by their TEFs. The TEFs for the various PCDD, PCDF and dioxin-like PCB congeners are listed in Annex 1.

A new Regulation, EU 1259/2011 revising maximum levels for dioxins, dioxin-like PCBs and non dioxin-like PCBs in foodstuffs including milk, came into force in December 2011. This has the effect of reducing the dioxin limits from 3.0 pg WHO-TEQ/g to 2.5 pg WHO-TEQ/g and the dioxin+ PCB limits from 6.0 pg WHO-TEQ/g to 5.5 pg WHO-TEQ/g. The TEF values have been modified for some congeners, both upwards and downwards, in accordance with latest scientific information. Limits have also been set for the first time for non dioxin-like PCBs. These changes will be reflected in future dioxin milk surveys and reports.

Systems for Establishing TEFs

A number of different systems for establishing toxic equivalent factors now exist. The NATO/CCMS (North Atlantic Treaty Organisation's Committee on Challenges of Modern Society) I-TEQ system which was used in the EPA 1996 report, defines most of the older data. The newer system devised by the World Health Organisation (WHO) in 1998 also incorporates PCBs. The WHO have also suggested that the TEQ scheme be re-evaluated every five years and that TEFs be reanalysed in the light of any new scientific information. Clearly it is important when comparing data to define correctly the TEQ units and also whether PCBs are being considered. Usually I-TEQ concentrations will be a little lower than WHO-TEQs as some of TEFs have been revised upwards by the WHO. The TEF values for both systems are tabulated in Annex 1. In general, it can be safely assumed that older data will have been calculated according to the I-TEQ system.

Treatment of Levels Below Detection Limits

In calculating TEQs for compounds that are not found in concentrations above the limit of detection, the conventional approach up to relatively recently was to use <u>one half</u> of the detection level for non-detects (congeners not found at the analytical detection level). A recent EC Directive which set maximum levels for dioxins in foodstuffs stipulated that limits of quantification (LOQs) be used instead of limits of detection (LODs)[2] and also that the full LOQ should be taken in the calculation of non-detects (EC 2001). This is a totally conservative approach to estimating TEQs at trace levels, and it can lead to an over-estimation of concentrations in low level samples. This method, which was generally introduced in 2002, has been used in the calculations below and should be borne in mind when making comparisons with older low level studies. As not all reported data consider non-detects, it is important to clarify this issue when comparing low level data from different sources.

[1]Limit of quantification is commonly defined as:

> *The limit of quantification is the smallest concentration of unknown that can reliably be **quantified** by the instrumental method. The accepted limit is that concentration of analyte, which produces an instrumental response that is ten times as large as the standard deviation S of the instrumental noise level (L.O.Q. = 10 x S/N)*

[2]Limit of detection as used in analytical chemistry is commonly defined as:

> *The limit of detection is the smallest concentration of unknown that can reliably be **detected** by the instrumental method. The accepted limit is that concentration of analyte, which produces an instrumental response that is three times as large as the standard deviation S of the instrumental noise level (L.O.D. = 3 x S/N)*

2. NATIONAL DIOXIN SURVEY

Background

This survey was planned as a follow-up to the earlier national surveys mentioned in the introduction. As far as possible, the same approach was adopted in terms of time of year and location of samples.

Samples were taken June and early August 2011 when the cows could be expected to be grazing outdoors. Details are given in Tables 1 and 2.

Sampling strategy

Two types of sampling stations were chosen:

Type A	background stations covering the entire country (24 samples)
Type B	potenial impact stations in areas of perceived potential risk (14 samples)

Type A samples were normally taken from full milk silos (30,000 to 50,000 gallons) in regional dairies. However there were a number of instances where sampling from silos was not possible and the samples were taken instead from road tankers representative of the area to be covered. Type B samples were taken from road tankers representing the "potential impact" areas.

Sampling procedure

Samples were taken in thick-walled pyrex glass bottles of one litre capacity, which had been washed with detergent and acetone. The sample volume was 800 ml. Duplicate samples were taken with the intention of submitting one sample for analysis and retaining the other sample in the EPA regional laboratories in the event of a sample being lost in transport or a repeat analysis being required.

The samples were taken by EPA personnel while the milk was still in its raw state. The samples were then taken to the nearest EPA regional laboratory where they were frozen at –20° C. Shipment of samples was by overnight courier in ice boxes to the laboratory (see below).

Analysis

The laboratory used for the dioxin analyses was the State Laboratory in Backweston Co Kildare. The agency continued to use Gesellschaft für Arbeitsplatz und Umweltanalytik (GfA) laboratory in Münster, Germany for the BFR analysis.

Analyses were carried out following pre-treatment and extraction from the milk fat, using high resolution gas chromatography and high resolution mass spectrometry with ^{13}C-labelled isomers as internal standards. This method is considered to be the most suitable for low-level dioxin measurements. The analytical methodology is in compliance with the requirement for the analysis of foodstuffs for PCDD/Fs and PCBs as laid down by the EU directive 2002/69 and its amendment 2004/44.

Results and Tables

The data showing WHO-TEQs for milk fat are shown in Tables 1 and 2 with a statistical summary in Table 3.

Data for whole milk are also available and are shown in Annex 2 as fresh-weight data for individual congeners. However, for comparison purposes it is generally more useful to use the milk fat rather than whole milk data due to the varying composition of fat in milk. Using the fat data also facilitates comparisons with other dairy products such as butter and cheese and also with human milk. Regulatory limits are also generally expressed in terms of dioxin content in fat.

The detailed analytical results showing the levels for the individual congeners are also given in Annex 2.

The fat content was measured separately and TEQs were determined in fat and then back-calculated to give corresponding levels in the original whole milk sample. (Annex 2)

Table 1

Milk fat related PCDD/F and PCB-TEQ values determined in the background samples A 1 - A 25

Sample	Milk supply area	Dioxins	PCBs	Dioxins& PCBs
		WHO-TEQ incl. LOQ	**WHO-TEQ incl. LOQ**	**Total WHO-TEQ incl. LOQ**
	Unit	*pg/g milk fat*	*pg/g milk fat*	*pg/g milk fat*
A1	Mitchelstown Area	0.231	0.188	0.419
A2	Co. Waterford	0.171	0.147	0.318
A3	Dublin South.Co./North Wicklow Area	0.237	0.170	0.407
A4	North Co. Wexford	0.483	0.177	0.661
A5	Charleville, Co Cork Area	0.190	0.153	0.343
A6	Ballyragget, Co Kilkenny Area	0.216	0.158	0.374
A7	Renmore, Co Galway Area	0.443	0.239	0.682
A8	Moate, Co Westmeath Area	0.367	0.139	0.506
A9	Tipperary Town/Thurles Areas	0.171	0.155	0.326
A10	Nenagh, Co. Tipperary Area	0.169	0.166	0.335
A11	Cavan/Longford/Leitrim	0.400	0.249	0.649
A12	Drinagh, Co Cork	0.223	0.166	0.389
A13	Bandon Area	0.219	0.135	0.354
A14	North Kerry Area	0.176	0.167	0.343
A15	Co Sligo	0.218	0.214	0.432
A16	Roscommon/East Galway	0.259	0.181	0.440

A18	Roscommon/Leitrim	0.224	0.187	0.410
A19	Co Monaghan	0.336	0.208	0.544
A20	Co Louth	0.312	0.190	0.503
A21	North Kildare/West Dublin	0.234	0.142	0.375
A22	So Kerry Cahirciveen area)	0.222	0.245	0.467
A23	South Wexford	0.260	0.179	0.439
A24	SE Co. Mayo	0.215	0.128	0.343
A25	Co. Donegal	0.520	0.306	0.826

Sample corresponding to A17 was taken only in the 1995 survey

Table 2

Milk fat related PCDD/F and PCB-TEQ values determined in the potential impact samples B1 - B 18

Sample No.	**Milk supply area**	**Dioxins**	**PCBs**	**Dioxins & PCBs**
		WHO-TEQ incl. LOQ	**WHO-TEQ incl. LOQ**	**Total WHO-TEQ incl. LOQ**
	Unit	*pg/g milk fat*	*pg/g milk fat*	*pg/g milk fat*
B1	Carrigtwohill/ Cobh/Great Island	0.241	0.153	0.394
B2	Aghada/East Cork Harbour	0.251	0.182	0.433
B3	Askeaton area	0.233	0.208	0.441
B4	Tarbert Co. Kerry	0.180	0.198	0.377
B5	Clarecastle Co.Clare	0.194	0.120	0.314
B6	Cooraclare Co.Clare	0.175	0.126	0.301
B7	Ballydine, So. Tipperary	0.186	0.161	0.346
B8	Swords/ Mulhuddart. Co.Dublin	0.365	0.395	0.759
B9	Grannagh. So.Kilkenny	0.198	0.160	0.358
B13	Kinsale (Dunderow) Co.Cork	0.171	0.128	0.299
B14	Ringaskiddy area. Co.Cork	0.382	0.248	0.630
B15	Crossakiel (nr Kells). Co.Meath	0.217	0.143	0.360
B17	Carranstown Co.Meath	0.222	0.168	0.390
B18	Kinnegad, Co Westmeath	0.302	0.210	0.512

Samples corresponding to B10, B11, B12 and B16 from 1995 or 2000 were not taken in more recent surveys.

Table 3

Summary of Milk Fat Data in pg TEQ/g fat

	"A" Samples			*"B" Samples*			*"A and "B" Samples combined*		
Sample	**Dioxins WHO-TEQ incl. LOQ [a]**	**PCBs WHO-TEQ incl. LOQ [a]**	**Dioxins and PCBs Total WHO-TEQ incl. LOQ [a]**	**Dioxins WHO-TEQ incl. LOQ [a]**	**PCBs WHO-TEQ incl. LOQ [a]**	**Dioxins and PCBs Total WHO-TEQ incl. LOQ [a]**	**Dioxins WHO-TEQ incl. LOQ [a]**	**PCBs WHO-TEQ incl. LOQ [a]**	**Dioxins and PCBs Total WHO-TEQ incl. LOQ [a]**
EU Limit	**3.0**		**6.0**	**3.0**		**6.0**	**3.0**		**6.0**
EU Action level	**2.0**	**2.0**		**2.0**	**2.0**		**2.0**	**2.0**	
Minimum	0.169	0.128	0.335	0.171	0.120	0.299	0.169	0.120	0.299
Maximum	0.520	0.306	0.826	0.382	0.395	0.759	0.520	0.395	0.826
Mean	0.275	0.184	0.459	0.237	0.186	0.422	0.261	0.184	0.445
Median	0.231	0.178	0.419	0.220	0.164	0.384	0.227	0.174	0.409

Discussion

Summary

A summary of the milk fat data showing a breakdown of the background (type A), and the potential impact (type B) samples along with the combined data set is presented in Table 3.

Dioxins

Considering the entire set of samples (Tables 1 and 2), the reported WHO-TEQ ranges for dioxins in milk fat are 0.169 to 0.520 pg with overall mean values of 0.261 pg WHO-TEQ/g. The highest value was the A25 sample from Donegal but was still within EU limits and action values.

PCBs

The highest dioxin-like PCB level was again the North Co. Dublin B8 sample at 0.395 pg WHO-TEQ/g, less than 20% of the EU action level. This sample was taken from North Co. Dublin and would be subject to the greatest anthropogenic influences of all the areas sampled. The the levels found are typical of those found internationally in a semi – urban environment. The mean value was 0.184 pg WHO-TEQ/g with a range of 0.120 to 0.395 pg WHO-TEQ/g. There is no separate EU limit value for dioxin-like PCBs.

Dioxins & PCBs

The range for the sum of Dioxins & PCBs is 0.299 to 0.826 pg WHO-TEQ/g with a mean of 0.445 pg WHO-TEQ/g. The highest value was the A25 sample because of the dioxin content of this sample as mentioned above.

Figure 1 Dioxins/Furans
2011 Data Compared with 2000-2011 Averages

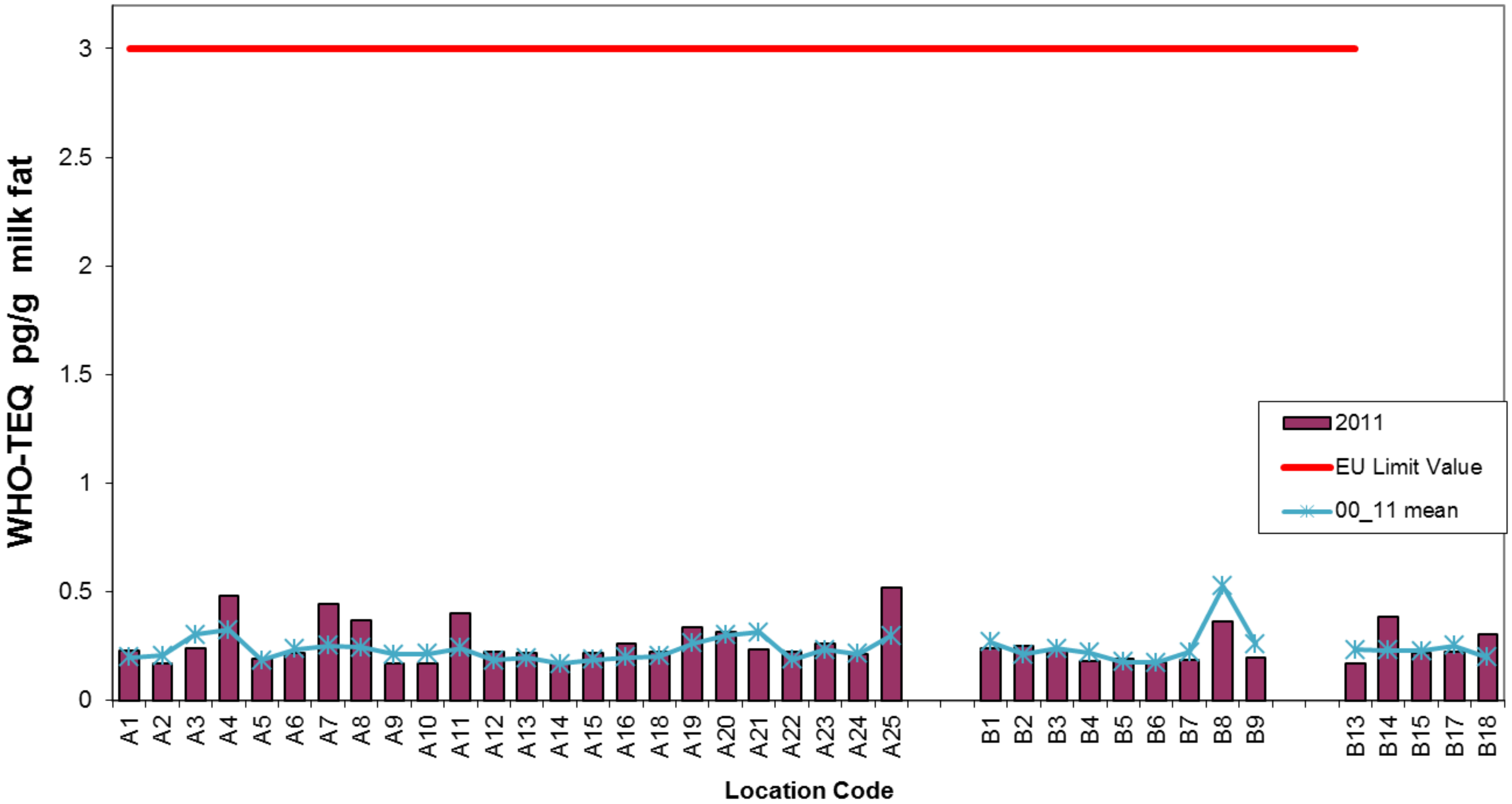


Figure 2 PCBs
2011 Data Compared with 2000-2011 Averages

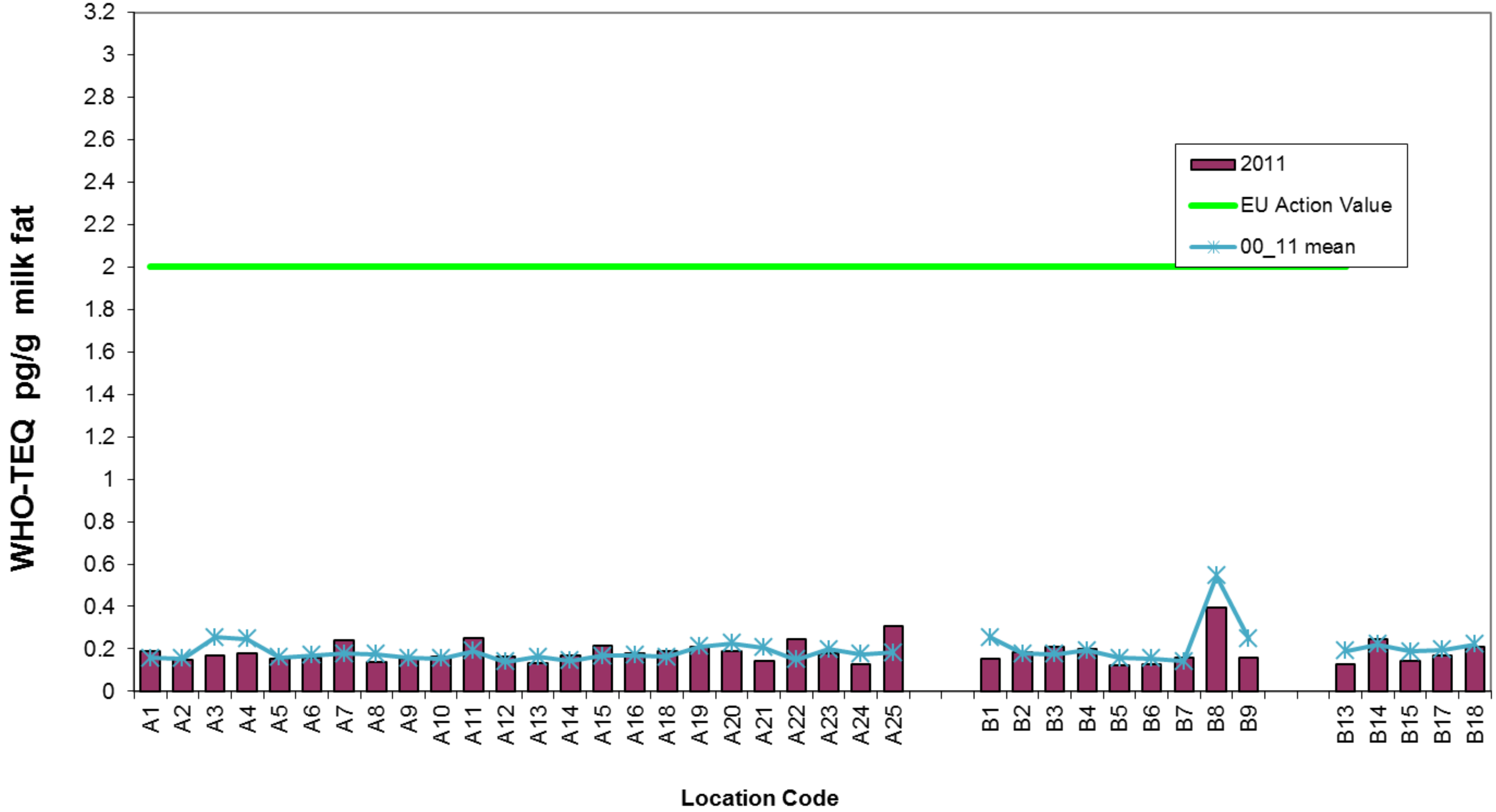
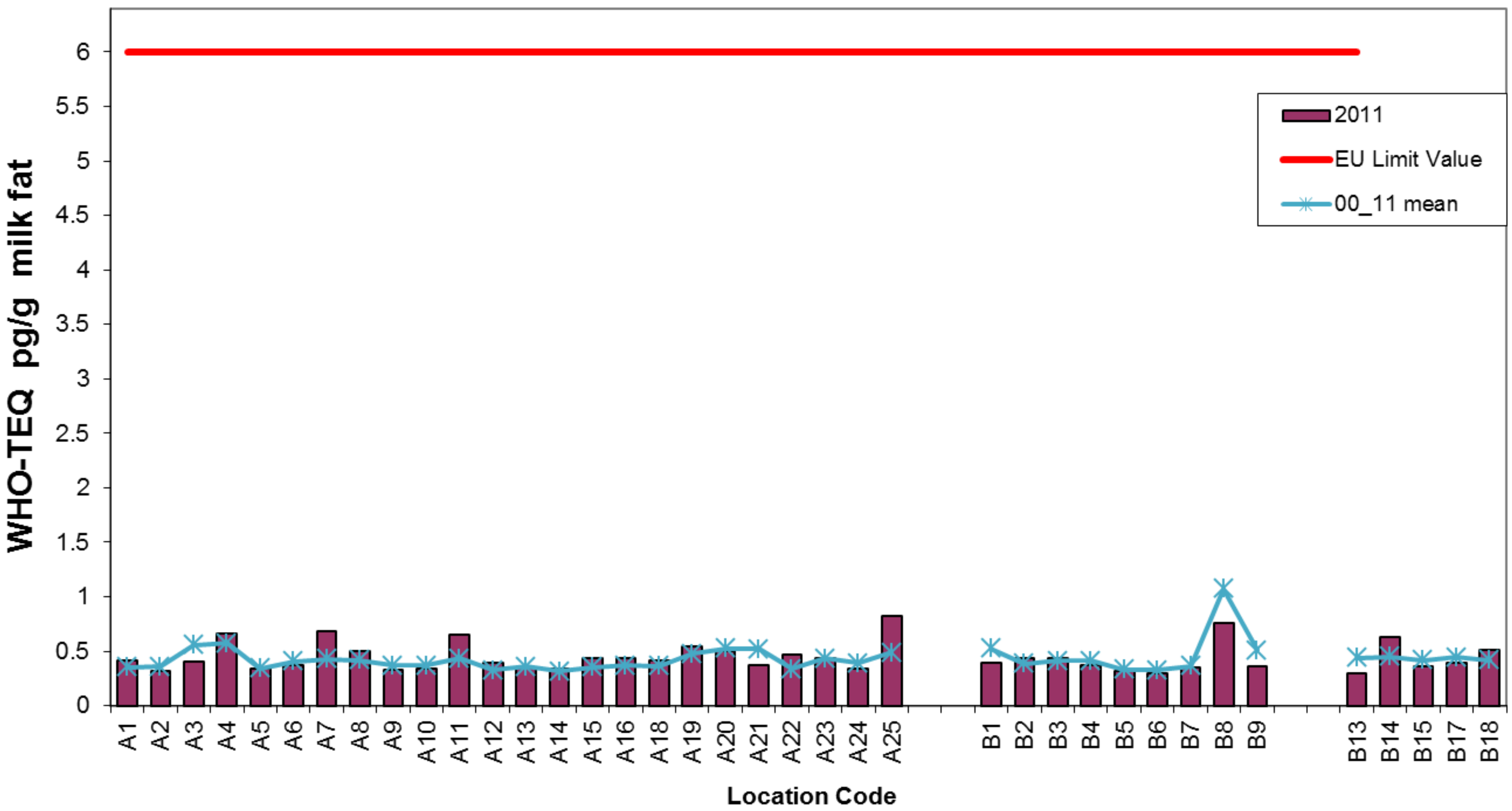


Figure 3 Dioxins/Furans + PCBs
2011 Data Compared with 2000-2011 Averages



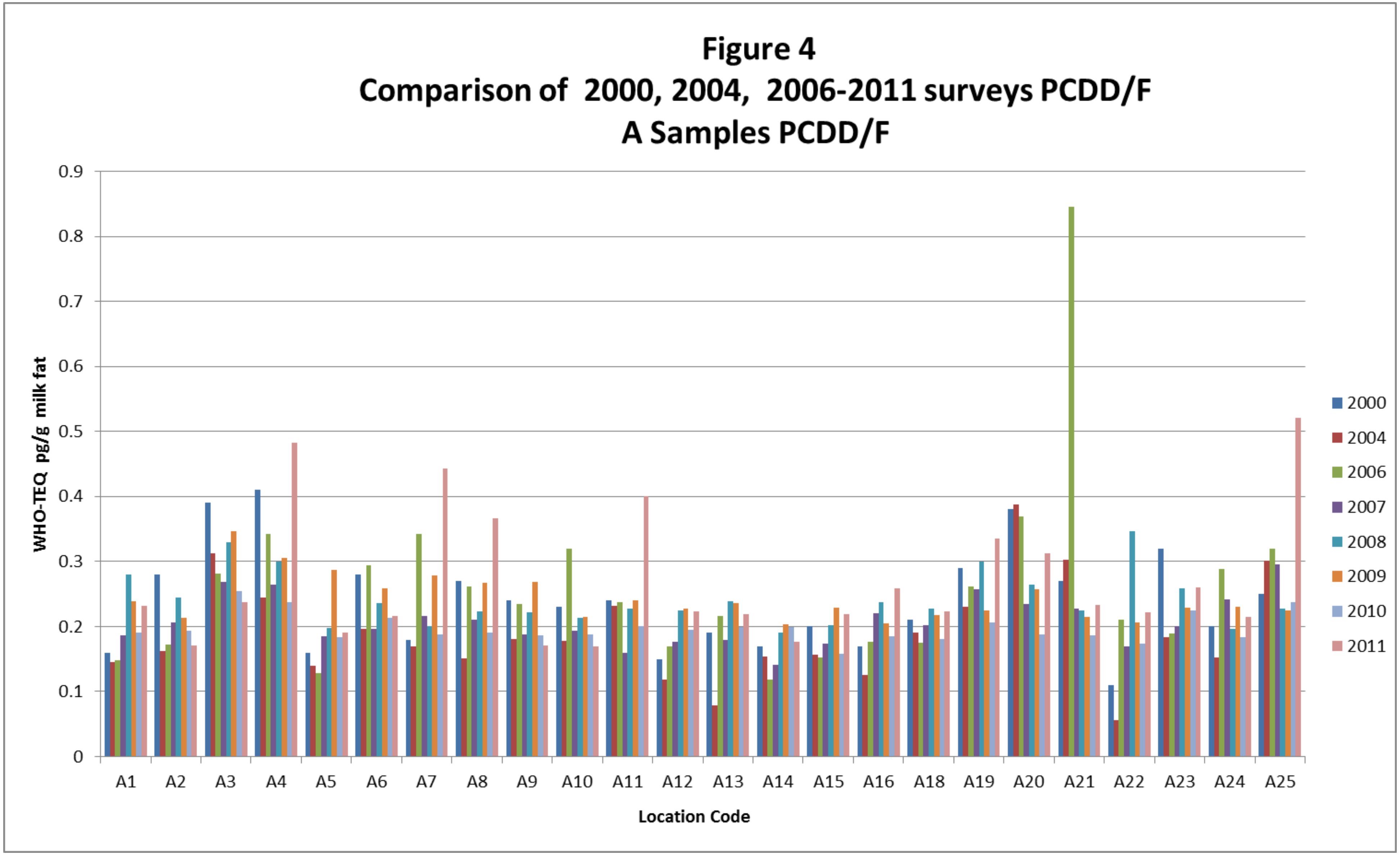


Figure 4
Comparison of 2000, 2004, 2006-2011 surveys PCDD/F
A Samples PCDD/F
WHO-TEQ pg/g milk fat
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A18
A19
A20
A21
A22
A23
A24
A25
Location Code
2000
2004
2006
2007
2008
2009
2010
2011

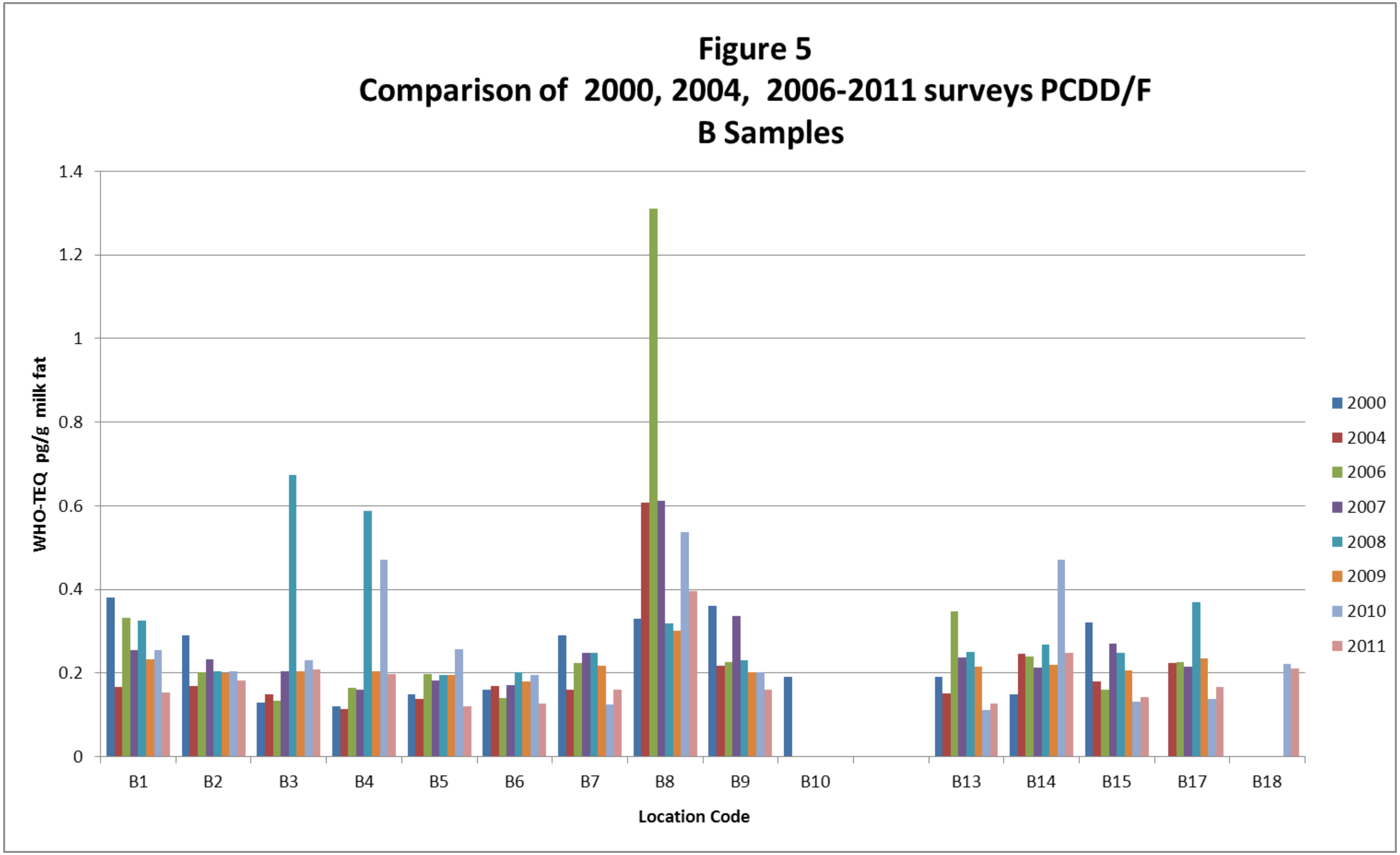


Figure 5
Comparison of 2000, 2004, 2006-2011 surveys PCDD/F
B Samples
WHO-TEQ pg/g milk fat
1.4
1.2
1
0.8
0.6
0.4
0.2
0
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B13
B14
B15
B17
B18
Location Code
2000
2004
2006
2007
2008
2009
2010
2011

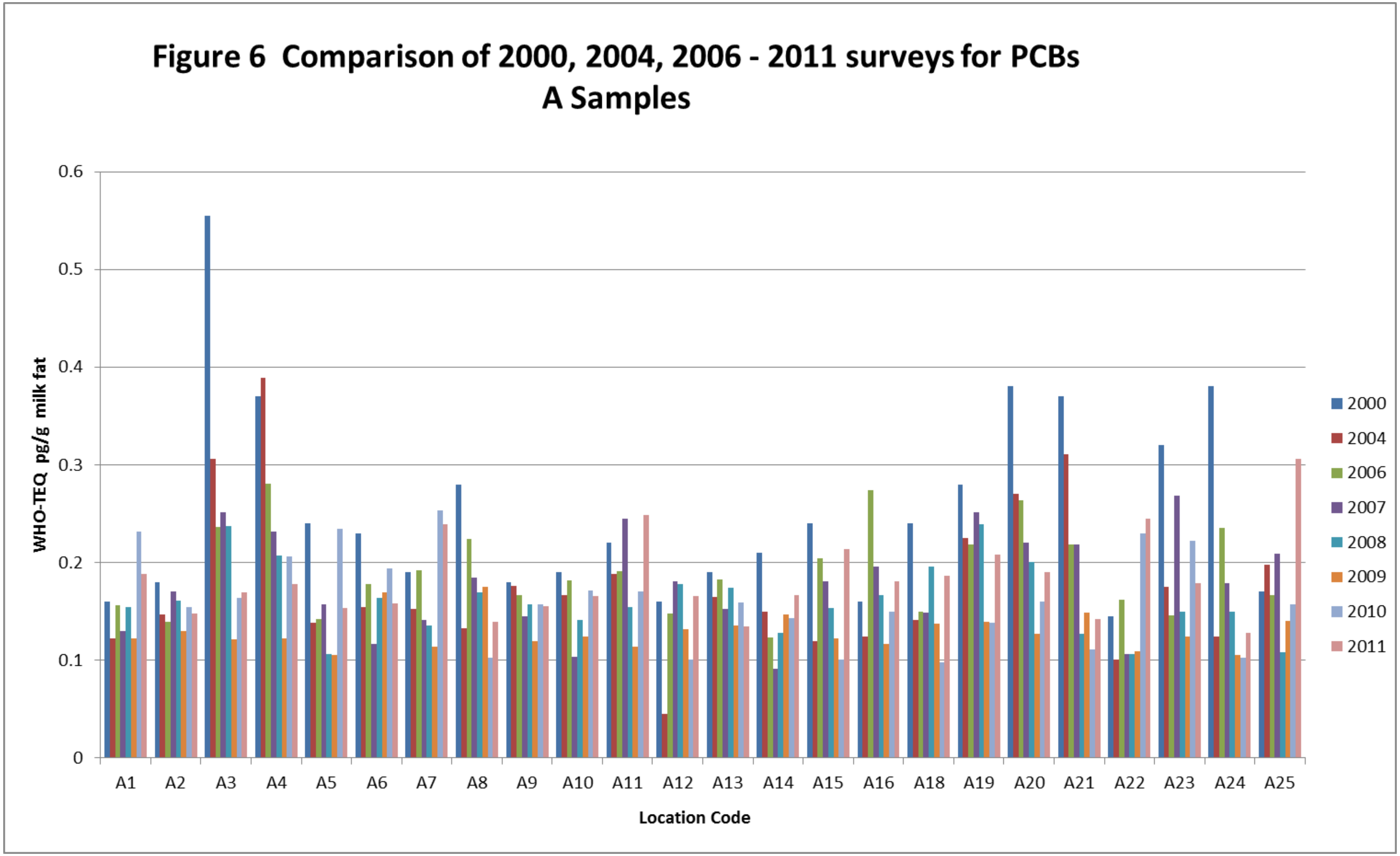


Figure 6 Comparison of 2000, 2004, 2006 - 2011 surveys for PCBs
A Samples
WHO-TEQ pg/g milk fat
0.6
0.5
0.4
0.3
0.2
0.1
0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A18
A19
A20
A21
A22
A23
A24
A25
Location Code
2000
2004
2006
2007
2008
2009
2010
2011

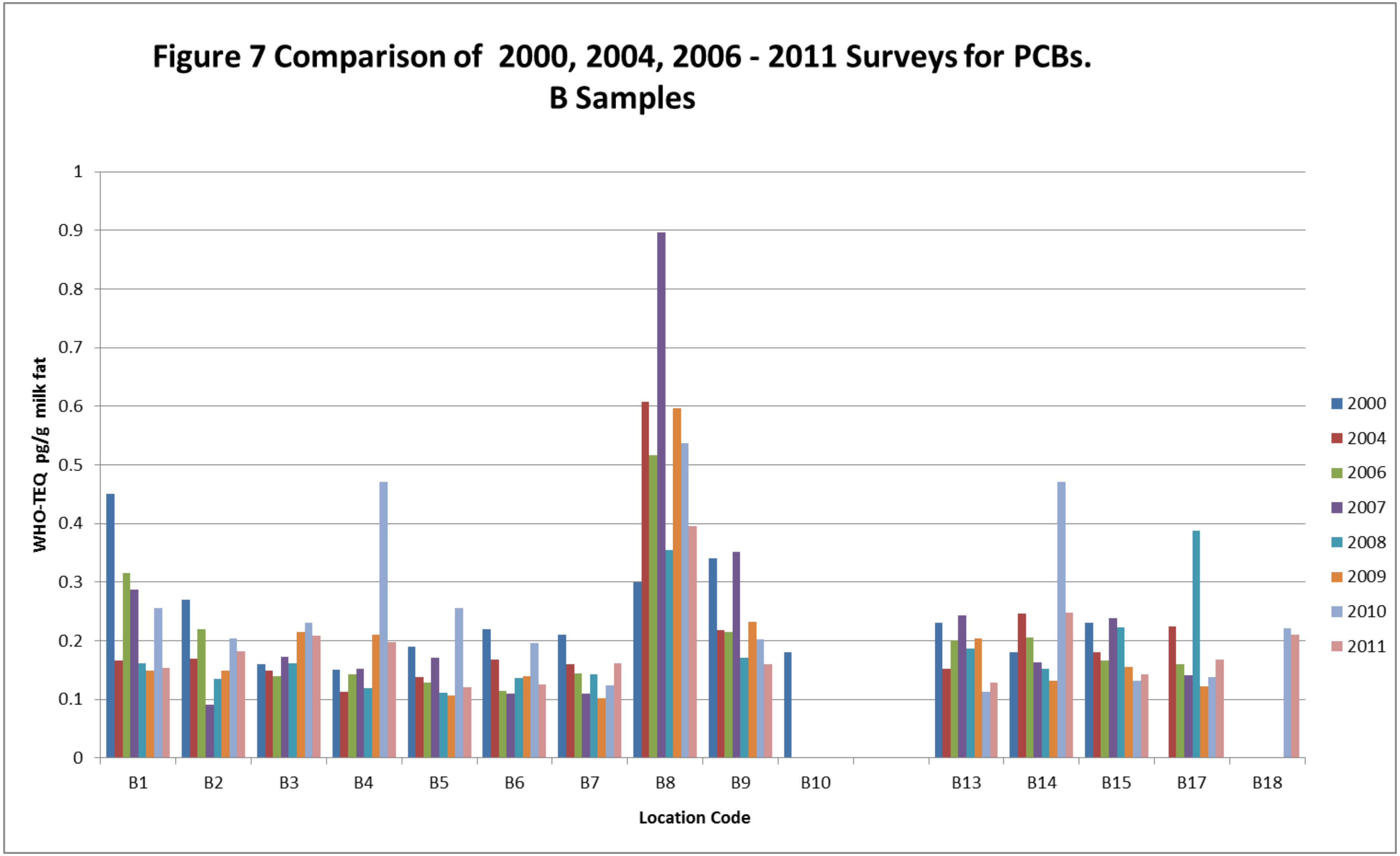


Figure 7 Comparison of 2000, 2004, 2006 - 2011 Surveys for PCBs.
B Samples
WHO-TEQ pg/g milk fat
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B13
B14
B15
B17
B18
Location Code
2000
2004
2006
2007
2008
2009
2010
2011

3. COMPARISON WITH EARLIER DIOXIN SURVEYS

Figures 1, 2 and 3 show the 2011 data in terms of the averages for the period 2000 to 2011 for dioxins, PCBs and dioxins + PCBs, respectively. It also shows the degree of compliance with regulatory limits. Figures 4-7 show a more detailed comparison with the individual data points for the A and B samples for both dioxins and PCBs. Comparisons with 1995 survey are not used since those results were reported using the old ITEQ units.

As previously mentioned, comparisons of low-level data over time should be made with a certain amount of caution. For example, analytical sensitivity has improved and the treatment of amounts reported below the limits of detection has changed (EPA 2005).

In addition, the amalgamation and re-organisation of certain dairies following the rationalisation of the dairy industry can make historical comparisons of individual sample points somewhat problematic. These issues are discussed more fully in earlier reports (EPA 2005).

The mean value for dioxins in milk fat in the 2011 survey was 0.265 pg WHO-TEQ/g compared to corresponding mean values of 0.202, 0.234, 0.269, 0.225, 0.275, 0.195 and 0.24 pg WHO-TEQ/g for the 2010,2009, 2008, 2007, 2006, 2004 and 2000 surveys, respectively. The overall mean for the period was 0.238 pg WHO-TEQ/g.

In the case of PCBs the 2011 mean value of 0.196 pg WHO-TEQ/g was in line with the 2010, 2009, 2008, 2007, 2006, 2004 and 2000 mean values 0.184, 0.151, 0.170, 0.200, 0.196, 0.187 and 0.247 pg WHO-TEQ/kg respectively. The overall PCB mean for the period 2000-2011 was 0.191 pg WHO-TEQ/g.

It can be seen that the 2011 results for dioxins and PCBs are broadly in line with the earlier similar EPA surveys.

Figure 1, read in conjunction with Tables 1 & 2, indicates that locations having average dioxin concentrations of less than 0.2 pg WHO-TEQ/g were typically in west Munster and Connaught, whereas those with concentrations greater than 0.3 pg WHO-TEQ/g were typically along the east coast. A similar pattern may be observed with respect to PCB concentrations. This is likely to reflect the broad pattern of an increase in anthropogenic influences from west to east.

4. OTHER STUDIES IN MILK AND DAIRY PRODUCTS

Data submitted to the EU Commission on 152 dairy samples (milk and milk products) between 1997 and 2003 from the then 15 member states plus Iceland and Norway as part of an EU-wide survey showed an overall mean of 0.77 pg WHO-TEQ/g fat (Gallani et al, 2004). No upper or lower limits are shown in the study.

Dairy samples analysed by GfA between 2003 and 2005 on behalf of mainly Western European clients showed an overall mean of 0.35 pg WHO-TEQ/g fat for dioxins with a range of 0.11 to 1.33 pg WHO-TEQ/g. (Hamm et al, 2005, n =138).

Data from a German monitoring programme of dairy product samples from North-Rhine Westphalia gave an overall mean for dioxins of 0.52 pg WHO-TEQ/g fat and 0.92 pg WHO-TEQ/g fat dioxin-like PCBs. The ranges were 0.30 to 0. 97 WHO-TEQ/g fat and 0.34 to 1.42 WHO-TEQ/g fat for dioxins and dioxin-like PCBs respectively. (Fuerst 2006)

A US EPA study of samples taken from eight different regions in the US in July 2000 and January 2001 showed an overall composite mean of 0.71 pg WHO-TEQ/g fat. Again no upper or lower limits are shown in the study. (Schuda et al 2004)

Samples taken on behalf of the UK Food standards Agency in 2005 showed a mean of 0.37 pg WHO-TEQ/g and a range 0 32 to 0.48 pg WHO-TEQ/g A similar 2006 study showed a mean of 0.34 pg WHO-TEQ/g with a range of 0.19 to 0.52 pg WHO-TEQ/g (FSA 2005, FSA 2006, n=4 in each case).

A French national survey carried out in April 2006 of 239 raw cow's milk samples from 93 plants showed average concentrations of 0.33 pg PCDD/Fs and 0.57 pg dioxin-like PCBs in raw cows' milk. (Durand et al 2008)

These comparisons are summarised in Table 4.

It is clear, therefore, that the levels of dioxins in the Irish studies are low by international comparisons.

There is now an increasing tendency internationally to measure dioxins and other micropollutants in human milk as a good means of monitoring human exposure and body burdens of these substances. A Irish project on dioxins in human milk undertaken by FSAI is described below

Dioxin Limits in Milk

The EU limit for dioxins and furans for milk and milk products is set at 3.0 pg WHO-TEQ/g fat. When PCBs are included it is 6.0 pg WHO-TEQ/g fat (EC 2006 (1)).

The EU action level for dioxins and furans is 2.0 pg WHO-TEQ/g fat. The action level for PCBs is also set at 2.0 pg WHO-TEQ/g fat. There is no separate limit for PCBs, (EC 2006 (2)). It is clear that the overall mean levels found in all of the Irish surveys are at least an order of magnitude below the above limits.

Dioxins and PCBs in Breast Milk

Arising from the 2008 dioxin in pork incident and as a follow up to a 2002 human breast milk study the FSAI have recently undertaken a human milk study in 2010 on POPS, including dioxins. The protocol for this study followed that developed by WHO for studies of this type. Eleven pooled breast milk samples from a total of 109 mothers were taken in four different maternity hospitals, Dublin (3) and Galway (1). The most important criteria for donating mothers were that they were first time mothers and that they resided in their current geographical area for a minimum of 5 years, although not all were born in Ireland. The range of WHO-TEQs for the 2010 study (N=11) for dioxins & PCBs was 7.49-13.7 with a mean of 9.66 pg/g milk fat. In 2002, the range (N=4) was 8.90 to 13.73 with a mean of 12.55 pg/g milk fat.

Similar to the 2002 study, the 2010 results showed that the concentrations of these contaminants are among the lowest in Europe. The authors also concluded that 2008 contamination incident in Ireland had no significant impact on the overall concentration of these substances on Irish breast milk.

Measurement of dioxins and PCBs in human milk is a very good indicator of human exposure to these and indeed to other POPs substances. However, direct comparison between human and cows' milk studies should be made with care. Breast milk concentrations tend to be much higher since humans lactate much more infrequently over their lifetime and also because they occupy a higher position in the food chain than cattle.

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Table 4:
Comparison of dioxin and PCB WHO-TEQ values from Irish cows' milk samples with data from international monitoring programs

Country	**Period of sampling**	**Number and specification of samples**	**Dioxins/Furans Mean values pg WHO-TEQ/g fat**	**PCBs Mean values pg WHO-TEQ/g fat**	**Dioxin/Furans plus PCB Mean values pg WHO-TEQ/g fat**
Ireland	2000	24 A-samples 13 B-samples	0.24 0.24	0.25 0.24	0.49 0.48
Ireland	2004	24 A-samples 13 B-samples	0.19 0.21	0.18 0.21	0.37 0.41
Ireland	2006	24 A-samples 13 B-samples	0.26 0.30	0.19 0.21	0.45 0.51
Ireland	2007	24 A-samples 13 B-samples	0.21 0.26	0.18 0.24	0.39 0.50
Ireland	2008	24 A-samples 13 B-samples	0.24 0.32	0.16 0.19	0.41 0.51
Ireland	2009	24 A-samples 13 B-samples	0.24 0.22	0.13 0.19	0.37 0.41
Ireland	2010	24 A-samples 14 B-samples	0.20 0.21	0.16 0.25	0.36 0.46
UK	2005	4 samples	0.37	0.22	0.59
UK	2006	4 samples	0.34	0.18	0.52
US	2000-2001	16 samples	0.71	Not reported	Not reported
Germany	2006	68 samples	0.52	0.92	1.44
France	2006	237 samples	0.33	0.57	0.90
Western Europe	2003-2005	138 Milk and milk products from Western European countries	0.39	0.62	0.98
European Union	1997 - 2003	152 Milk and milk products from EC monitoring programmes	0.77	1.65	2.42

5. BROMINATED FLAME RETARDANTS AND BROMINATED DIOXINS

General

Brominated Flame Retardants (BFRs) replaced PCB as the major chemical flame retardant in the late 1970s and are commonly used in furniture, fabrics and electronic products as a means of reducing the flammability of combustible organic materials. They act as radical traps, i.e. in case of fire the pyrolysis products are retarded in their reaction with atmospheric oxygen by reaction with the halogen radicals released from the BFR. The benefit of these chemicals is their ability to slow ignition and rate of fire growth, and as a result increase available escape time in the event of a fire.

Brominated dioxins and furans (PBDD/PBDF) can be formed as a by-product of the combustion of these substances.

.

Different types of Brominated Flame Retardants

TBBPA tetrabromo bisphenol A

PBBs: Polybrominated biphenyls (structurally similar to PCBs)

HBCD: Hexabromocyclododecane

PBDEs: Polybrominated diphenyl ethers
- Deca-BDE (Decabromodiphenyl ether or BDE-209)
- Octa-BDE (Octabromodiphenyl ether)
- Penta-BDE (Pentabromodiphenyl ether)

TBBPA, the PBDEs and the PBBs contain two brominated carbon rings, making them very stable and efficient in a large number of plastics. PBBs and PBDE are of greatest environmental interest because they are considered as persistent and bioaccumulative. PentaBDE is considered as very poisonous to water organisms. PBDEs are classified as priority substances according to the EU Water Framework Directive. EU has banned the use of Penta-and OctaBDE since 2004. BDE-47 and BDE-99 are the predominant congeners in environmental samples (FSAI 2005). However, only few estimates of human dietary PBDE exposure are available and little is known about other forms of human exposure (e.g. inhalation, skin contact). Certain PBDEs (Hexa, Hepta, Tetra and Penta BDE) are also classified as POPs under the Stockholm Convention on POPs.
PBBs are also banned.

Brominated dioxins and furans (PBDD/PBDF)

These substances are formed unintentionally, either through, incineration of wastes that include consumer products containing brominated flame retardants like PBDEs, accidental fires or as trace contaminants in mixtures of bromine-containing chemicals.

Results of Study.

Five pooled samples were analysed for the above range of BFRs and PBDD/PBDFs. Seventeen PBDE congeners (BDE-17, 28, 47, 49, 66, 71, 77, 85, 99, 100, 119, 126, 138, 153, 154, 183 and 209), some individual PBBs (BB-52, 101, 153 and 209), the totals of Tetra to NonaBBs, hexabromocyclododecane (sum of a-, b- and g-HBCD) and tetrabrombisphenol A (TBBP-A) have been monitored in this study.

Only PBDEs were detected in this study.
The data are summarised in Table 5.

PBDEs
The range for Σ−PBDEs (N=5) was 60.1 to 133.7 ng/kg fat with a mean of 95 ng/kg fat. (Table 5) This compares with the mean value of 202, 143, 93, 152, 200 ng/kg fat, from 2010, 2009, 2008, 2007 and 2006 respectively (EPA 2011, EPA 2010, EPA 2009, EPA 2008, EPA 2007, Grümping & Petersen 2007) and also contrasts favourably with the 2005 FSAI study carried out in the same laboratory where the average concentration for Σ−PBDE was 407 ng/kg fat (N=12) FSAI (2006).
Although there are no maximum limits set for PBDEs, these levels are relatively low by international comparisons.
It will be seen that the slightly elevated PBDE concentrations from the 2010 survey for sample number 1, have now dropped down to normal levels. As a precaution, an additional single sample from the area affected by the original farm , B14, was taken and showed a PBDE concentration of 185 ng/kg, which is within a normal range.
Since the source of the original contamination has not yet been finally identified, the FSAI/Department of Agriculture investigation is continuing, even though the levels of contamination have reduced considerably.

Similar to the earlier surveys, the main contributors to the total PBDE load were BDE-47 and BDE-99. Unlike earlier surveys, no BDE-153 congeners were detected. No other PBDE isomers were found.

Brominated Dioxins PBDD/PBDFs
No PBDD/PBDF congeners were detected in 2011. This is in line with the 2007, 2008 2009 and 2010 data.

Table 5

Summary of Milk Fat Data for PBDEs

	Sample 1	*Sample 2*	*Sample 3*	*Sample 4*	*Sample 5*	*Mean*
	Cork Hbr pg/g fat	*Midlands pg/g fat*	*West pg/g fat*	*East pg/g fat*	*N/NW pg/g fat*	*pg/fat*
Pooled from samples	B1 B2 B14	A5 A8 A9	A17 A15 A24	A3 A20 A23	A11 A19 A25	
PBDEs	**125.5**	**82.8**	**72.7**	**133.7**	**60.1**	**95.0**

6. CONCLUSIONS

1. All dioxin levels recorded in this survey compare favourably with those taken from a random selection of similar studies in other EU countries. While assessment of consumer exposure to dioxins through the consumption of milk was not the object of this environmental survey, the highest levels were well below legislative limits.

2. The results are broadly in line with earlier EPA surveys.

3. The dioxin levels were in line with FSAI breast milk study of 2010 which confirmed low levels of exposure to the Irish population.

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Glossary

"A" samples	background samples covering the entire country
"B" samples	potential impact samples from areas of perceived potential risk
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4-D	2,4-dichlorophenoxyacetic acid
Aliphatic chemicals	organic chemicals which do not contain benzene rings
Aromatic chemicals	organic chemicals containing benzene rings
BFRs	brominated flame retardants
dielectric constant	capacity to store electrical energy
EPA	Environmental Protection Agency (Ireland)
FSAI	Food Safety Authority of Ireland
G	gramme
GfA	Gesellschaft für Arbeitsplatz und Umweltanalytik laboratory, Münster, Germany
IPC	Integrated Pollution Control
I-TEQ	Toxic Equivalent (weighted toxicity of a mixture of dioxin congeners expressed as PCDD) using NATO convention
lipophilic	refers to the tendency of a substance to dissolve in fats or oils
LOD	limit of detection
LOQ	limit of quantification
NATO	North Atlantic Treaty Organisation
Precursor	A substance from which another substance is formed

PBDEs:	polybrominated diphenyl ethers
PBDD	polybrominated dibenzo-para-dioxin
PBDF	polybrominated dibenzofuran
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-para-dioxin
PCDF	polychlorinated dibenzofuran
Pg	picogram, 10^{-12} of a gramme.
POPs	Persistent Organic Pollutants
TEF	Toxic Equivalent Factor (toxicity weighting factor for individual congeners)
USEPA	Environmental Protection Agency (United States)
WHO	World Health Organisation
WHO TEQ	Toxic Equivalent (weighted toxicity of a mixture of dioxin congeners expressed as PCDD) using WHO convention

Annex 1

Toxicity Equivalent Factors (TEFs) used for calculation of I-TEQs and WHO-TEQs

PCDD/F parameter	I-TEF	WHO-TEF (1998)
PCDFs		
2,3,7,8-TetraCDF	0,1	0,1
1,2,3,7,8-PentaCDF	0,05	0,05
2,3,4,7,8-PentaCDF	0,5	0,5
1,2,3,4,7,8-HexaCDF	0,1	0,1
1,2,3,6,7,8-HexaCDF	0,1	0,1
2,3,4,6,7,8-HexaCDF	0,1	0,1
1,2,3,7,8,9-HexaCDF	0,1	0,1
1,2,3,4,6,7,8-HeptaCDF	0,01	0,01
1,2,3,4,7,8,9-HeptaCDF	0,01	0,01
OctaCDF	0,001	0,0001
PCDDs		
2,3,7,8-TetraCDD	1,0	1,0
1,2,3,7,8-PentaCDD	0,5	1,0
1,2,3,4,7,8-HexaCDD	0,1	0,1
1,2,3,6,7,8-HexaCDD	0,1	0,1

1,2,3,7,8,9-HexaCDD	0,1	0,1
1,2,3,4,6,7,8-HeptaCDD	0,01	0,01
OctaCDD	0,001	0,0001

PCB congeners		**WHO-TEF (1998)**
Chlorosubstitution Pattern	**IUPAC Number**	
3,4,4‘,5-Tetrachlorobiphenyl	PCB 81	**0,0001**
3,3‘,4,4‘-Tetrachlorobiphenyl	PCB 77	**0,0001**
2‘,3,4,4‘,5-Pentachlorobiphenyl	PCB 123	**0,0001**
2,3‘,4,4‘,5-Pentachlorobiphenyl	PCB 118	**0,0001**
2,3,4,4‘,5-Pentachlorobiphenyl	PCB 114	**0,0005**
2,3,3‘,4,4‘-Pentachlorobiphenyl	PCB 105	**0,0001**
3,3‘,4,4‘,5,-Pentachlorobiphenyl	PCB 126	**0,1**
2,3‘,4,4‘,5,5‘-Hexachlorobiphenyl	PCB 167	**0,00001**
2,3,3‘,4,4‘,5-Hexachlorobiphenyl	PCB 156	**0,0005**
2,3,3‘,4,4‘,5‘-Hexachlorobiphenyl	PCB 157	**0,0005**
3,3‘,4,4‘,5,5‘-Hexachlorobiphenyl	PCB 169	**0,01**
2,3,3‘,4,4‘,5,5‘-Heptachlorobiphenyl	PCB 189	**0,0001**

An Ghníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaol do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomh-nithe a bhfuilimid gníomhach leo ná comhshaol na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Ghníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil, Pobal agus Rialtais Áitiúil.

ÁR bhFREAGRACHTAÍ

CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaol i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreail;
- scardadh dramhuisce.

FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain.
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil - aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce.
- Obair le húdaráis áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí comhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaol mar thoradh ar a ngníomhaíochtaí.

MONATÓIREACHT, ANAILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOL

- Monatóireacht ar chaighdeán aeir agus caighdeáin aibhneacha, locha, uiscí taoide agus uiscí talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntí a dhéanamh.

RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA HÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdéan aeir agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaol na hÉireann (cosúil le pleananna bainistíochta dramhaíola agus forbartha).

PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaol a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózóin.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Ghníomhaireacht i 1993 chun comhshaol na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord lánaimseartha, ar a bhfuil Príomhstiúrthóir agus ceithre Stiúrthóir.

Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar imní iad agus le comhairle a thabhairt don Bhord.

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