Biomonitoring Research Kaunas Lithuania, 2022

ToxicoWatch Foundation - December 2022

Biomonitoring Research Kaunas
Lithuania, 2022

Acknowledgements

Thanks to Zero Waste Europe for enabling this toxicology research on persistent organic pollutants (POPs) in the environment of Kaunas, Lithuania.

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Abbreviations

Abbreviation	Meaning
APCD	Air Pollution Control Devices
BAT	Best Available Techniques
BEP	Best Environmental Practice
BEQ	Biological Equivalents
BMI	Body Mass Index
dl-PCB	Dioxin-Like Polychlorinated Biphenyls
DR CALUX®	Dioxin Responsive Chemical-Activated LUciferase gene eXpression
dw	Dry Weight
EFSA	European Food and Safety Authority
FITC-T4	Fluorescein IsoThioCyanate L-Thyroxine (T4)
GC-MS	Gas Chromatography Mass Spectrometry GC-MS
GenX	Group of fluorochemicals related to of hexafluoropropylene oxide dimer acid (HFPO-DA)
i-PCB	Indicator Polychlorinated Biphenyl
LB	Lower Bound; results under detection limit are set to zero
LOD	Limit of Detection
LOQ	Limit of Quantification
MB	Middle Bound; values are set as half the detection limit values
MWI	Municipal Waste Incineration
ndl-PCB	Non-Dioxin-Like Polychlorinated Biphenyl (Non-Dioxin-Like PCB)
ng	Nanogram; 10^{-9} gram
OTNOC	Other Than Normal Operating Conditions
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PFAS	Per- and PolyFluoroAlkyl Substances
pg	Picogram; 10^{-12} gram
POP	Persistent Organic Pollutants
RPF	Relative Potency Factors
RvA	Dutch Accreditation Council
SVHC	Substances of Very High Concern
SWI	Solid Waste Incineration
TCDD	2,3,7,8-tetrachloordibenzo-*p*-dioxine
TDI	Tolerable Daily Intake
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalents
TOF	Total Organic Fluorine
TW	ToxicoWatch
TWI	Tolerable Weekly Intake
UB	Upper Bound (ub), results under detection limit are set as detection limit values.
µg	Microgram 10^{-3} gram
WtE	Waste to Energy (waste incinerator)

Abbreviation	Dioxins, furans (PCDD/F) and dioxin-like PCBs	Toxic equivalency factor
	Congeners	
Dioxins (n=7)		
TCDD	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1
PCDD	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1
HxCDD1	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0.1
HxCDD2	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	0.1
HxCDD3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	0.1
HpCDD	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	0.01
OCDD	Octachlorodibenzo-p-dioxin	0.0003
Furans (n=10)		
TCDF	2,3,7,8-Tetrachlorodibenzofuran	0.1
PCDF1	1,2,3,7,8-Pentachlorodibenzofuran	0.03
PCDF2	2,3,4,7,8-Pentachlorodibenzofuran	0.3
HxCDF1	1,2,3,4,7,8-Hexachlorodibenzofuran	0.1
HxCDF2	1,2,3,6,7,8-Hexachlorodibenzofuran	0.1
HxCDF3	1,2,3,7,8,9-Hexachlorodibenzofuran	0.1
HxCDF4	2,3,4,6,7,8-Hexachlorodibenzofuran	0.1
HPCDF1	1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.01
HPCDF2	1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.01
OCDF	Octachlorodibenzofuran	0.0003
Polychlorinated biphenyl (n=12)		
PCB77	3,3',4,4'-Tetrachlorobiphenyl (#77)	0.0001
PCB81	3,4,4',5-Tetrachlorobiphenyl (#81)	0.0003
PCB126	3,3',4,4',5-Pentachlorobiphenyl (#126)	0.1
PCB169	3,3',4,4',5,5'-Hexachlorobiphenyl (#169)	0.03
PCB105	2,3,3',4,4'-Pentachlorobiphenyl (#105)	0.00003
PCB114	2,3,4,4',5-Pentachlorobiphenyl (#114)	0.00003
PCB118	2,3',4,4',5-Pentachlorobiphenyl (#118)	0.00003
PCB123	2,3,4,4',5-Pentachlorobiphenyl (#123)	0.00003
PCB156	2,3,3',4,4',5-Hexachlorobiphenyl (#156)	0.00003
PCB157	2,3,3',4,4',5'-Hexachlorobiphenyl (#157)	0.00003
PCB167	2,3',4,4',5,5'-Hexachlorobiphenyl (#167)	0.00003
PCB189	2,3,3',4,4',5,5'-Heptachlorobiphenyl (#189)	0.00003

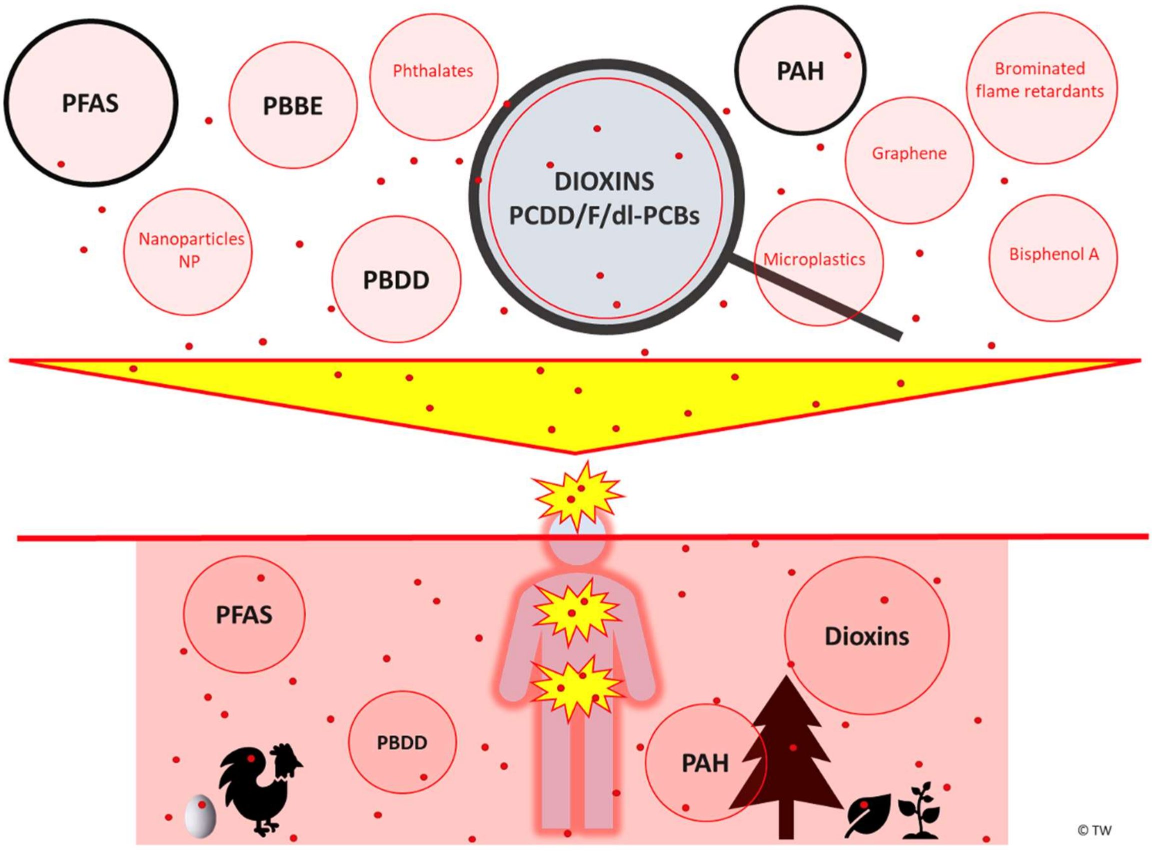
This is part 2 of the biomonitoring research.
References and background information are found in TW Biomonitoring report, Kaunas, Lithuania 2021.

Executive summary

This biomonitoring research on POP emissions in relation to waste (WtE) incineration is a European project, coordinated by Zero Waste Europe. The project is running simultaneously for 2021 and 2022 in three countries: Lithuania, Spain, and the Czech Republic. ToxicoWatch (TW) Foundation, based in the Netherlands, is participating as a scientific partner together with three environmental organizations for each country, as for Lithuania Žiedinė Ekonomika.

Waste incineration has been a controversial topic for decades. The industry claims to have achieved huge reductions in toxic emissions, however, research on the environment, food and human body shows a very different picture. There is a need to raise awareness about toxic pollution in our environment. Solutions must be found for the ongoing growing waste and its emissions resulting in (un) intentionally produced persistent organic pollutants (POPs), like dioxins, PFAS, PAH etc.

The industrial process of Incineration is extremely complex, due to the highly toxic content of our everyday household waste. Despite all the best available techniques, waste incinerators are not able to reduce persistent organic pollutants such as dioxin emissions to a zero level. Analyses with innovative bioassay techniques as well as chemical analysis show a broad spectrum of POPs as dioxins, dl-PCBs, PAHs and PFAS in high concentration around waste incinerators. The toxic compounds are analysed in eggs, pine needles and mosses.



It is not just an egg problem

Introduction

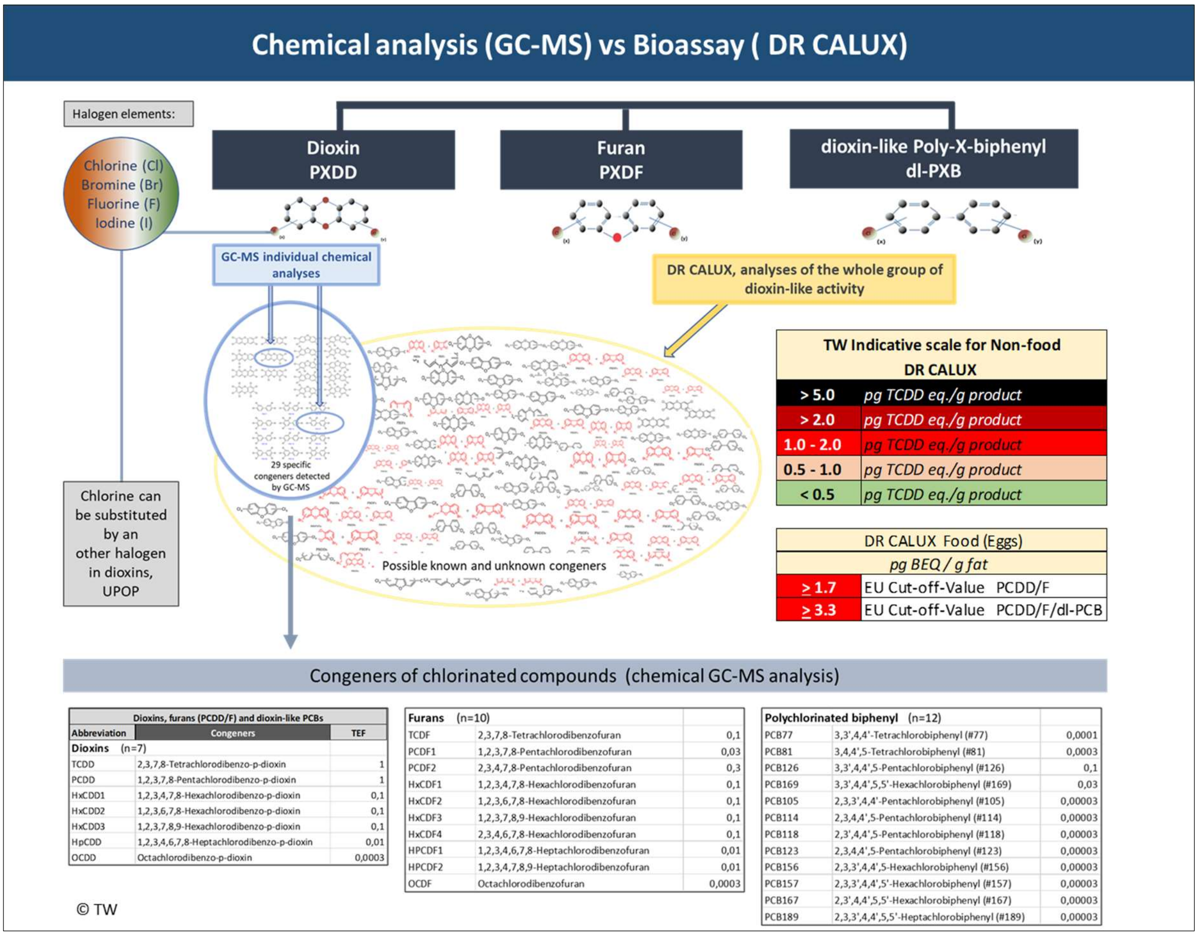
In Lithuania, most municipal solid waste has generally been disposed of in landfills. A new high-efficiency waste-fired cogeneration power plant in Kaunas with an electric capacity of about 24 MW and heat production capacity of about 70 MW entered full-scale operation on 27 November 2020.

Figure: UAB Kauno Cogeneration Power Plant, (WtE)

The height of the chimney is 43 metres in an open area with a dominant southwest wind. The WtE incinerator has a maximum capacity of combustion of 800 tons of waste/day. The WtE incinerator produces about 40 per cent of the heat requirements of Kaunas city. The name of the waste incinerator is the UAB Kauno Cogeneration Power Plant (Lithuanian: UAB Kauno Kogeneracinė Jėgainė) or the UAB Kauno CHP plant or Kaunas Combined Heat and Power Plant. In this report, the incinerator is referred to as the Kaunas WtE (waste) incinerator.

Analyse methods

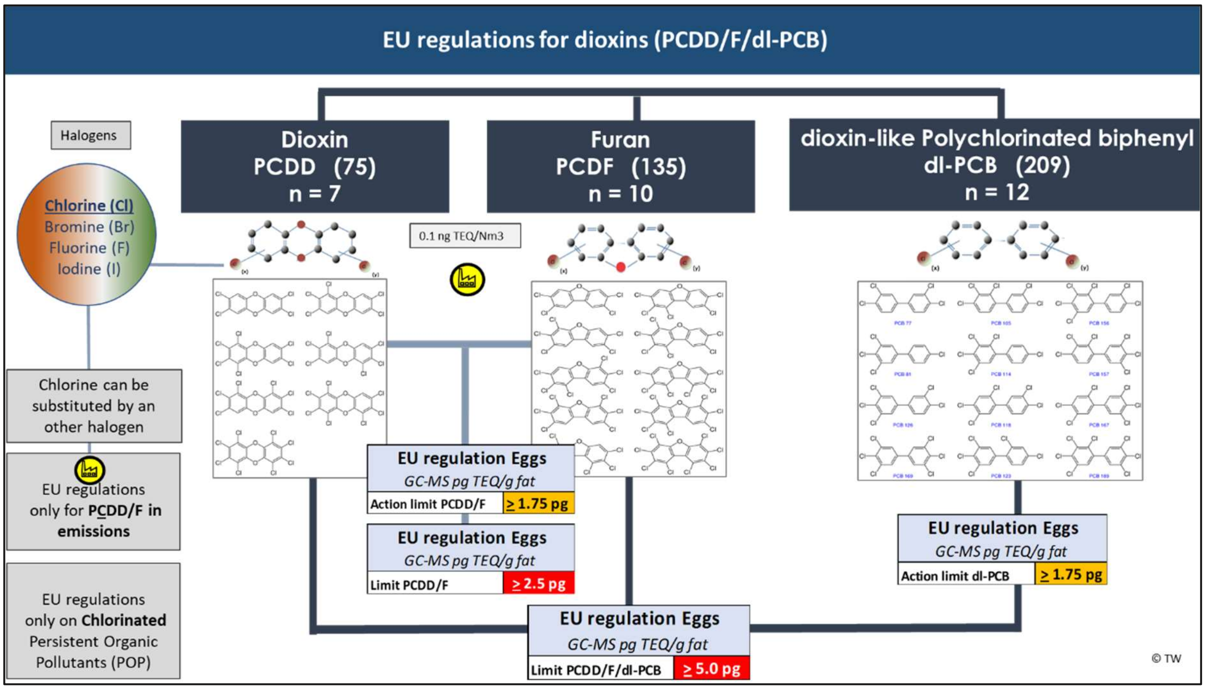
Extra analyses are performed with LC-LC-MS on 24 PFAS substances by Normed, Rotterdam NL. The figures below are an explanation of the bioassay (DR CALUX)) and the chemical GC-MS analyses on dioxins (PCDD/F/dl-PCB) related to the EU regulation of dioxins on eggs.



Dioxins, furans (PCDD/F) and dioxin-like PCBs		
Abbreviation	Congeners	TEF
Dioxins (n=7)		
TCDD	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1
PCDD	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1
HxCDD1	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0,1
HxCDD2	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	0,1
HxCDD3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	0,1
HpCDD	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	0,01
OCDD	Octachlorodibenzo-p-dioxin	0,0003

Furans (n=10)		
TCDF	2,3,7,8-Tetrachlorodibenzofuran	0,1
PCDF1	1,2,3,7,8-Pentachlorodibenzofuran	0,03
PCDF2	2,3,4,7,8-Pentachlorodibenzofuran	0,3
HxCDF1	1,2,3,4,7,8-Hexachlorodibenzofuran	0,1
HxCDF2	1,2,3,6,7,8-Hexachlorodibenzofuran	0,1
HxCDF3	1,2,3,7,8,9-Hexachlorodibenzofuran	0,1
HxCDF4	2,3,4,6,7,8-Hexachlorodibenzofuran	0,1
HPCDF1	1,2,3,4,6,7,8-Heptachlorodibenzofuran	0,01
HPCDF2	1,2,3,4,7,8,9-Heptachlorodibenzofuran	0,01
OCDF	Octachlorodibenzofuran	0,0003

Polychlorinated biphenyl (n=12)		
PCB77	3,3',4,4'-Tetrachlorobiphenyl (#77)	0,0001
PCB81	3,4,4',5-Tetrachlorobiphenyl (#81)	0,0003
PCB126	3,3',4,4',5-Pentachlorobiphenyl (#126)	0,1
PCB169	3,3',4,4',5,5'-Hexachlorobiphenyl (#169)	0,03
PCB105	2,3,3',4,4'-Pentachlorobiphenyl (#105)	0,00003
PCB114	2,3,4,4',5-Pentachlorobiphenyl (#114)	0,00003
PCB118	2,3',4,4',5-Pentachlorobiphenyl (#118)	0,00003
PCB123	2,3,4,4',5-Pentachlorobiphenyl (#123)	0,00003
PCB156	2,3,3',4,4',5-Hexachlorobiphenyl (#156)	0,00003
PCB157	2,3,3',4,4',5'-Hexachlorobiphenyl (#157)	0,00003
PCB167	2,3',4,4',5,5'-Hexachlorobiphenyl (#167)	0,00003
PCB189	2,3,3',4,4',5,5'-Heptachlorobiphenyl (#189)	0,00003



Sampling

All egg locations were visited for sampling in person by the Zero Waste Lithuania team, by D. Tracevičius of Zero Waste Lithuania. The sampling of eggs, vegetation and moss took place on 12 and 13 June 12th and 13th 2022 and the third round took place on October 3rd, 2022

Results Eggs of backyard chicken 2022

For the analysis of the eggs, two (2) methods are used. First, the eggs are analysed with the bioassay DR CALUX. This method detects the total toxicity of dioxins, and not only the regulated chlorinated dioxins (PCDD/F/dl-PCB) but also brominated (PBDD/F) and other (mixed) halogenated dioxins, see figures below. Secondly the eggs are analysed with the chemical analyses GC-MS, this is also mandated when the results of DR CALUX analyses are above the Cut-off/limit.

Kaunas, Lithuania 2021/2022				
PCDD/F/dl-PCB - GC-MS				
pg TEQ/g fat				
		2021	2022	%
Eggs	Egg-01	3,8	2,5	-35%
	Egg-02	3,2	1,8	-45%
	Egg-03	1,5	1,6	5%
	Egg-04	3,0	1,9	-36%
	Egg-05	4,3	12,1	181%
	Egg-06	20,0	4,9	-76%
Cut-off	GC-MS limit	5,0		

Kaunas, Lithuania 2021/2022				
PCDD/F/dl-PCB - DR CALUX				
pg BEQ/g fat				
		2021	2022	%
Eggs	Egg-01	5,9	4,8	-19%
	Egg-02	6,7	3,3	-51%
	Egg-03	2,1	3,8	81%
	Egg-04	3,0	3,2	7%
	Egg-05	7,0	15,0	114%
	Egg-06	9,3	8,6	-8%
Cut-off	DR CALUX	3,30		

Kaunas, Lithuania 2021/2022				
PCDD/F - GC-MS				
pg TEQ/g fat				
		2021	2022	%
Eggs	Egg-01	2,4	1,6	-35%
	Egg-02	2,3	1,2	-49%
	Egg-03	0,8	0,9	18%
	Egg-04	1,9	1,2	-39%
	Egg-05	2,2	1,5	-30%
	Egg-06	1,7	1,4	-15%
Cut-off	GC-MS limit	2,5		
Cut-off	GC-MS action	1,75		

Kaunas, Lithuania 2021/2022				
PCDD/F - DR CALUX				
pg BEQ/g fat				
		2021	2022	%
Eggs	Egg-01	4,5	3,3	-27%
	Egg-02	5,0	2,6	-48%
	Egg-03	1,2	1,7	42%
	Egg-04	2,1	2,3	10%
	Egg-05	5,0	3,0	-40%
	Egg-06	2,8	3,8	36%
Cut-off	DR CALUX	1,70		

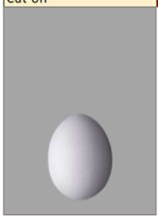
Kaunas, Lithuania 2021/2022				
dl-PCB - GC-MS				
pg TEQ/g fat				
		2021	2022	%
Eggs	Egg-01	1,4	0,9	-35%
	Egg-02	0,9	0,6	-38%
	Egg-03	0,8	0,7	-13%
	Egg-04	1,1	0,7	-32%
	Egg-05	2,1	10,5	401%
	Egg-06	18,0	3,4	-81%
Cut-off	GC-MS action	1,75		

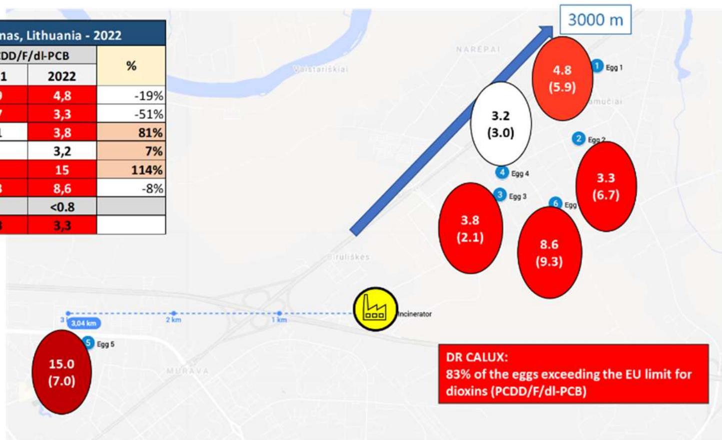
Kaunas, Lithuania 2021/2022				
dl-PCB - DR CALUX				
pg BEQ/g fat				
		2021	2022	%
Eggs	Egg-01	1,4	1,5	7%
	Egg-02	1,7	0,7	-59%
	Egg-03	0,9	2,1	133%
	Egg-04	0,9	0,9	0%
	Egg-05	2,0	12,0	500%
	Egg-06	6,5	4,8	-26%
Cut-off	DR CALUX			

Results dioxins in Eggs by bioassay analysis - DR CALUX

Results dioxins (PCDD/F/dl-PCB) in eggs - Kaunas, 2022 (2021) - DR CALUX

Results dioxin in Egg Kaunas, Lithuania - 2022			
DR CALUX	PCDD/F/dl-PCB		%
pg BEQ /g fat (ub)	2021	2022	
TW-LT22-Egg-01	5,9	4,8	-19%
TW-LT22-Egg-02	6,7	3,3	-51%
TW-LT22-Egg-03	2,1	3,8	81%
TW-LT22-Egg-04	3	3,2	7%
TW-LT22-Egg-05	7	15	114%
TW-LT22-Egg-06	9,3	8,6	-8%
TW-LT22-Egg-00		<0.8	
Cut-off	3,3	3,3	

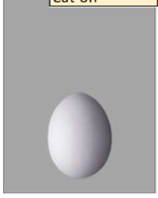


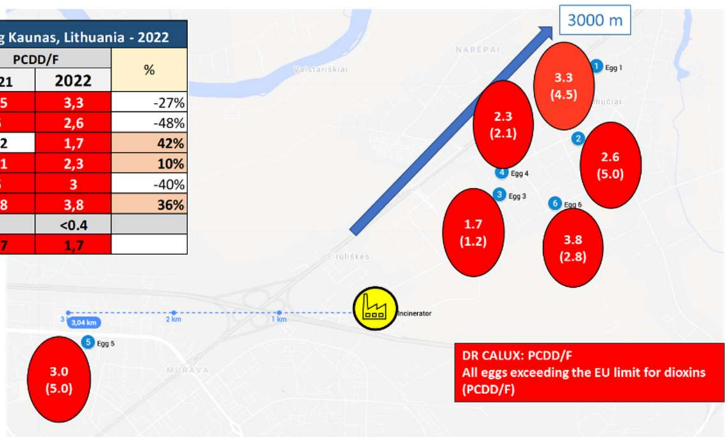


DR CALUX: 83% of the eggs exceeded the EU limit for dioxins (PCDD/F/dl-PCB).

Results dioxins (PCDD/F) in eggs - Kaunas, 2022 (2021) DR CALUX

Results dioxin in Egg Kaunas, Lithuania - 2022			
DR CALUX	PCDD/F		%
pg BEQ /g fat (ub)	2021	2022	
TW-LT22-Egg-01	4,5	3,3	-27%
TW-LT22-Egg-02	5	2,6	-48%
TW-LT22-Egg-03	1,2	1,7	42%
TW-LT22-Egg-04	2,1	2,3	10%
TW-LT22-Egg-05	5	3	-40%
TW-LT22-Egg-06	2,8	3,8	36%
TW-LT22-Egg-00		<0.4	
Cut-off	1,7	1,7	

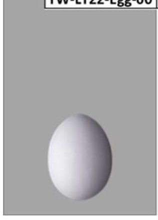


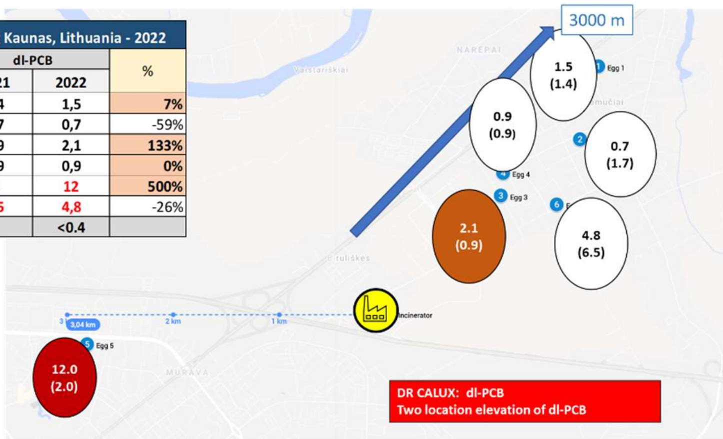


All eggs exceeding the EU limit for dioxins (PCDD/F) analysed by DR CALUX. Remarkable, increase of dioxins (PCDD/F) on the locations most nearby the incinerator.

Results dioxin-like PCB (dl-PCB) in eggs - Kaunas, 2022 (2021) DR CALUX

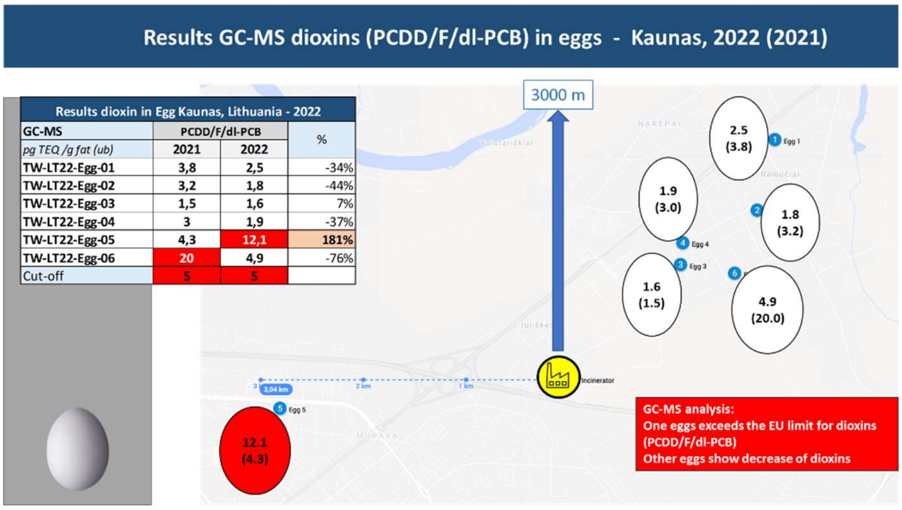
Results dioxin in Egg Kaunas, Lithuania - 2022			
DR CALUX	dl-PCB		%
pg BEQ /g fat	2021	2022	
TW-LT22-Egg-01	1,4	1,5	7%
TW-LT22-Egg-02	1,7	0,7	-59%
TW-LT22-Egg-03	0,9	2,1	133%
TW-LT22-Egg-04	0,9	0,9	0%
TW-LT22-Egg-05	2	12	500%
TW-LT22-Egg-06	6,5	4,8	-26%
TW-LT22-Egg-00		<0.4	





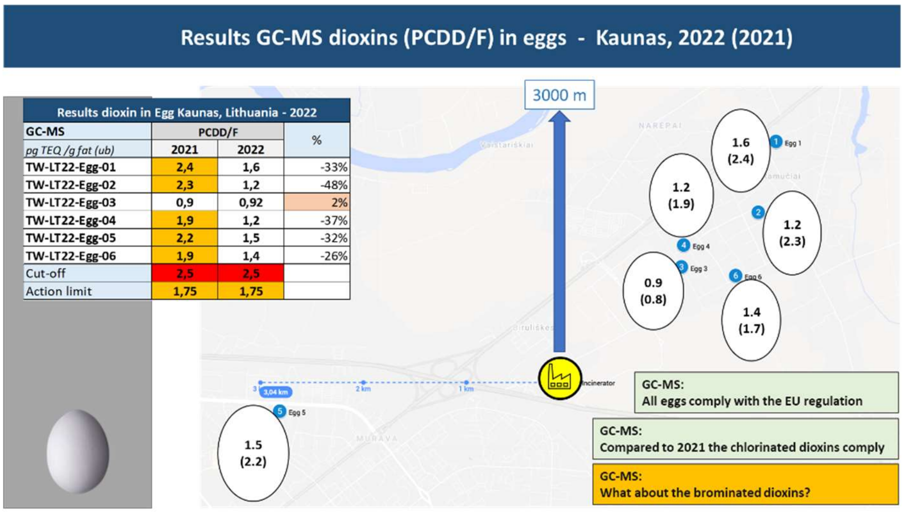
Two locations show elevation of dl-PCB

Results dioxin in Eggs by chemical analysis - GC-MS



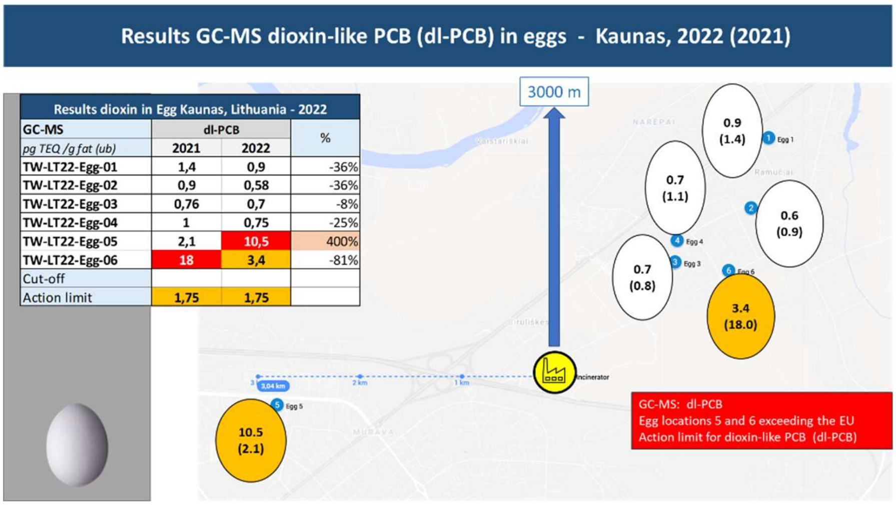
Results dioxin in Egg Kaunas, Lithuania - 2022			
GC-MS	PCDD/F/dl-PCB		%
pg TEQ /g fat (ub)	2021	2022	
TW-LT22-Egg-01	3,8	2,5	-34%
TW-LT22-Egg-02	3,2	1,8	-44%
TW-LT22-Egg-03	1,5	1,6	7%
TW-LT22-Egg-04	3	1,9	-37%
TW-LT22-Egg-05	4,3	12,1	181%
TW-LT22-Egg-06	20	4,9	-76%
Cut-off	5	5	

Four (4) locations show a slight decrease in dioxins.
One (1) location, nearly a factor 2 exceeding the safety limits of eggs for GC-MS 5 pg TEQ/g fat



Results dioxin in Egg Kaunas, Lithuania - 2022			
GC-MS	PCDD/F		%
pg TEQ /g fat (ub)	2021	2022	
TW-LT22-Egg-01	2,4	1,6	-33%
TW-LT22-Egg-02	2,3	1,2	-48%
TW-LT22-Egg-03	0,9	0,92	2%
TW-LT22-Egg-04	1,9	1,2	-37%
TW-LT22-Egg-05	2,2	1,5	-32%
TW-LT22-Egg-06	1,9	1,4	-26%
Cut-off	2,5	2,5	
Action limit	1,75	1,75	

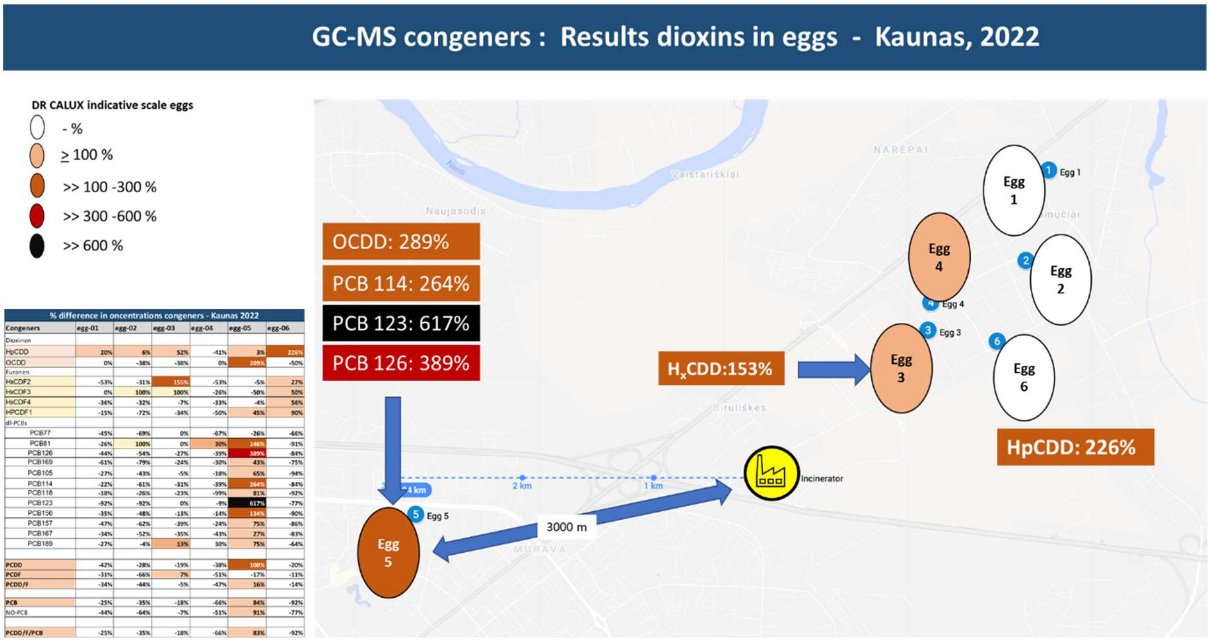
Five (5) locations show slight decreases in the PCDD/F levels, indicating 2021. The start-up of the incinerator could have been a reason for the elevation of PCDD/F. The difference with the DR CALUX can be explained by the presence of brominated dioxins, not included in the regular measurements and not included in this research.



Results dioxin in Egg Kaunas, Lithuania - 2022			
GC-MS	dl-PCB		%
pg TEQ /g fat (ub)	2021	2022	
TW-LT22-Egg-01	1,4	0,9	-36%
TW-LT22-Egg-02	0,9	0,58	-36%
TW-LT22-Egg-03	0,76	0,7	-8%
TW-LT22-Egg-04	1	0,75	-25%
TW-LT22-Egg-05	2,1	10,5	400%
TW-LT22-Egg-06	18	3,4	-81%
Cut-off			
Action limit	1,75	1,75	

Two locations exceed the action limit for dl-PCB of 1.75 pg TEQ/g fat. Remarkable is the decrease of dl-PCB in location 5 and the increase in location 6.

The testing phase of the newly built Kaunas WtE incinerator emitted more dioxins, reading from the elevated dioxin levels in 2021. By zooming in on the specific congeners of dioxins in eggs by GC-MS analyses, typical congener elevations of waste incineration can be noticed as OCDD, PCB 126, HxCDD and HpCDD. More detailed data from the incinerator might be more conclusive about this.



% difference in oncentrations congeners - Kaunas 2022						
Congeners	egg-01	egg-02	egg-03	egg-04	egg-05	egg-06
Dioxinen						
HpCDD	20%	6%	52%	-41%	3%	226%
OCDD	0%	-38%	-38%	0%	289%	-50%
Furanen						
HxCDF2	-53%	-31%	155%	-53%	-5%	27%
HxCDF3	0%	100%	100%	-26%	-50%	50%
HxCDF4	-36%	-32%	-7%	-33%	-4%	56%
HPCDF1	-15%	-72%	-34%	-50%	45%	90%
dl-PCBs						
PCB77	-45%	-69%	0%	-67%	-26%	-66%
PCB81	-26%	100%	0%	30%	146%	-91%
PCB126	-44%	-54%	-27%	-39%	389%	-84%
PCB169	-61%	-79%	-24%	-30%	43%	-75%
PCB105	-27%	-43%	-5%	-18%	65%	-94%
PCB114	-22%	-61%	-31%	-39%	264%	-84%
PCB118	-18%	-26%	-23%	-99%	81%	-92%
PCB123	-92%	-92%	0%	-9%	617%	-77%
PCB156	-35%	-48%	-13%	-14%	134%	-90%
PCB157	-47%	-62%	-39%	-24%	75%	-86%
PCB167	-34%	-52%	-35%	-43%	27%	-83%
PCB189	-27%	-4%	13%	30%	75%	-64%
PCDD	-42%	-28%	-19%	-38%	100%	-20%
PCDF	-31%	-66%	7%	-51%	-17%	-11%
PCDD/F	-34%	-44%	-5%	-47%	16%	-14%
PCB	-25%	-35%	-18%	-66%	84%	-92%
NO-PCB	-44%	-64%	-7%	-51%	91%	-77%
PCDD/F/PCB	-25%	-35%	-18%	-66%	83%	-92%

Remarkably egg location 5 shows high values on dl-PCBs. In the figure below are the specific congeners to be found. Most remarkable is the elevation of PCB 123 and PCB 126.

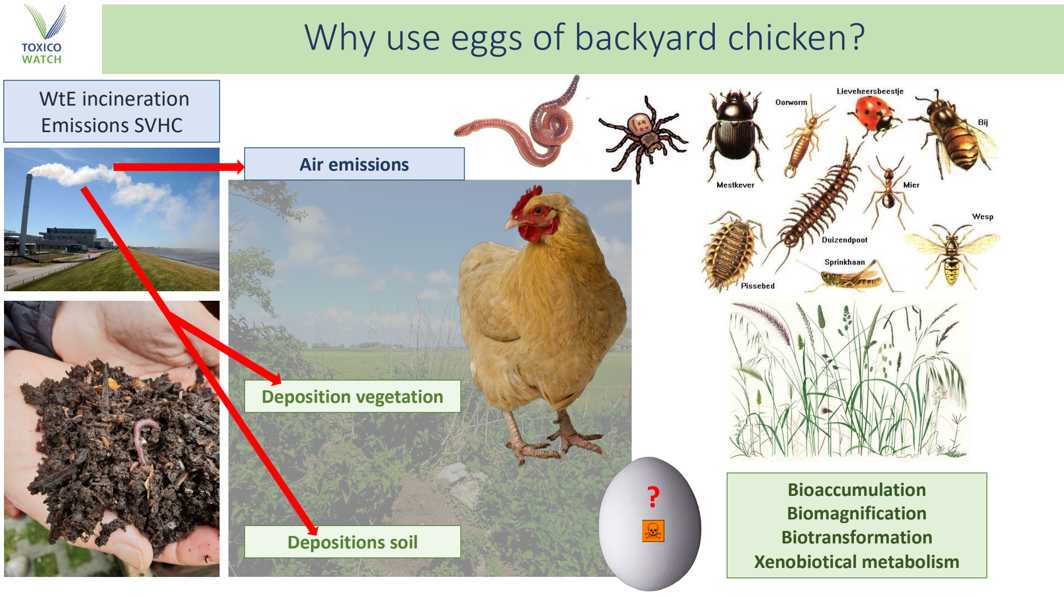
% difference in oncentrations congeners - Kaunas 2022						
Congeners	**egg-01**	**egg-02**	**egg-03**	**egg-04**	**egg-05**	**egg-06**
Dioxinen						
HpCDD	20%	6%	52%	-41%	3%	226%
OCDD	0%	-38%	-38%	0%	289%	-50%
Furanen						
HxCDF2	-53%	-31%	155%	-53%	-5%	27%
HxCDF3	0%	100%	100%	-26%	-50%	50%
HxCDF4	-36%	-32%	-7%	-33%	-4%	56%
HPCDF1	-15%	-72%	-34%	-50%	45%	90%
dl-PCBs						
PCB77	-45%	-69%	0%	-67%	-26%	-66%
PCB81	-26%	100%	0%	30%	146%	-91%
PCB126	-44%	-54%	-27%	-39%	389%	-84%
PCB169	-61%	-79%	-24%	-30%	43%	-75%
PCB105	-27%	-43%	-5%	-18%	65%	-94%
PCB114	-22%	-61%	-31%	-39%	264%	-84%
PCB118	-18%	-26%	-23%	-99%	81%	-92%
PCB123	-92%	-92%	0%	-9%	617%	-77%
PCB156	-35%	-48%	-13%	-14%	134%	-90%
PCB157	-47%	-62%	-39%	-24%	75%	-86%
PCB167	-34%	-52%	-35%	-43%	27%	-83%
PCB189	-27%	-4%	13%	30%	75%	-64%
PCDD	-42%	-28%	-19%	-38%	100%	-20%
PCDF	-31%	-66%	7%	-51%	-17%	-11%
PCDD/F	-34%	-44%	-5%	-47%	16%	-14%
PCB	-25%	-35%	-18%	-66%	84%	-92%
NO-PCB	-44%	-64%	-7%	-51%	91%	-77%
PCDD/F/PCB	-25%	-35%	-18%	-66%	83%	-92%

“It is not an egg problem”

One must realise that no safe level of exposure to dioxin exists for human health and the environment. Every level of dioxin and dioxin-like chemicals is associated with adverse human health effects. All opportunities should be undertaken to eliminate persistent organic pollutants such as dioxins. Incinerating waste always results in dioxin production. Measurements have been taken in general in this industry to reduce dioxin emissions; however total elimination is not possible for these Substances of Very High Concern (SVHC). The industry claimed to have diminished dioxin emissions, instead, emissions and deposition of dioxins are increasingly found in the environment, as reported in TW biomonitoring research in Europe.

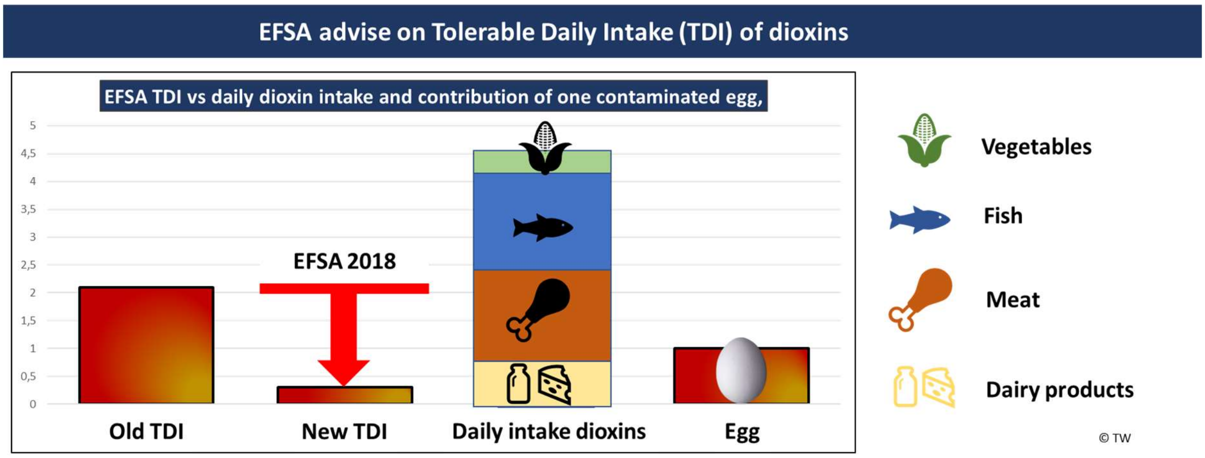
For TW biomonitoring research on emissions related to waste incineration, eggs of backyard chickens are used as biomarkers to obtain an indication of the environmental contamination of dioxins (PCDD/F/dl-PCB), PFAS and PAH of a specific area. TW biomonitoring results of Kaunas 2021 and 2022 indicate an environment under stress, presented by high analyse values of dioxins in - besides eggs of backyard chicken - other biomatrices, like vegetation as pine needles and mosses. To summarise these high results of dioxins as “*only an egg problem*”, is just a one-sided focus that distracts from what the conclusion is in the overall perspective of a contaminated environment by persistent organic pollutants (POPs). These TW analyse results of 2021 and 2022 should have bells ringing for serious local dioxin pollution. Banning the consumption of backyard chicken eggs, as an answer to the biomonitoring studies on dioxin emissions, is not addressing the real cause of dioxin pollution.
An EFSA study[1], on page 189, shows clearly that the share part in total of dioxins in meat, fish, milk, butter, and cheese all is a much bigger threat to our health than focusing only on dioxins in eggs. A backyard chicken egg is a sensitive tool for measuring dioxin pollution in the environment. Backyard chickens feed most of the time on seeds, insects, worms, snails, vegetation, natural soil and breaching the outdoor air. Eggs of backyard chickens, in ideal circumstances, should be in principle healthier than chicken eggs from the semi-indoor bioindustry. Just because their feed contains natural biodiversity, without the toxic compounds of agro-industry farming and/or frequent veterinary pharmacy. If toxic compounds are found in backyard chicken eggs, the real cause of the presence of dioxins should be addressed and measurements should be undertaken to achieve a reduction/elimination of the level of dioxins in the environment.

[1] *Knutsen HK et al. (2018) Scientific Opinion on the risk for animal and human health related to the presence of dioxins and dioxin-like PCBs in feed and food. EFSA Journal 2018;16(11):5333, 331, p. 189*


TOXICO WATCH
Why use eggs of backyard chicken?
WtE incineration
Emissions SVHC
Air emissions
Deposition vegetation
Depositions soil
?
Oorworm
Lieveheersbeestje
Bij
Mestkever
Mier
Wesp
Duizendpoot
Sprinkhaan
Pissebed
Bioaccumulation
Biomagnification
Biotransformation
Xenobiotical metabolism

Dioxins 7 x more toxic, adaption regulation dioxins in food, egg?

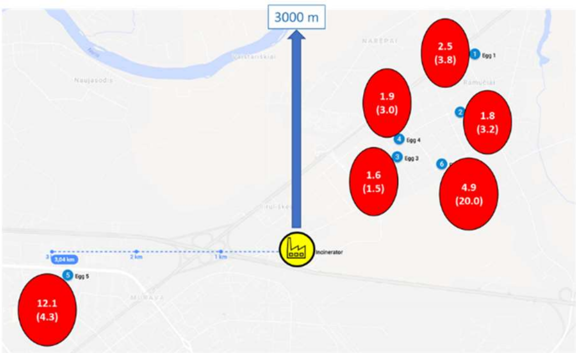
In the biomonitoring report Kaunas of last year 2021, the EU regulation on eggs was referenced. TW mentioned the update of the European Food Safety Authority (EFSA) advice in 2018 on the toxicity of dioxins by lowering the safe levels of dioxins with a factor seven (7), or 7 x more toxic advice than the EFSA set up in 2001 for specific eggs.[2] This has not yet been implemented in the EU regulation of food. Until now the official EU limits on food (eggs) are based on the old TWI levels for dioxins (2001). If the new EFSA advise 2018 would be implemented, all the eggs would be passing this adapted limit for 'safer' dioxin levels in eggs.

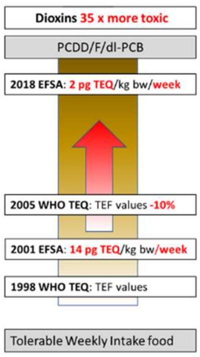


For example, see the figure below for the GC-MS analyse results for the sum of dioxins (PCDD/F/dl-PCB) in eggs Kaunas 2022, if the updated dioxins safety levels, according to the EFSA advice 2018, were applied to the result of the chemical analyses on eggs.

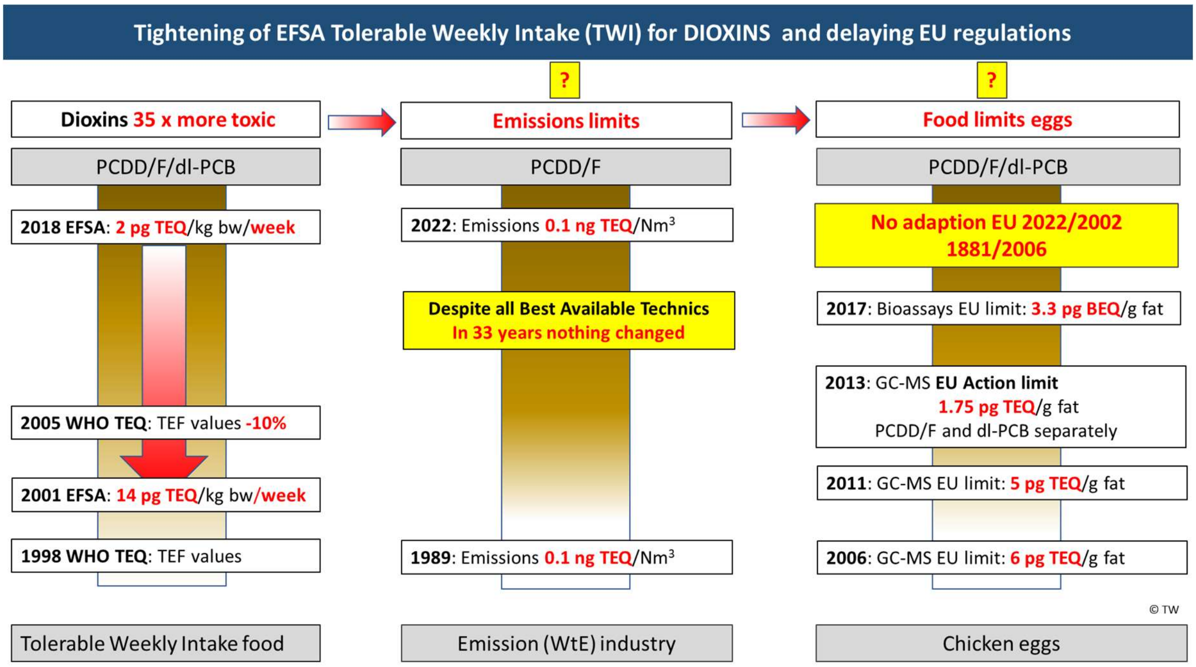
If dioxin levels were adapted to the new TWI of EFSA 2018

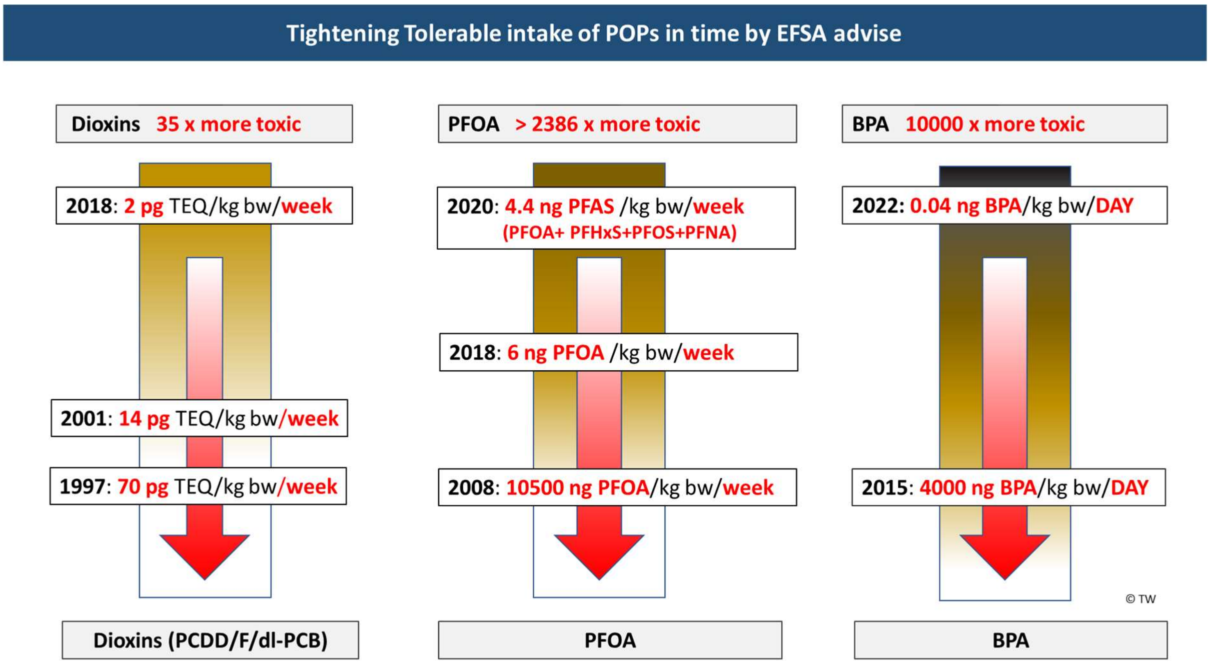
Results dioxin in Egg Kaunas, Lithuania - 2022			
GC-MS			
pg TEQ /g fat (ub)	PCDD/F/dl-PCB	PCDD/F	dl-PCB
TW-LT22-Egg-01	2,5	1,6	0,9
TW-LT22-Egg-02	1,8	1,2	0,58
TW-LT22-Egg-03	1,6	0,92	0,7
TW-LT22-Egg-04	1,9	1,2	0,75
TW-LT22-Egg-05	12,1	1,5	10,5
TW-LT22-Egg-06	4,9	1,4	3,4
TW-LT22-Egg-00			
Cut-off	5	2,5	
Action limit		1,75	1,75
EFSA 2018 TWI	0,71	0,36	
		0,25	0,25





[2] *EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain), Knutsen HK et al. (2018). Scientific Opinion on the risk for animal and human health related to the presence of dioxins and dioxin-like PCBs in feed and food. EFSA Journal 2018;16(11):5333, 331 pp.*


Tightening of EFSA Tolerable Weekly Intake (TWI) for DIOXINS and delaying EU regulations
?
?
Dioxins 35 x more toxic
Emissions limits
Food limits eggs
PCDD/F/dl-PCB
PCDD/F
PCDD/F/dl-PCB
2018 EFSA: 2 pg TEQ/kg bw/week
2005 WHO TEQ: TEF values -10%
2001 EFSA: 14 pg TEQ/kg bw/week
1998 WHO TEQ: TEF values
2022: Emissions 0.1 ng TEQ/Nm3
Despite all Best Available Technics
In 33 years nothing changed
1989: Emissions 0.1 ng TEQ/Nm3
No adaption EU 2022/2002
1881/2006
2017: Bioassays EU limit: 3.3 pg BEQ/g fat
2013: GC-MS EU Action limit
1.75 pg TEQ/g fat
PCDD/F and dl-PCB separately
2011: GC-MS EU limit: 5 pg TEQ/g fat
2006: GC-MS EU limit: 6 pg TEQ/g fat
© TW
Tolerable Weekly Intake food
Emission (WtE) industry
Chicken eggs


Tightening Tolerable intake of POPs in time by EFSA advise
Dioxins 35 x more toxic
PFOA > 2386 x more toxic
BPA 10000 x more toxic
2018: 2 pg TEQ/kg bw/week
2001: 14 pg TEQ/kg bw/week
1997: 70 pg TEQ/kg bw/week
2020: 4.4 ng PFAS /kg bw/week
(PFOA+ PFHxS+PFOS+PFNA)
2018: 6 ng PFOA /kg bw/week
2008: 10500 ng PFOA/kg bw/week
2022: 0.04 ng BPA/kg bw/DAY
2015: 4000 ng BPA/kg bw/DAY
© TW
Dioxins (PCDD/F/dl-PCB)
PFOA
BPA

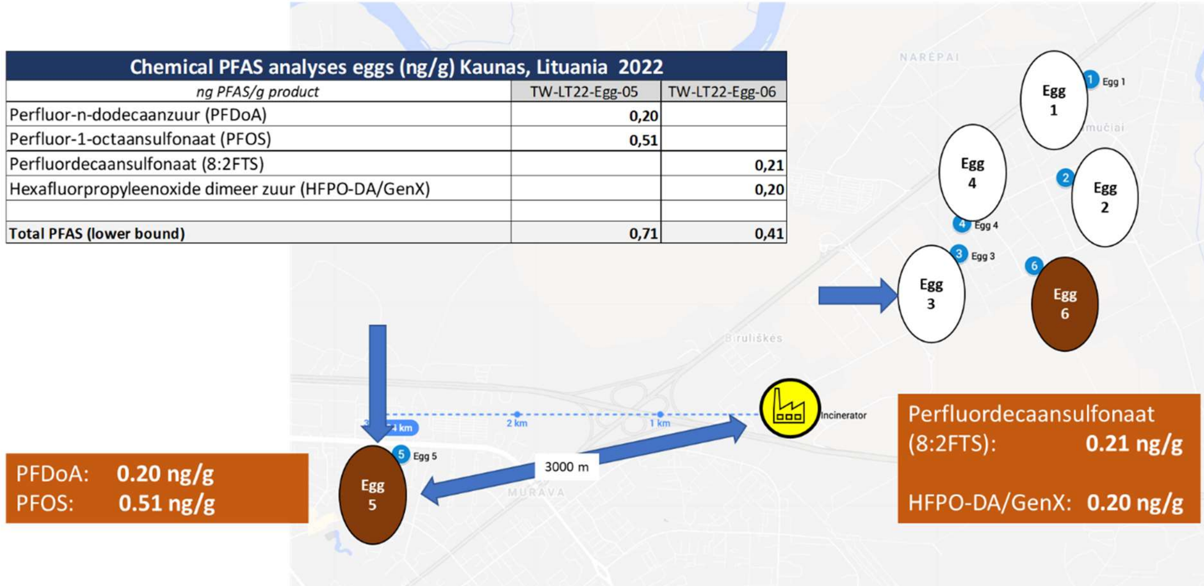
PFAS in eggs

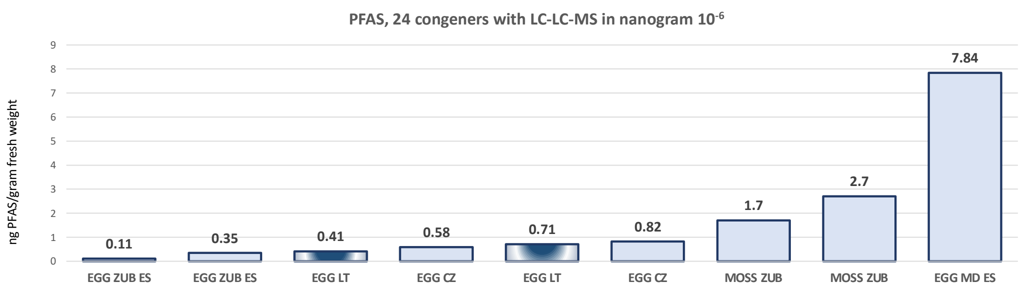
We have also analysed PFAS in eggs. PFAS can also be a product from the waste incinerator (see report 1). The chemical analysis (LC-LC-MS) shows in the two eggs different congeners of PFAS. In the location West of the incinerator, PFOS and PFDoA were found, while in the egg location Southwest Gen-X and 8:2 FTS were found.

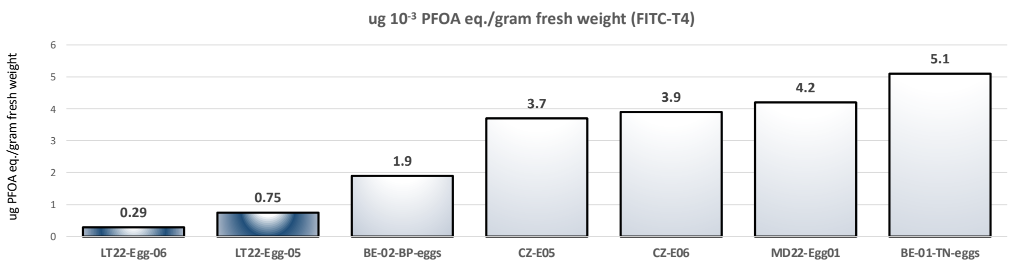
PFAS in eggs - Kaunas, Lithuania 2022

Chemical PFAS analyses eggs (ng/g) Kaunas, Lituania 2022

ng PFAS/g product	TW-LT22-Egg-05	TW-LT22-Egg-06
Perfluor-n-dodecaanzuur (PFDoA)	0,20	
Perfluor-1-octaansulfonaat (PFOS)	0,51	
Perfluordecaansulfonaat (8:2FTS)		0,21
Hexafluorpropyleenoxide dimeer zuur (HFPO-DA/GenX)		0,20
Total PFAS (lower bound)	0,71	0,41

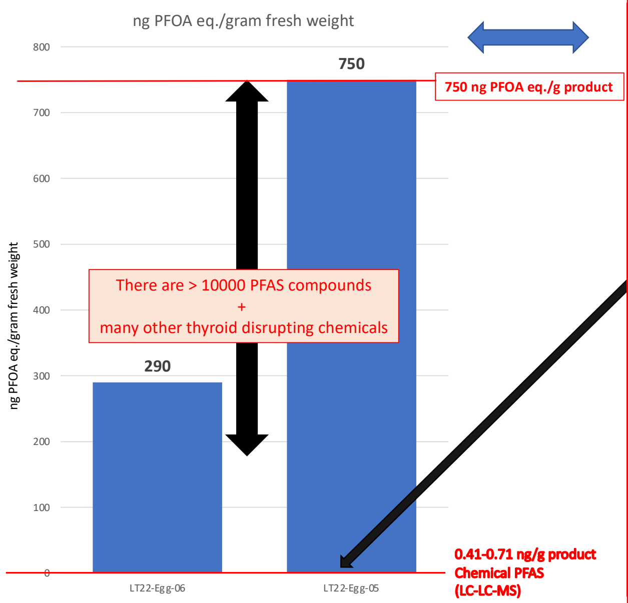




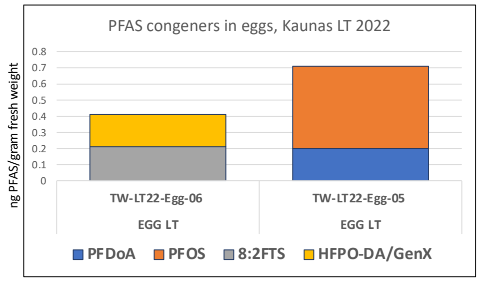


All data from TW research Europe 2019-2022

PFAS analyses with FITC-T4 and limited chemicals analyses on 24 PFAS, Kaunas



Chemical PFAS analyses eggs (ng/g) Kaunas, Lituania 2022		
ng PFAS/g product	TW-LT22-Egg-05	TW-LT22-Egg-06
Perfluor-n-dodecaanzuur (PFDoA)	0.20	
Perfluor-1-octaansulfonaat (PFOS)	0.51	
Perfluordecaansulfonaat (8:2FTS)		0.21
Hexafluorpropyleenoxide dimeer zuur (HFPO-DA/GenX)		0.20
Total PFAS (lower bound)	0.71	0.41



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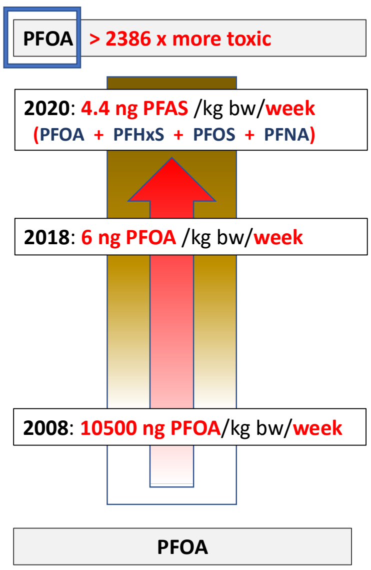
Tolerable intake of PFAS is exceeding in eggs Kaunas, LT 2022



PFOS

	Chemical PFAS analyses eggs (ng/g) Kaunas, Lituania 2022		
EFSA	*ng PFAS/g product*	TW-LT22-Egg-05	TW-LT22-Egg-06
x	Perfluor-n-dodecaanzuur (PFDoA)	0.20	
v	Perfluor-1-octaansulfonaat (PFOS)	0.51	
x	Perfluordecaansulfonaat (8:2FTS)		0.21
x	Hexafluorpropyleenoxide dimeer zuur (HFPO-DA/GenX)		0.20
	PFAS EFSA PFOA+ PFHxS+PFOS+PFNA	0.51	0
	One egg contains	30.6	0
	TWI 4.4 ng PFAS/bw/week		
	TWI PFAS (EFSA) person 70 kg	308	
	TWI PAS (EFSA) child 20 kg	88	

Chemical PFAS analyses:
a child can eat one (1) egg per five (5) weeks
based on EFSA advice of only 4 PFAS out of > 10.000 PFAS

Bioassay PFAS FITC-T4:
a child can eat one (1) egg per year

This concerns PFAS, when considering dioxins (PCDD/F/dl-PCB)
a child can eat one (1) egg per two (2) years

© TW

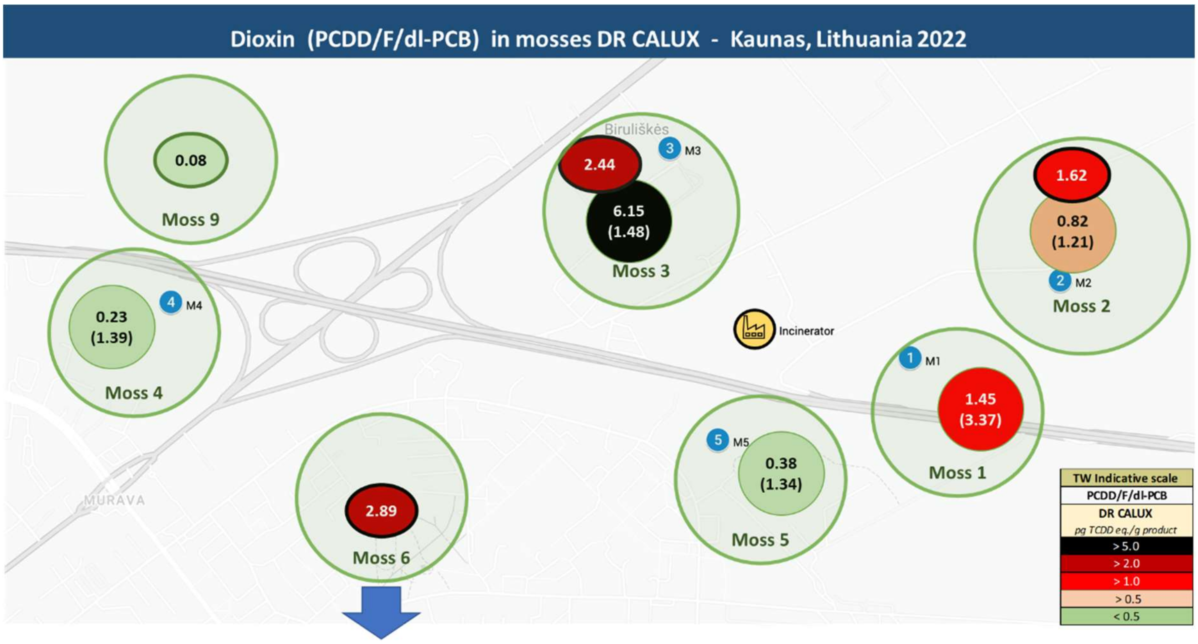
Mosses

The mosses of the selected six (6) locations are mainly *Hylocomium splendens*, sampled around the incinerator, see figures below. Mosses are sampled in the open field, avoiding the proximity of roads and not under the dense tree canopies to avoid the shedding of leaves for uptake emissions by air. Mosses are sampled in July and October 2022. In October two extra reference samples are taken South and West from the waste incinerator in Kaunas.

Result dioxins (PCDD/D/dl-PCB) in mosses, October 2022

Results Mosses - Kaunas, Lithuania 2022								
			BDS 17-06-2022	Results DR CALUX			PAH	PFAS FITC-T4
2022	Sample nr.		TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB		
Collected LT		LT nr. Mosses		pg TCDD eq./g product (ub)			ng BaP eq./g product	ng PFOA eq./g product
21-5-2022	1	Mosses 1 (M1)	TW22-LT-M1	1,45	1,4	0,05		
21-5-2022	2	Mosses 2 (M2)	TW22-LT-M2	0,82	0,77	0,05		
21-5-2022	3	Mosses 3 (M3)	TW22-LT-M3	6,15	6,1	0,05		
21-5-2022	3	Mosses 4 (M4)	TW22-LT-M4	0,23	0,18	0,05		
21-5-2022	5	Mosses 5 (M5)	TW22-LT-M5	0,38	0,37	0,11		
			BDS 03-08-2022	Results GC-MS				
2022	Sample nr.		TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB		
Collected LT		LT nr. Mosses		pg TEQ/g product (ub)				
21-5-2022	1	Mosses 1 (M1) GC-MS	TW22-LT-M1	1,15	0,94	0,22		
21-5-2022	3	Mosses 3 (M3) GC-MS	TW22-LT-M3	1,21	0,97	0,25		
			BDS 07-11-2022	Results DR CALUX			PAH	PFAS FITC-T4
2022	Sample nr.		TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB		
Collected LT		LT Nr Mosses		pg TCDD eq./g product (ub)			ng BaP eq./g product	ng PFOA eq./g product
23-10-2022	6	Mos-3-1a (M6)	TW22-LT-M6	2,89	1,72	1,17	2559	
23-10-2022	7	Mos-3-2a (M7)	TW22-LT-M7	1,62	0,83	0,79	4100	
23-10-2022	8	Mos-3-3a (M8)	TW22-LT-M8	2,44	1,9	0,54		
23-10-2022	9	Mos-3-4a (M9)	TW22-LT-M9	0,08	0,062	0,013		

The figure below displays the results of the sum of dioxins (PCDD/F/dl-PCBs). At location 3, West of the incinerator, the results with DR CALUX for dioxins are the highest with 6,15 pg TCDD eq./g product. In 2021 location 1 had the highest level of dioxins in mosses. The other moss locations have analysed results between 0.08-2.89 pg TCDD eq./g product. The values in the green circles are the analyse results of 2022 and between brackets (..) are the results of 2021. In the red circle are the results of the extra analyses in October 2022 on mosses. Remarkable is the high value of dioxins in the reference location (M6) south near the bridge of the 'Three Virgins" over the river Memel. Together with the results of the pine needles in this area, these finding suggests an unknown source of dioxin pollution in this environment.



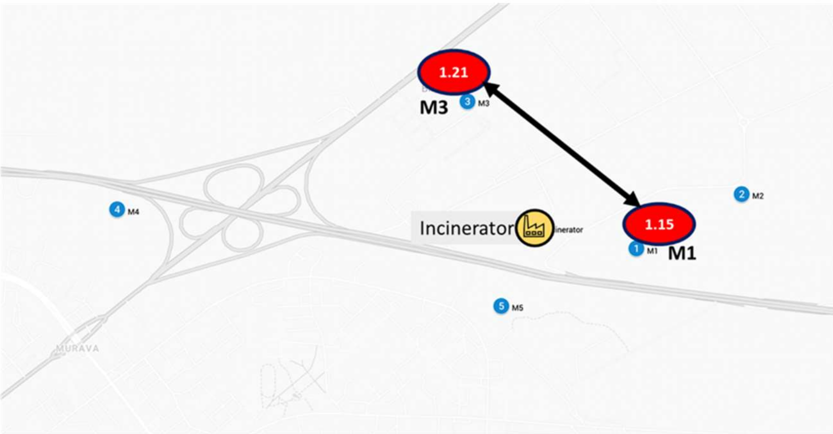
Results Mosses - Kaunas, Lithuania 2022						
			BDS 17-06-2022	Results DR CALUX ub		
2022	Sample nr.		TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB
Collected LT		LT nr. Mosses		pg TCDD eq./g product (ub)		
21-5-2022	1	Mosses 1 (M1)	TW22-LT-M1	1,45	1,4	0,05
21-5-2022	2	Mosses 2 (M2)	TW22-LT-M2	0,82	0,77	0,05
21-5-2022	3	Mosses 3 (M3)	TW22-LT-M3	6,15	6,1	0,05
21-5-2022	3	Mosses 4 (M4)	TW22-LT-M4	0,23	0,18	0,05
21-5-2022	5	Mosses 5 (M5)	TW22-LT-M5	0,38	0,37	0,11
			BDS 07-11-2022	Results DR CALUX		
			TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB
Collected LT		LT Nr Mosses		pg TCDD eq./g product (ub)		
23-10-2022	6	Mos-3-1a (M6)	TW22-LT-M6	2,89	1,72	1,17
23-10-2022	7	Mos-3-2a (M7)	TW22-LT-M7	1,62	0,83	0,79
23-10-2022	8	Mos-3-3a (M8)	TW22-LT-M8	2,44	1,9	0,54
23-10-2022	9	Mos-3-4a (M9)	TW22-LT-M9	0,08	0,062	0,013

Chemical analyses on mosses

Mosses samples M1 and M3 have been analysed with the chemical method of GC-MS. The figure below is shown the differences in PCDD/F/dl-PCBs in concentrations and TEQ values. However, the cause of the high elevation in the DR CALUX is not explained. The bioassay DR CALUX as TW explained before, is sensitive to brominated dioxins, which is not included in the EU regulations for waste incineration emissions. More research is needed on this matter, to explain these differences in the results of bioassay and chemical analyses. If the contribution of brominated dioxins is the cause, implementation in the EU regulation is recommended. Brominated dioxins are a product of the uncompleted combustion of material containing brominated flame retardants, like the housing of many electronics.

GC-MS dioxins (PCDD/F/dl-PCB) analyses mosses - Kaunas, Lithuania 2022

Kaunas			
	concentration		
	M1	M3	differences
TCDD	0,06	0,13	132%
PCDD	0,26	0,18	-31%
HxCDD1	0,19	0,15	-21%
HxCDD2	0,28	0,32	14%
HxCDD3	0,25	0,21	-16%
HpCDD	1,30	1,60	23%
OCDD	3,50	4,80	37%
TCDF	0,89	0,50	-44%
PCDF1	0,70	0,79	13%
PCDF2	0,84	0,75	-11%
HxCDF1	0,53	0,82	55%
HxCDF2	0,61	0,72	18%
HxCDF3	0,02	0,02	0%
HxCDF4	0,33	0,78	136%
HPCDF1	2,20	3,50	59%
HPCDF2	0,07	0,38	435%
OCDF	1,00	2,50	150%
	concentration		
	M1	M3	differences
PCDD	5,84	7,39	27%
PCDF	7,19	10,76	50%
PCDD/F	13,03	18,15	39%
dl-PCB	191,94	355,29	85%
PCDD/F/dl-P	204,97	373,44	82%



			BDS 03-08-2022	Results GC-MS		
2022	Sample nr.		TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB
Collected LT		LT nr. Mosses		*pg TEQ/g product (ub)*		
21-5-2022	1	Mosses 1 (M1) GC-MS	TW22-LT-M1	1,15	0,94	0,22
21-5-2022	3	Mosses 3 (M3) GC-MS	TW22-LT-M3	1,21	0,97	0,25

All 3-4 different measurements in time (2021, 2022 May, and October) and methods (DR CALUX and GC-MS) on the same locations M1 and M3 show high elevated dioxins in the nearby environment of the incinerator.

Results dioxin-like PCB (dl-PCB) in mosses

Mosses show a dl-PCB range between 0.06 - 0.79 pg TCDD eq./g product by DR CALUX. These values found are low compared to the results of other TW biomonitoring surveys. The chemical analysis show variation in the congener patterns, which can be related to wind direction patterns and the physical characteristics of the different PCB congeners by chemical GC-MS analyses on dioxin-like PCB (dl-PCB).

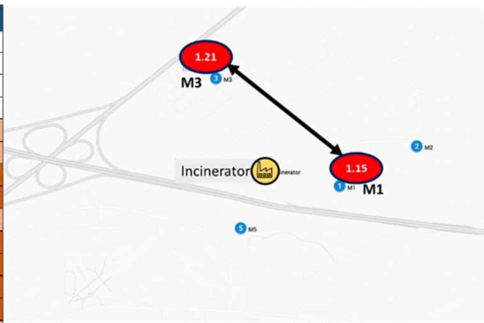
Results Mosses - Kaunas, Lithuania 2022						
			BDS 17-06-2022	Results DR CALUX ub		
2022	Sample nr.		TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB
Collected LT		LT nr. Mosses		pg TCDD eq./g product (ub)		
21-5-2022	1	Mosses 1 (M1)	TW22-LT-M1	1,45	1,4	0,05
21-5-2022	2	Mosses 2 (M2)	TW22-LT-M2	0,82	0,77	0,05
21-5-2022	3	Mosses 3 (M3)	TW22-LT-M3	6,15	6,1	0,05
21-5-2022	3	Mosses 4 (M4)	TW22-LT-M4	0,23	0,18	0,05
21-5-2022	5	Mosses 5 (M5)	TW22-LT-M5	0,38	0,37	0,11
			BDS 07-11-2022	Results DR CALUX		
			TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB
Collected LT		LT Nr Mosses		pg TCDD eq./g product (ub)		
23-10-2022	6	Mos-3-1a (M6)	TW22-LT-M6	2,89	1,72	1,17
23-10-2022	7	Mos-3-2a (M7)	TW22-LT-M7	1,62	0,83	0,79
23-10-2022	8	Mos-3-3a (M8)	TW22-LT-M8	2,44	1,9	0,54
23-10-2022	9	Mos-3-4a (M9)	TW22-LT-M9	0,08	0,062	0,013

			BDS 03-08-2022	Results GC-MS		
2022	Sample nr.		TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB
Collected LT		LT nr. Mosses		pg TEQ/g product (ub)		
21-5-2022	1	Mosses 1 (M1) GC-MS	TW22-LT-M1	1,15	0,94	0,22
21-5-2022	3	Mosses 3 (M3) GC-MS	TW22-LT-M3	1,21	0,97	0,25

GC-MS dioxin-like PCB (dl-PCB) analyses mosses - Kaunas, Lithuania 2022

Kaunas			
concentration			
	M1	M3	differences
PCB77	11,00	7,40	-33%
PCB81	0,74	0,49	-34%
PCB126	2,00	2,20	10%
PCB169	0,40	0,50	25%
PCB105	45,00	97,00	116%
PCB114	5,00	10,00	100%
PCB118	94,00	160,00	70%
PCB123	2,00	5,10	155%
PCB156	16,00	34,00	113%
PCB157	6,40	17,00	166%
PCB167	7,60	19,00	150%
PCB189	1,80	2,60	44%

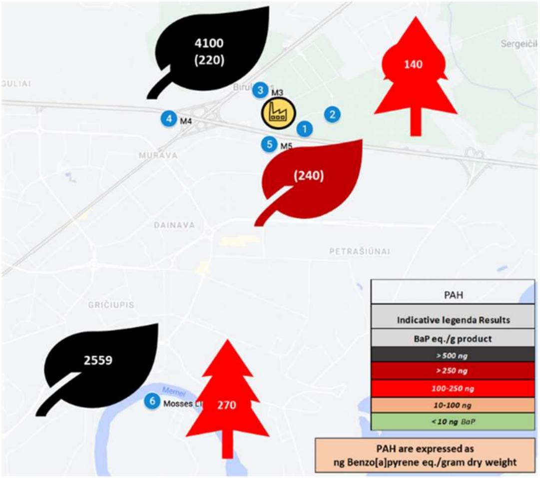
Kaunas			
TEQ			
	M1	M3	differences
PCB77	0,0011	0,00074	-33%
PCB81	0,000222	0,000147	-34%
PCB126	0,2	0,22	10%
PCB169	0,012	0,015	25%
PCB105	0,00135	0,00291	116%
PCB114	0,00015	0,0003	100%
PCB118	0,00282	0,0048	70%
PCB123	0,00006	0,000153	155%
PCB156	0,00048	0,00102	113%
PCB157	0,000192	0,00051	166%
PCB167	0,000228	0,00057	150%
PCB189	0,000054	0,000078	44%



PAH in vegetation (mosses and pine needles)

The group of polycyclic aromatic hydrocarbons, PAHs, is a useful biomarker tool to detect toxic chemical emissions of thermo-confounders. Compounds from the PAH group may have carcinogenic, mutagenic, teratogenic, and immunosuppressive influences on living organisms. As seen in the figure below, there is obviously another source of pollution in the previously chosen reference place. It also shows the difficulties to find a 'clean' reference site. Pollution is everywhere.

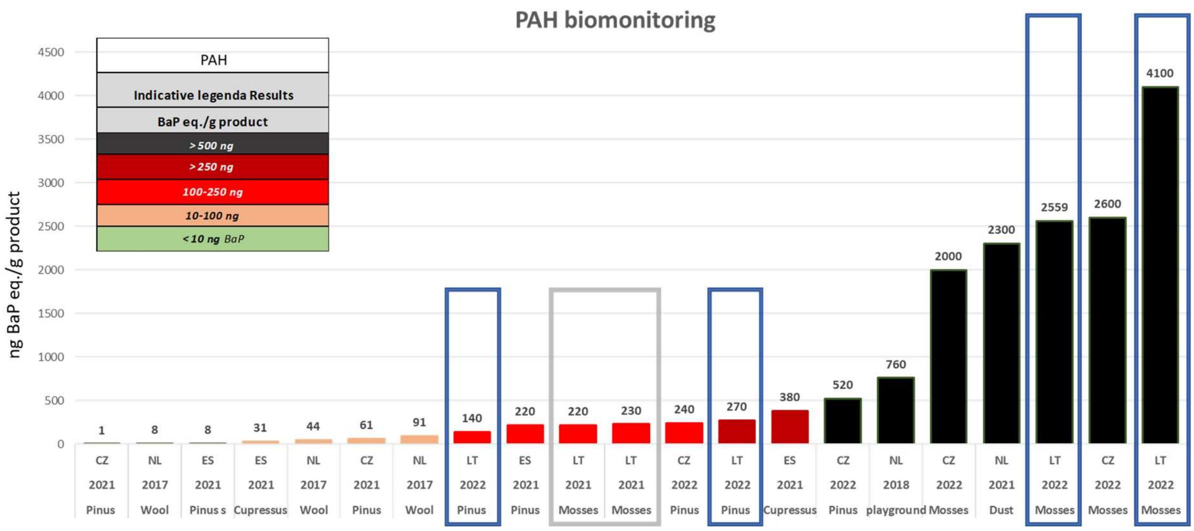
Results PAH pine needles and mosses - Kaunas, 2022 (2021)



Results Mosses - Kaunas, Lithuania 2022							
			BDS 07-11-2022	Results DR CALUX			PAH
2022	Sample nr.		TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB	
Collected LT		LT Nr Mosses		pg TCDD eq./g product (ub)			ng BaP eq./g product
23-10-2022	6	Mos-3-1a (M6)	TW22-LT-M6	2,89	1,72	1,17	2559
23-10-2022	7	Mos-3-2a (M7)	TW22-LT-M7	1,62	0,83	0,79	4100
23-10-2022	8	Mos-3-3a (M8)	TW22-LT-M8	2,44	1,9	0,54	
23-10-2022	9	Mos-3-4a (M9)	TW22-LT-M9	0,08	0,062	0,013	

The figure below shows how the found results should be interpreted. The results are the highest ones in this biomonitoring research.

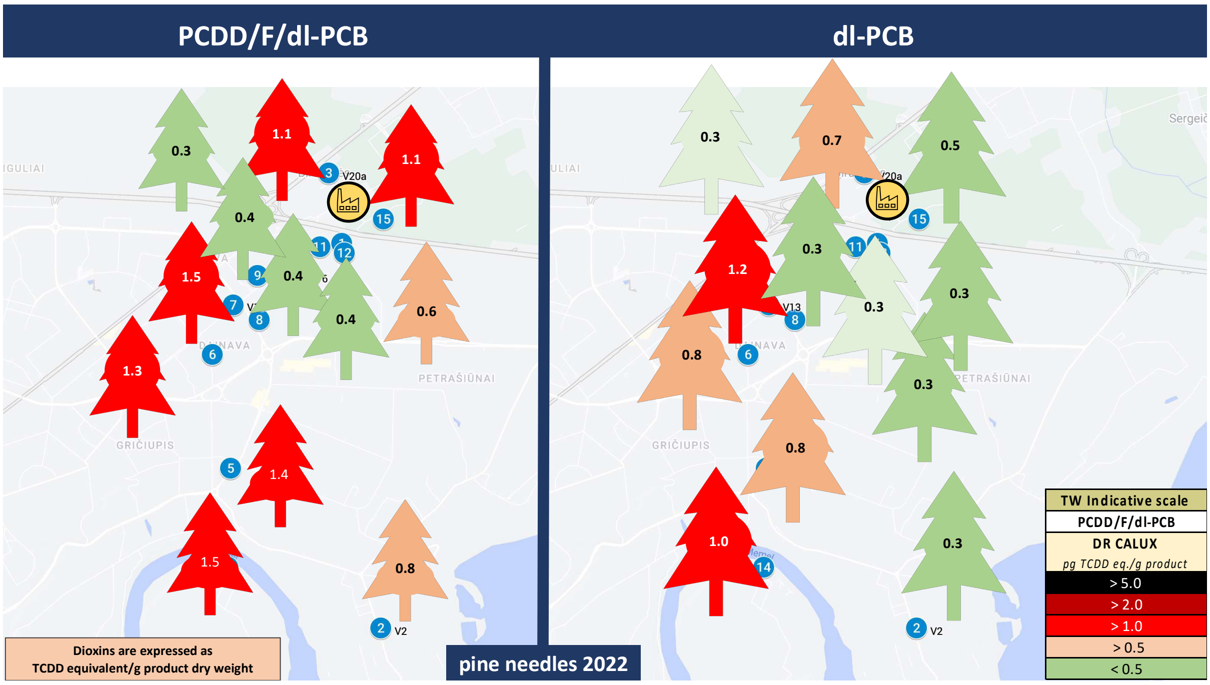
PAH comparison scale – 2022



Results dioxins in pine needles (DR CALUX)

The results of the DR CALUX analyses on pine needles are shown in the figure below. It demonstrates a predominantly increase in dioxins (PCDD/F) in the vicinity of the waste incinerator, but also South of the incinerator. This indicates another source of dioxins because directly South of the incinerator the dioxins are found to be lowered to the results of 2021. This agrees with the results found in the eggs. Based on the moisture content, there has been a correction factor to the other analyses of vegetation (mosses and pine needles).

Results Pine needles - Kaunas, Lithuania 2022								
			BDS 07-11-2022	Results DR CALUX			PAH	PFAS FITC-T4
			TW-REF-NR	PCDD/F/dl-PCB	PCDD/F	dl-PCB		
Collected LT		LT Nr Pine needles		pg TCDD eq./g product (ub)			ng BaP eq./g product	ng PFOA eq./g product
23-10-2022	10	Picea abies PA-3-4c	TW22-LT-PA-3-4c	0,31	0,095	0,21		
23-10-2022	11	Picea abies PA-3-1B	TW22-LT-PA-3-1B	1,5	0,5	1	270	
23-10-2022	12	Pinus sylvestris PS-3-2B	TW22-LT-PS-3-2B	1,06	0,59	0,47		
23-10-2022	13	Picea abies PA-3-3B	TW22-LT-PA-3-3B	1,08	0,42	0,66	140	
23-10-2022	14	Pinus sylvestris PS-3-4B	TW22-LT-PS-3-4B					



Pine needles Kaunas (MB)					
	TW-REF-NR	DR CALUX pg BEQ/gr product			
		PCDD/F/dl-PCB	PCDD/F/dl-PCB	PCDD/F	dl-PCB
	Pine needles/Picea abies	2021	Results 2022		
1	Veg18-PA-SW01 Veg17-PA-SW02	0.38	0.43	0.17	0.26
2	Veg1a-PA-03	0.73	0.37	0.12	0.26
3	Veg16-PA-SW04 Veg15-SW06	0.91	0.41	0.16	0.26
4	Veg19-PA-SE05	0.97	0.64	0.38	0.26
5	Veg21A-PA-07/LT22-V2B	0.52	1.06	0.59	0.47
6	veg14-PA-SW08 veg13-PA-SW09	0.85	1.53	0.41	1.12
7	Veg20A-PS-10/LT22-3B	0.93	1.08	0.42	0.66
8	veg08-PA-SW11	0.47	1.28	0.47	0.81
9	TW22-LT-V2		0.81	0.55	0.26
10	TW22-LT-V3		1.38	0.58	0.81
11	TW22-LT_PA-3-1B		1.50	0.50	1.00
14	TW22-LT_PA-3-4C		0.31	0.10	0.21

Conclusion

In this biomonitoring research, persistent organic pollutants are monitored in eggs, pine needles, evergreen leaves, and mosses with bioassays and chemical analyses in 2021 and 2022. The results are summarised in the figure below. Biomarkers of eggs, northeast and west, show elevated levels of dioxins and dioxin-like PCB. PFAS is found in eggs and with the chemical analysis, PFOS and Gen-X could be identified. Dioxins in mosses and pine needles are elevated in the direct environment of the incinerator.

High levels of PAH are found in the direct environment of the incinerator. Overall elevated levels of persistent organic pollutants show an environment under the stress of toxic compounds. It is therefore of utmost importance that, in cooperation with the management of the waste incinerator, the contribution of the emission of the incinerator will be determined in this aspect. There is a need for detailed data on the emissions of the incinerator, meaning minute data of semi-continuous measurements, including OTNOC events such as start-ups and shutdowns. Consideration should also be given to possible other sources of pollution, 5000 m southwest, near the Memel River.

The new tolerable weekly intake for dioxins and dioxin-like PCBs, seven times tighter, means much more attention is needed to control emissions of dioxin pollution and persistent organic pollutants in general. The main question in this study is: *what is the share of the waste incinerator*? The possibility of spot localised loadings, when there is an OTNOC as a start-up or shutdown, will always be present and will produce many toxic pollutants. There should be much more testing and monitoring in the vicinity of waste incinerators in general. Further research is needed to reduce or eliminate the ongoing findings of hazardous persistent organic pollutants in the environment.