Hidden Emissions Waste Incinerator IVRY-PARIS XIII

AMESA Semi-Continuous Measurements 2020 - 2021

A study on AMESA data of **34 937 hours** measurements

ToxicoWatch, May 2023

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Thanks to Collectif 3R (Réduire, Réutiliser, Recycler) for enabling this research.

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Acronyms

Acronym	Full phrase
AMESA	Adsorption MEthod for SAmpling Dioxins and Furans
APCD	Air Pollution Control Devices
BAT	Best Available Techniques
BEP	Best Environmental Practice
BEQ	Biological Equivalents
CO_2	Carbon dioxide (chemical formula CO2)
DIP	*Dossier d'information du public*
dl-PCB	dioxin-like Polychlorinated Biphenyls
DR CALUX®	Dioxin Responsive Chemical-Activated LUciferase gene eXpression
EFSA	European Food and Safety Authority
GC-MS	Gas Chromatography Mass Spectrometry GC-MS
I-TEQ	The older International Toxic Equivalent (I-TEQ) scheme by the North Atlantic Treaty Organisation (NATO) was initially set up in 1989 and later extended and updated
MWI	Municipal Waste Incineration
ng	Nanogram; 10^{-9} gram
Nm^3	Normal Meter Cubed per Hour; quantity of Gas which at 0 Degrees Celsius and at an absolute pressure of 1.01325 bar and when free of water vapour occupies the volume of 1 cubic metre
NOx	NOx is shorthand for nitric oxide (NO) and nitrogen dioxide (NO2)
OTNOC	Other Than Normal Operating Conditions
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PCDD/F/dl-PCB	Polychlorinated Dibenzodioxins/ Dibenzofurans/ dioxin-like Polychlorinated Biphenyls
PFAS	Per- and PolyFluoroAlkyl Substances
pg	Picogram; 10^{-12} gram
POP	Persistent Organic Pollutants
REC	Residual Energy Power Plant (*Dutch: Reststoffen Energie Centrale*), Harlingen, NL
SOx	Sulfur and oxygen containing compounds such as SO, SO2, SO3, S7O2, S6O2, S2O2, etc
SVHC	Substances of Very High Concern
Syctom	Metropolitan household waste agency
TCDD	2,3,7,8-tetrachloordibenzo-*p*-dioxine
TDI	Tolerable Daily Intake
TEF	Toxic Equivalency Factor;
TEQ or WHO-TEQ	Toxic Equivalent: WHO modified Toxic Equivalency Factor (TEF) values in 2005
TW	ToxicoWatch
TWI	Tolerable Weekly Intake
µg	Microgram 10^{-3} gram
WHO	World Health Organization
WtE	Waste to Energy (waste incinerator)

Executive summary

ToxicoWatch's 2021 biomonitoring study has revealed high levels of dioxins in hen eggs from owners of domestic chicken coops, as well as in vegetation samples (conifers, olive trees, mosses) in the area around the Ivry - Paris XIII waste incinerator. The question is whether this waste incinerator could be responsible for the high levels of dioxins found in hen eggs and vegetation.

To answer this question, a follow-up study is requested by Collectif 3R (Réduire, Réutiliser, Recycler) on semi-continuous measurements (**A**dsorption **ME**thod for **SA**mpling Dioxins and Furans, **AMESA**) and provided by SYCTOM, the public owner of IVRY-PARIS XIII waste incinerator operated by French multinational SUEZ. The reports studied by TW include the yearly information report ("*Dossier d'information du public",* DIP) published by SUEZ under Article R.125-2 of the French Code of Environment, as well as data from the AMESA semi-continuous dioxin sampling device, and reports by private companies subcontracted by SUEZ (SOCOR AIR and Bureau Veritas) from 2 years of semi-continuous measurements of emissions from IVRY-PARIS XIII in 2020 and 2021.

Semi-continuous measurements of emissions are a major step forward compared to EU-mandated short-term sampling of only twelve (12) hours a year, pre-announced and only under ideal combustion. It is called semi-continuous measurements since results can only be provided after sampling and analysis, mostly after six (6) weeks. The second reason, why these measurements must be called 'semi-continuous' is that these technical devices are not able to operate continuously. The sampling efficiency should at least meet the 85% requirement.

The provided data from the results of dioxin measurements with the semi-continuous (AMESA) sampling show that the waste incinerator IVRY-PARIS XIII exceeded the European standard of 0.1 ng TEQ/ Nm^3 only once in the two (2) year measurement campaign of 2020-2021. The last new build, the most modern waste incinerator in the Netherlands in 2011, the REC in Harlingen, has exceeded this EU standard twice in a two (2) year measurement campaign 2015-2017. However, compared with the REC waste incinerator in the Netherlands, the average dioxin emissions of IVRY-PARIS XIII are 3-4 times higher for lines 1 and 2, respectively. In the Netherlands, a moratorium on waste incinerators has been in place since 20092. For dioxins, a stricter limit of 0.01 ng TEQ/Nm3 has been fixed for the last waste incinerator built (REC), compared with the European limit value of 0.1 ng TEQ/Nm3, which has been in force for 33 years. **If stricter limit value, as in the Netherlands, had been applied to the Ivry - Paris XIII incinerator, it would have been in breach for almost the entire period studied (2020-2021).**

The emissions data show that the waste incineration process is extremely vulnerable to disturbances. The sampling device of the AMESA was found to be out of service for more than 3,000 hours per furnace, i.e. 125 days or 4 months over 2 years. Apart from maintenance periods, the incinerator experienced more than 4,000 hours of "combustion control" problems i.e. 167 days or 5 months in 2 years. If these problems could be linked to low temperatures in combustion, problems for proper incineration are huge. Article 50 of Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions requires a waste combustion temperature of 850°C for at least 2 seconds in the post-combustion zone.

The interruptions of almost 7,000 hours in the AMESA system during the period studied at the Ivry-Paris XIII incinerator are hardly explained in the reports and data documents provided by SUEZ and Syctom for this research. The number of events or sampling failures in the AMESA system at the Ivry-Paris XIII incinerator is extremely high compared with the Dutch incinerator REC for a comparable period of 2 years.

The result of the ToxicoWatch study points out several malfunctions at the Ivry - Paris XIII incinerator. It is worth asking - in general terms - whether building a (new) waste incinerator is a sustainable solution for waste disposal. And more specifically, should a (newly built) waste incinerator be in such a densely populated environment? **The emission of toxic substances represents a serious risk to public health and is unfortunately inevitable when waste is incinerated.** Structural malfunctions occurring during shutdowns and restarts could become more transparent and understandable and, more importantly, **could be reduced if they were more strictly controlled by competent public authorities.**

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[1] *https://lap3.nl/service/english/*

Introduction

Dioxins from industrial emissions toxic substances, so-called unintentionally produced persistent organic pollutants (POPs/UPOPs). The EU mandates for industrial emissions are only based on short terms measurements (12 hours/year, collected under ideal production processes and pre-announced) of a small group of chlorinated dioxins (PCDD/F/dl-PCB).
Since the total group of dioxins is associated with many health problems and diseases for human populations and the environment, all efforts should be made to eliminate or at least to do the utmost to reduce these substances of very high concern (SVHC).

In 2021, ToxicoWatch was commissioned by the Collectif 3R (Reduce, Reuse, Recycle) to carry out a biomonitoring study at Ivry - Paris XIII. Owners of domestic chicken coops near the Ivry - Paris XIII waste incinerator were contacted to analyse the eggs produced. In addition, vegetation (evergreen trees and mosses) in the area around Ivry - Paris XIII was also used as a biomarker. The results of this ToxicoWatch research in 2021 showed extremely high values of dioxins (PCDD/F/dl-PCB) in eggs and vegetation, especially compared to other biomonitoring studies conducted by ToxicoWatch in Europe related to waste incineration (2014-2022). In view of these alarming results, it was decided to carry out a follow-up study on technical data from semi-continuous measurements (AMESA) at the Ivry - Paris XIII incinerator.

The Syctom management of the incinerator IVRY-PARIS XIII provided C3R data of semi-continuous (AMESA) measurements from 2020 and 2021. It is particularly interesting to compare the performance of the REC incinerator built in 2011 in the Netherlands and presented as the most modern Waste-to-Energy (WtE) incinerator in Western Europe by the Dutch government, with the IVRY-PARIS XIII incinerator built in 1969 which is planned to be demolished and replaced by a new one by 2024. ToxicoWatch has experience of studying technical data of waste incineration and participated - as an independent participant/foundation - in several technical working groups in the Netherlands as well for SAICM/COPs 8, Stockholm convention (UNEP), in Geneva. The results of an extended and unique TW study of >20,000 hours (2015-2017) on the semi-continuous (AMESA) emission data of the WtE waste incinerator REC, Harlingen, the Netherlands are used as reference material in this report.

The results of TW-biomonitoring IVRY-PARIS XIII 2021 show high dioxin levels in eggs from backyard chickens, tree leaves, pine needles, and mosses in the environment of Ivry-sur-Seine, around waste incinerator IVRY-PARIS XIII. Action taken by the French national and local authorities seems to have been limited to targeting the egg consumption issue, instead of the source of pollution.[2] However, the eggs are only an indicator of the presence of dioxins in the environmental area of research. Banning the consumption of backyard chicken eggs, as an answer to the results of the biomonitoring study on dioxin emissions, is not addressing the real cause of dioxin pollution. Further research is needed to know how the source(s) of dioxin contaminations can reduce the toxic load in the environment by real sound management for the benefit of human and environmental health as a sustainable solution. [3]

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[2] *https://www.iledefrance.ars.sante.fr/polluants-organiques-persistants-lagence-recommande-titre-conservatoire-de-ne-pas-consommer-les*

[3] *See the Agence Régionale de Santé's "questions and answers" web page https://www.iledefrance.ars.sante.fr/polluants-organiques-persistants-dans-les-oeufs-de-poulaillers-domestiques-ce-quil-faut-savoir*

In April 2023, the *Agence Régionale de Santé* published a second press release, followed in May 2023 by a web page with FAQs (see footnote 3). Once again, **the recommendation was to stop eating eggs from domestic hen houses**, which extended to the entire Ile-de-France region (population 12 million). The recommendation is based on provisional results from 25 domestic hen houses surveyed. 14 sites were selected around the 3 largest incinerators around Paris (Ivry-sur-Seine, Issy-les-Moulineaux, Saint-Ouen-sur-Seine), as well as 11 sites more than 3 km from a possible source of dioxins. The provisional results of the study indicate contamination of all the egg and soil samples by the 3 groups of POPs analysed (dioxins, furans, PCB-dl).

All backyard chicken eggs in the TW-biomonitoring research IVRY-PARIS XIII of 2021 are selected on prerequisites formulated in the TW questionnaire. The European Food and Safety Authority (EFSA) study on dioxins shows dioxins are still a big issue and cannot be neglected. [4] Dioxin contamination is a major health threat and cannot be dismissed as only an egg problem. Figure 1, shows our environment contaminated with substances of very high concern (SVHC), threatening human health by disorders of the brain, heart, and reproduction system. Working on sufficient regulation and enforcement at the source (industry) of SVHC contamination could be a step forward for a more toxic-free world to live in.

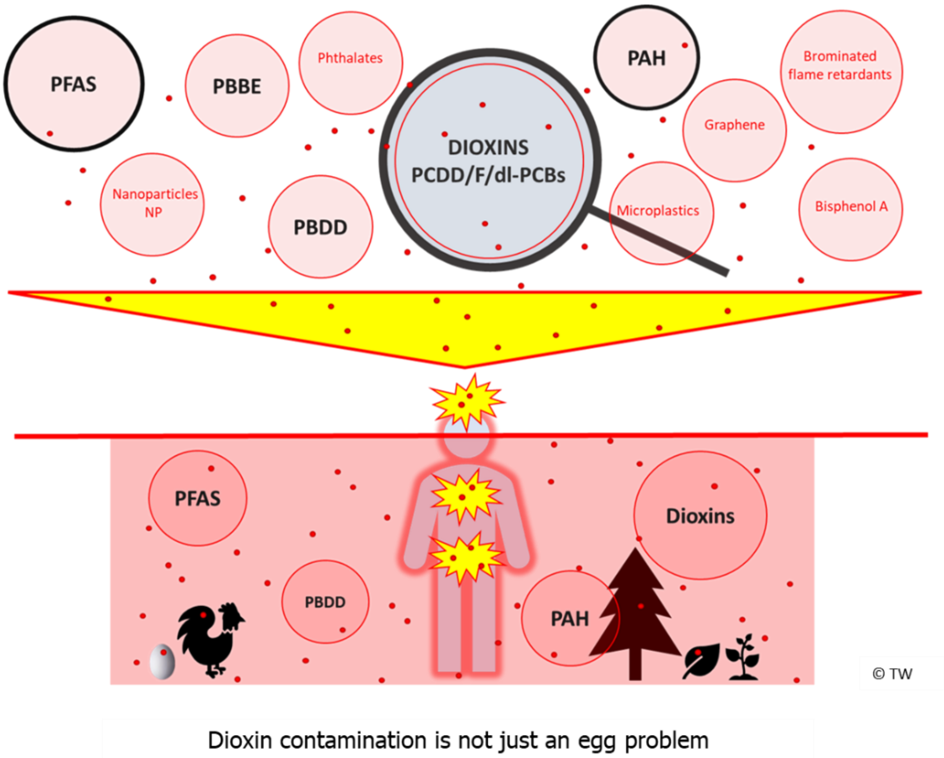


Figure 1: "Dioxin contamination is not just an egg problem", infographic TW.

The aim of ToxicoWatch (TW) Foundation, a Public Benefit Organisation (PBO), is to raise public awareness of man-made toxic substances in our environment. One of the main fields of research for TW is biomonitoring emissions of persistent organic pollutants (POPs), such as dioxins and PFAS mostly in relation to waste incineration in Europe.

[4] *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*

1. The Regulatory Framework for Emissions Waste Incinerators

1.1. EU Regulation on dioxins (PCDD/F) emissions

There are international agreements on emissions of extremely hazardous substances such as dioxins, especially as they can be transported over long distances. Incineration emissions of dioxins in the EU are regulated by a maximum **of 0.1 ng TEQ/Nm³** for the sum of 7 chlorinated dioxins (PCDD) and 10 chlorinated furans (PCDF), *Figures 2 and 3*. Dioxin-like polychlorinated biphenyls (dl-PCB), brominated (PBDD/F), mixed halogenated dioxins (PXDD/F), chlorinated paraffins, as well as other substances such as PFAS, are not regulated by EU for waste incinerator emissions. In the EU-food directives for chicken eggs, limit values for 12 dioxin-like PCBs (dl-PCB) are included, *in Figure 5*.

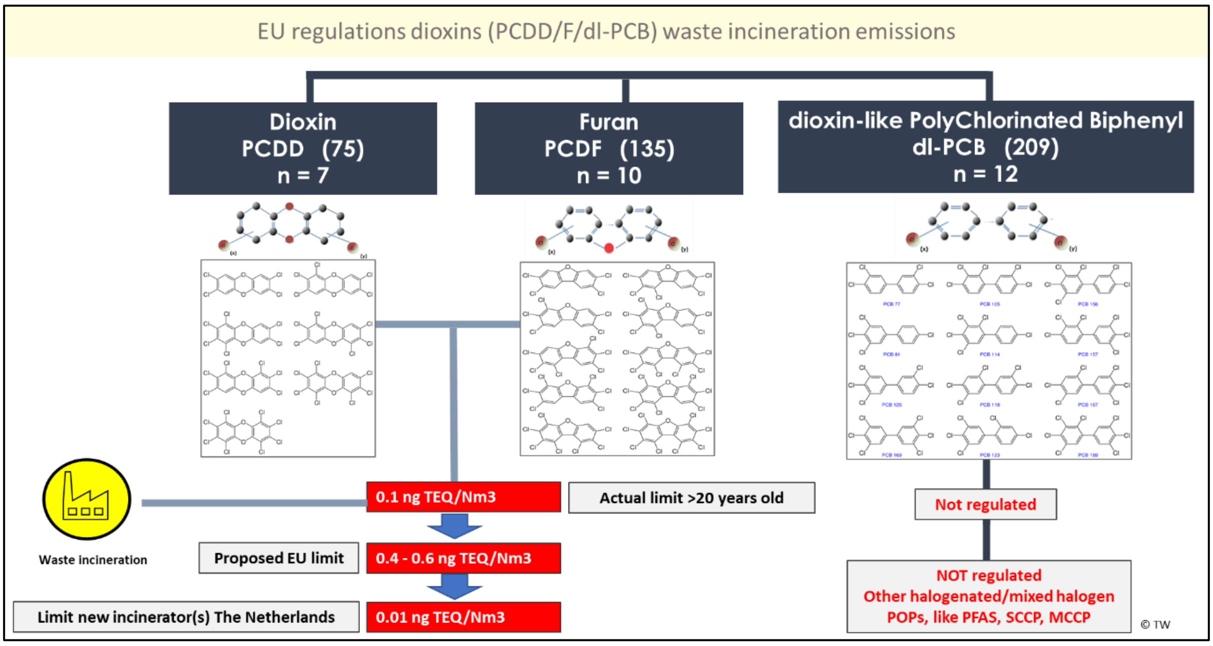
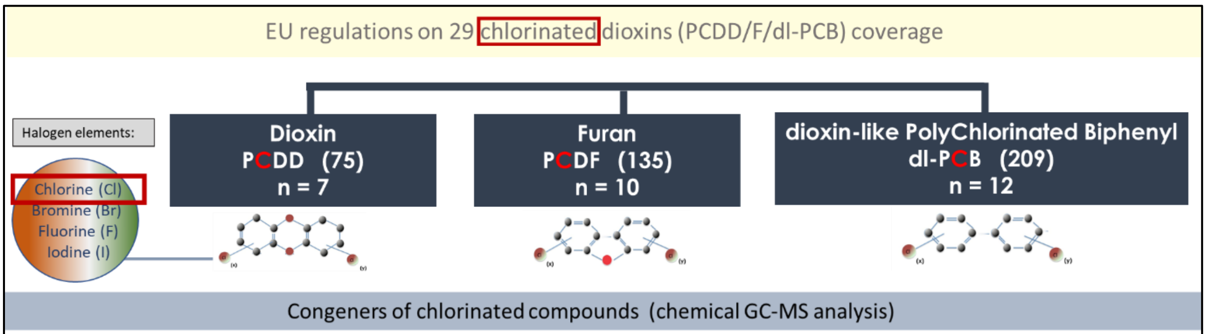


Figure 2: EU Regulated overview chemical analyses GC-MS on chlorinated dioxins (PCDD/F/dl-PCB)

In the Netherlands, there is, since 2011, a moratorium on building new incinerators. The last built waste incinerator in 2011 has, therefore, a dioxin (PCDD/F) emission limit value 10 times stricter, 0,01 ng TEQ/ Nm³ than required for other incinerators.



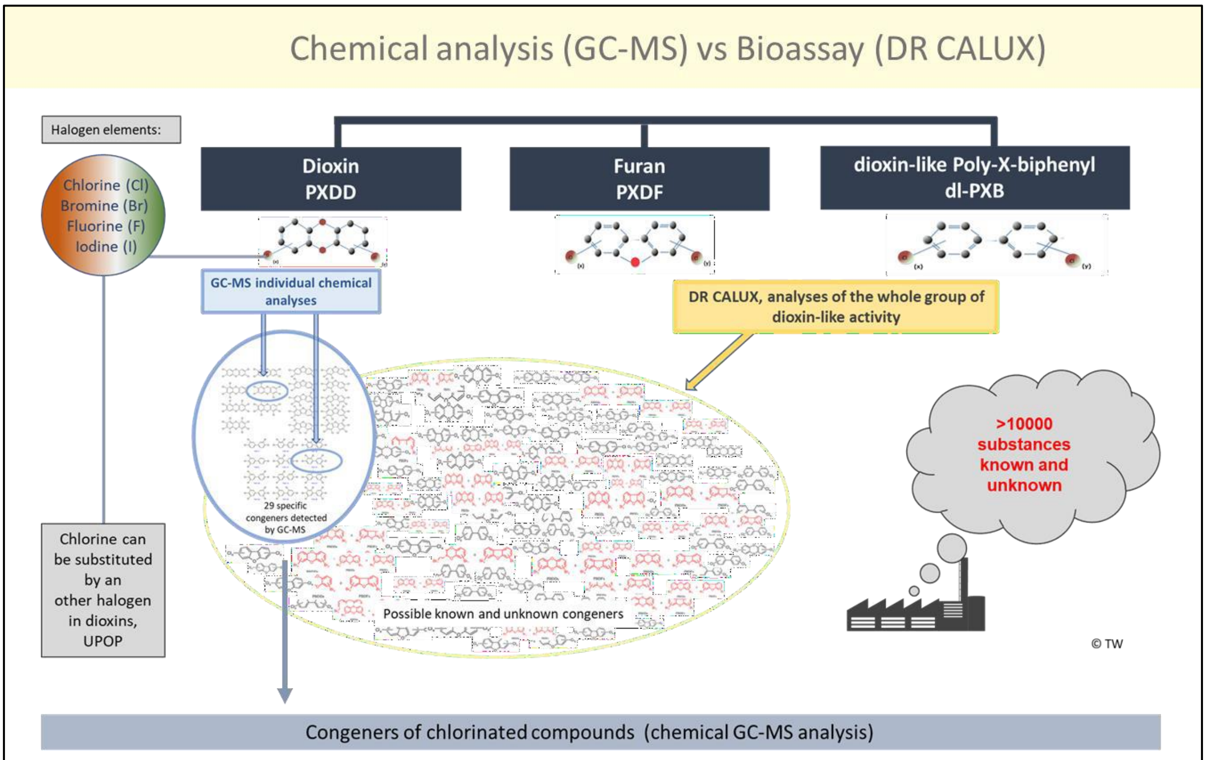
Dioxins, furans (PCDD/F) and dioxin-like PCBs		
Abbreviation	**Congeners**	**TEF**
Dioxins (n=7)		
TCDD	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1
PCDD	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1
HxCDD1	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0,1
HxCDD2	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	0,1
HxCDD3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin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

© TW

Figure 3: EU Regulation standards in ng TEQ/ Nm3 for dioxin (PCDD/F) emissions waste incinerator



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

Figure 4: Chemical analysis (GC-MS) vs Bioassay (DR CALUX) analysis

TW biomonitoring research on dioxins in eggs of backyard chickens and vegetation is based on bioassay (DR CALUX) and chemical analysis (GC-MS), as explained in *Figures 4 and 5*.

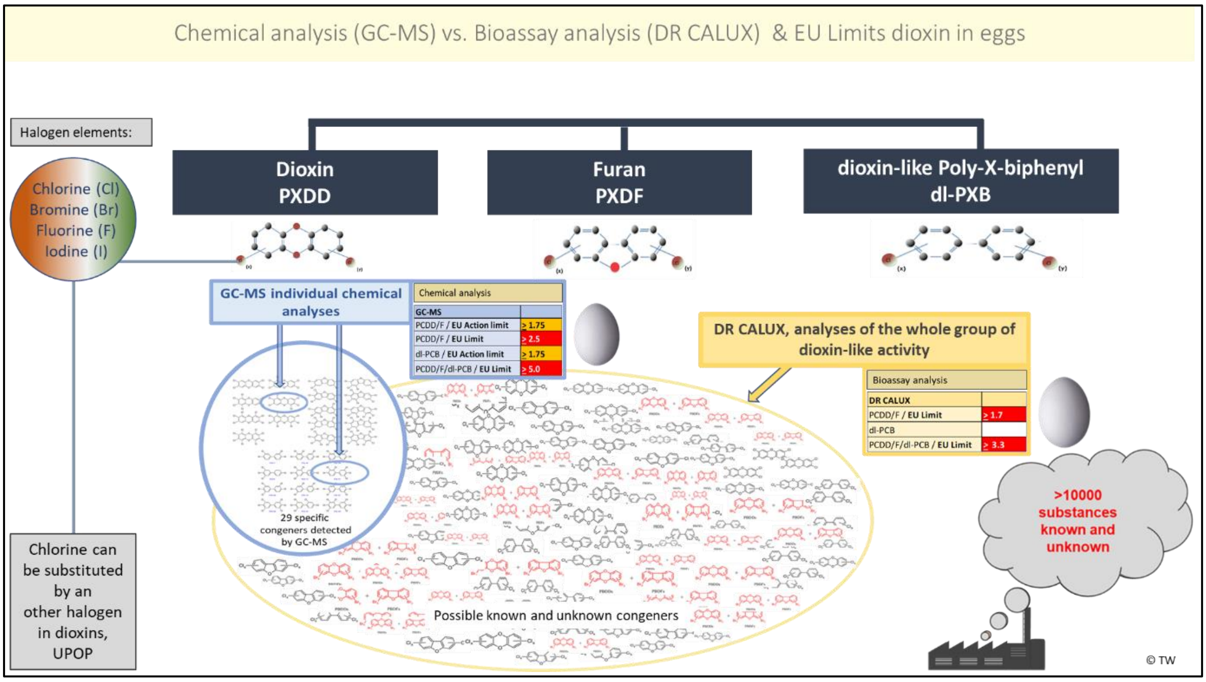


Figure 5: Chemical analysis (GC-MS) vs Bioassay (DR CALUX) and EU limits for food (Eggs)

1.2 French regulatory framework and IVRY-PARIS XIII Incinerator

In the French regulation, the limit value for dioxins (PCDD/F) of 0.1 ng TEQ/Nm³ has been in force since 2002.[5] Article 10 of this regulation lays down the maximum duration of stops, breakdowns, or technical failures of semi-continuous measurement devices. During a year, the cumulative downtime of a semi-continuous measurement device shall not exceed 15% of the plant's operating time.

The Environmental Authorisation of the current IVRY-PARIS XIII Incinerator states that "*permanent measurement of dioxins and furans*" is mandatory as part of self-monitoring to calculate the concentration of dioxins and furans for maximum 1 month, as well as monthly emissions. [6]

In the document Environmental Authorization of the future IVRY-PARIS XIII incinerator, the limit values of dioxins (PCDD/F) are as follows: [7,8] (Chapter 3.2.6.5)

- 0.05 ng TEQ/Nm³ for measurements with a duration between 6 and 8 hours
- 0.08 ng TEQ/Nm³ for semi-continuous measurements
- 0.000231 g TEQ/day for the total average daily average

Chapter 10.2.1.2 is about self-monitoring of dioxins and furans. The objective is to measure both chlorinated (PCDD/F) and brominated dioxins (PBDD/F) (DAILY emissions)

Chapter 10.2.1.3. is about self-monitoring of dioxins and furans in the environment (Owen + biomonitoring of mosses and cabbages)

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[5] *FRENCH NATIONAL REGULATION = Arrêté du 20 septembre 2002*
[6] *Arrêté n°2005-5028 du 26 décembre 2005/: https://www.val-de-marne.gouv.fr/contenu/telechargement/6775/49100/file/Arr%c3%aat%c3%a9+pr%c3%a9fectoral+modificatif+2005.pdf*
[7] *ENVIRONMENTAL AUTHORIZATION OF THE FUTURE IVRY-PARIS XIII INCINERATOR = Arrêté d'autorisation n° 2018-3879 du 23 novembre 2018*
[8] *Arrêté d'autorisation n° 2018-3879 du 23 novembre 2018, Annex, Chapter 3.2.6.5*

1.3. Emission and food limits dioxin (PCDD/F/dl-PCB) emissions

In *Figure 6* below, the middle column shows 33 years of EU policy to reduce dioxin emissions and dioxin contamination of food. The European Food and Safety Authority (EFSA) scientific panel's review on dioxin toxicity carried out a reassessment in 2018 and concluded, as an adviser for EU member states, that the limit for human dioxin uptake from food needs to be: 2 pg TEQ/kg/bw/week. This is a factor of 35 times more toxicity than previously in 2001 and should, according to the EFSA, be implemented in EU regulations as a safe limit.

However, this EFSA advice is not reflected in any EU measurements to reduce dioxins in food, nor in emission regulation of waste incinerators. *Figure 6* shows the recognition of the increased toxicity of dioxin to human health, despite these findings, this has not been implemented into stricter limits for food and emissions.

> In the EU: **no updating** limit over the last 33 years of emission regulations has taken place since 1989, despite all the development and application of the best available techniques (BAT).

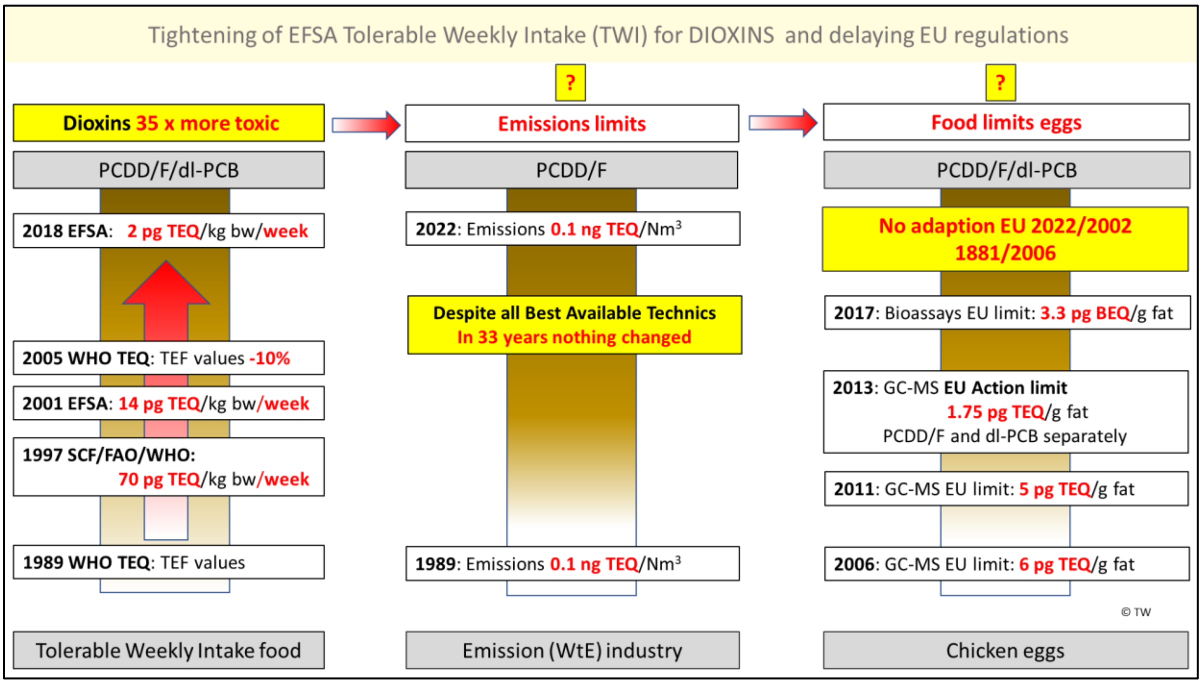


Figure 6: Tightening of EFSA Tolerable Weekly Intake (TWI) for dioxins (PCDD/F/dl-PCB) and delaying EU regulations.

1.4 Unregulated hazardous substances

Waste incineration results in emissions of a multitude of toxic substances; some substances, such as dioxins, are unintentionally produced by incomplete combustion. The dioxin emission limits required by the EU only cover 17 chlorinated dioxins and furans (*Figure 2*). In addition, 12 heavy metals should be measured periodically. Leaving a lot of polluting substances of very high concern uncontrolled and unmeasured in emissions of waste incineration by such a limitation of monitoring. See *Figures 7 and 8*.

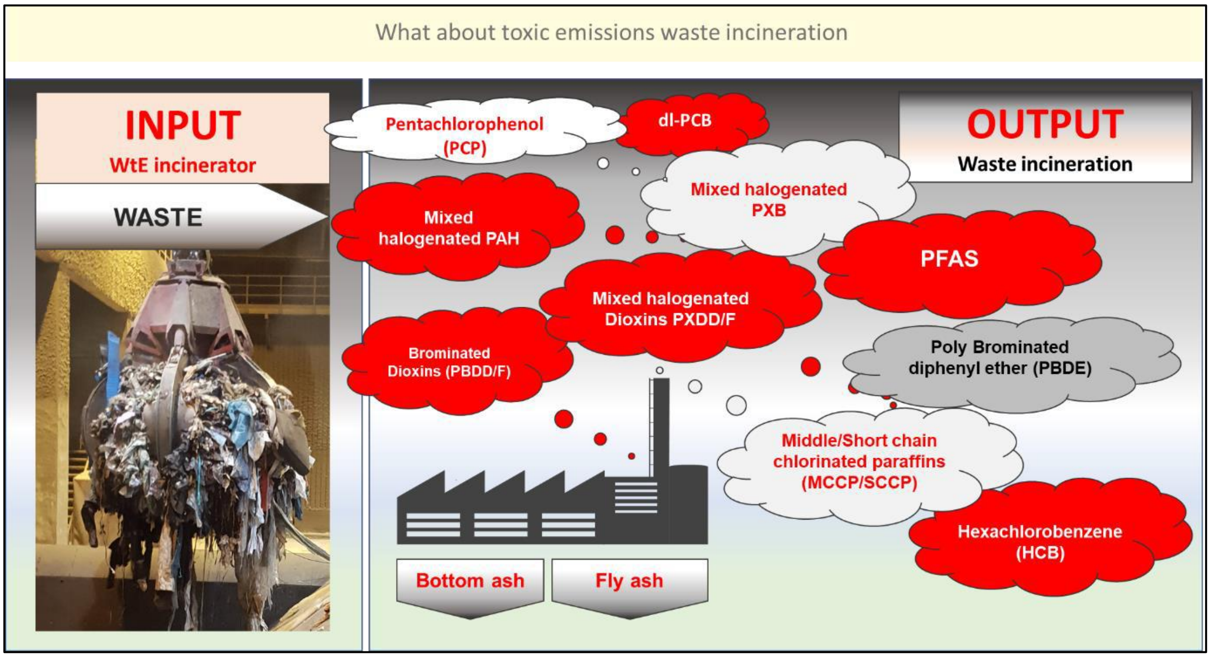


Figure 7: Unregulated toxic emissions from incineration, Picture TW at REC (NL) 19-10-2019.

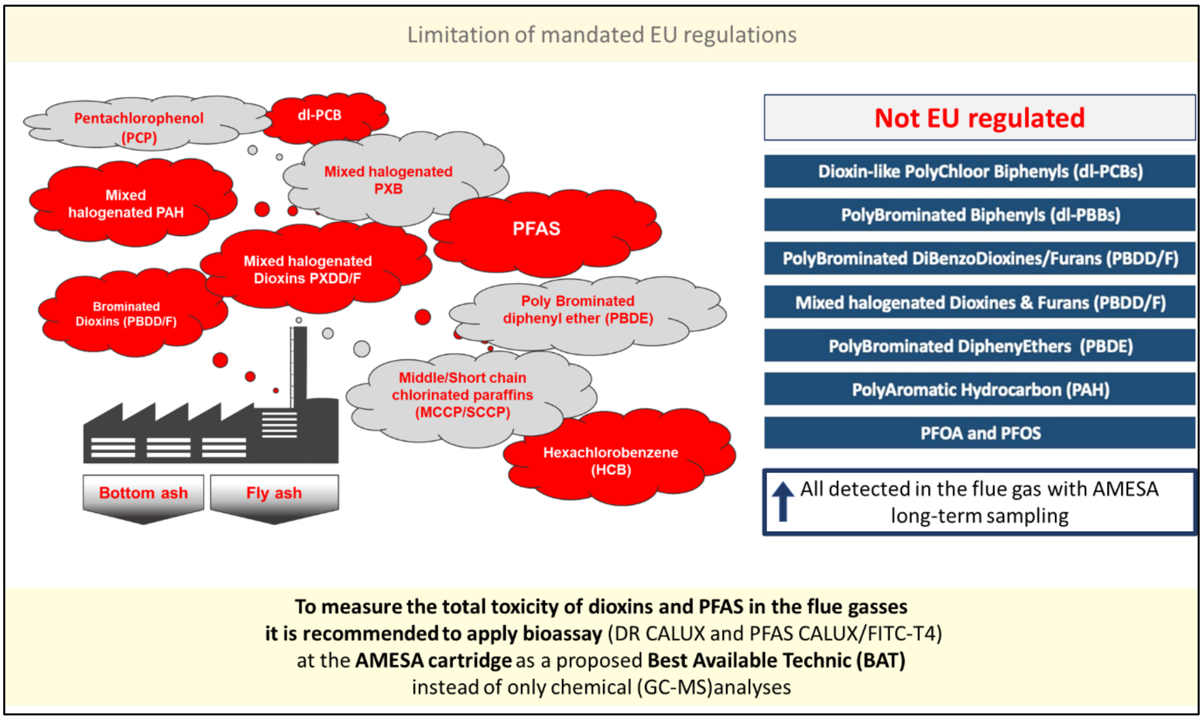


Figure 8: Limited measurements and analyses of hazardous emissions of waste incineration

1.5 Safe limits of persistent organic pollutants (POPs)

Figure 9 shows three groups of persistent organic pollutants (POPs) concerning their found potency to harm human health in time perspectives. Tolerable intakes of dioxins are set by the European Food and Safety Authority (EFSA). In 2018, the acceptable daily intake of dioxins was fixed at a level 35 times stricter than it was in 2001. However, this EFSA opinion has not been transposed into stricter standards for food or emissions. Other POPs, such as PFASs, have now been declared more than 2386 times toxic by EFSA, and bisphenol A, abbreviated to BPA, has also been shown to be more than 10000 times more toxic in just 7 years.

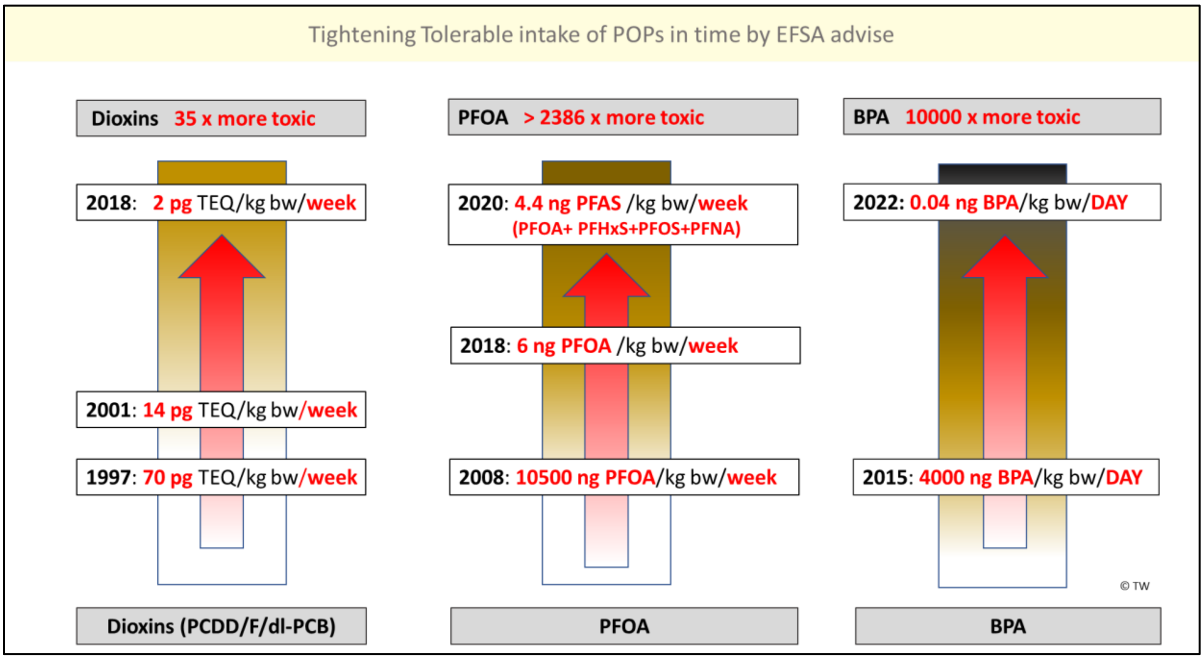


Figure 9: Tightening Tolerable intake of POPs in time by European Food and Safety Authority (EFSA).

Although BPA should be largely destroyed by incineration, if combustion takes place at temperatures > 850° C, it is assumed that 0.001% of the BPA still will be emitted. BPA is one of the most produced chemicals in the world with an annual production of more than 12 million tonnes in 2022 and this is still growing. So many plastics are produced with a content of BPA and with that, the waste stream is full of BPA. Nowadays a lot of consumer products are marked as 'BPA-free', suggesting the products will be not toxic anymore. However, studies show substitutes for BPA are often more hazardous for human health and the environment, that is why they are called 'regrettable substitutes' because of their even more toxic potency, even though these products are promoted on the consumer market with "green labels of BPA-Free", although possible leakage into the environment from incineration residues (bottom and fly ash) and emissions.

Persistent organic pollutants (POPs) constitute a significant environmental exposure and despite increasing regulations at the national and global levels, the general population continues to be exposed to levels that may cause lasting health effects such as cancers and hormonal disorders and harm the immune system.

"*Tightening the Tolerable intake of POPs in time by EFSA advice*" The figure above shows, how insights on the toxicity of specific substances have led to stricter intake of safety limits for specific substances like dioxins, PFOA (PFAS) and BPA. In 21 years of research, dioxins have been found to be 35 times more toxic. This has not led to tightening of safe food and emission standards. PFAS a group of fluorinated compounds, in the spotlight these days, has hardly been studied in relation to waste incineration. While PFAS compounds are dominant in the waste stream and shown by TW research to be thermally persistent. In ToxicoWatch studies, PFAS occurs in every biomatrices studied in relation to waste incineration. The toxicity of PFAS has been re-evaluated by a factor greater than 2000 over the last 12years.

1.6 Other Than Normal Operating Conditions (OTNOC)

Interruptions, for diverse reasons, in standard combustion processes are called *'Other Than Normal Operating Conditions'*, abbreviated as OTNOC. These are moments/events during the waste incineration process when the required normal combustion is failing, like temperature drops in the post-combustion zone (PCZ), ID fan failure, start-ups, or a shutdown. **OTNOC is directly correlated with the possibility of high dioxin emissions, as research on OTNOC events has shown. The automatic semi-continuous measurement system, in this case, AMESA, is an excellent tool for recording deviating combustion conditions as OTNOC, besides its initial purpose of dioxin sampling**.

Monitoring temperature is important for optimal combustion processes. If the temperature window in the post-combustion zone (PCZ) drops under 850˚C, during an OTNOC, dioxins will be produced (Figure 10). AMESA data registers "events", which are vulnerable to dioxin emissions into the environment.[9] The topic of exceeding dioxin emissions during OTNOC is still being researched and placed on the agenda of the Stockholm and Basel Conferences (UNEP, Geneva) to be implemented structurally in the guidelines for incinerators. Li (2018) found high levels of dl-PCB formation during the start-up and shutdown (OTNOC).[10] This could also be the case for the fact that high results of dl-PCB in IVRY-PARIS XIII are measured in the TW biomonitoring 2021. Dioxin-like PCBs (dl-PCBs) had a great application in all kinds of construction materials and paints and therefore could be in all kinds of products of demolition and dumping. Emissions during OTNOC certainly need to be investigated in waste incineration.

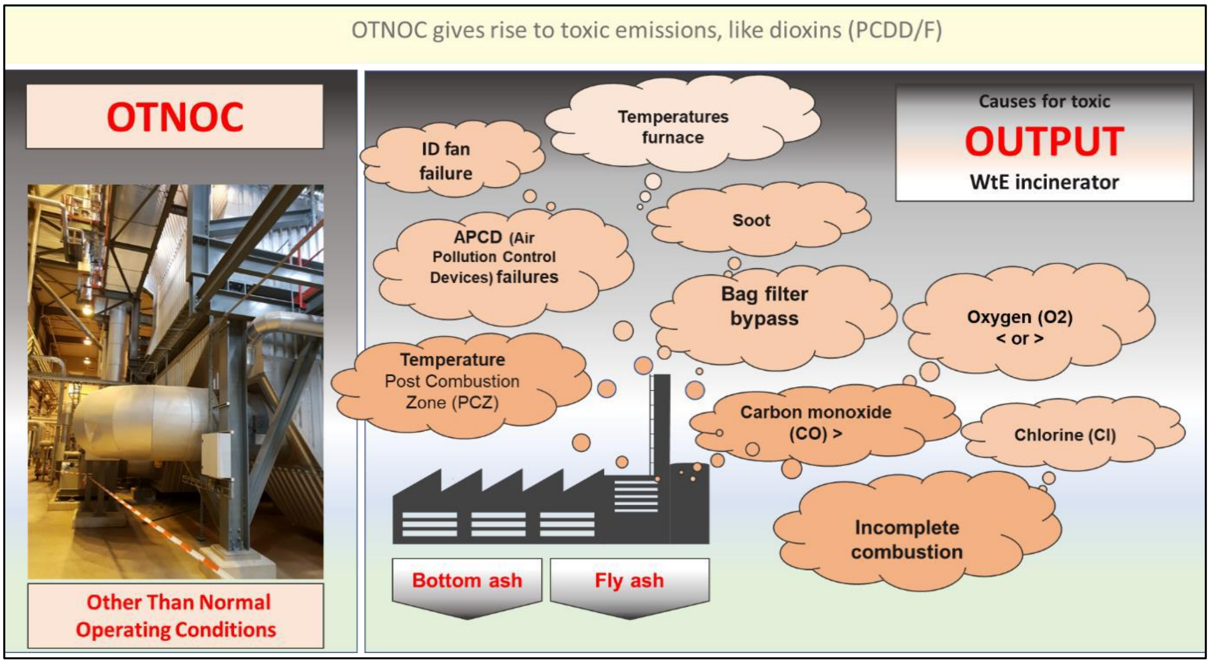


Figure 10: OTNOC situations with potentially high dioxin formation, emissions, picture: TW, at REC (NL) 19-10-2019

Semi-continuous measurements are sensitive to OTNOC but are also the times when sampling can be interrupted. The instrumentation of semi-continuous measurements, such as the AMESA, does have the ability to indicate in the log files, why the sampling was interrupted.

[9], *Olie K, Esbensen, KH (2018). Emission regimes of POPs of a Dutch incinerator: regulated, measured and hidden issues, Conference paper Dioxins 2018 Krakow.*

[10] *Li M, Wang C, Cen K, Ni M, Li X. (2018) Emission characteristics and vapour/particulate phase distributions of PCDD/F in a hazardous waste incinerator under transient conditions. R. Soc. open sci. 5: 171079.*

2 Interior IVRY-PARIS XIII Waste Incinerator

2.1. Technical overview of the interior of the waste incinerator

Figures 11 and 12 show the interior of IVRY-PARIS XIII for a better understanding of the waste incineration process. These figures reveal the schematically different stages of cleaning the flue gases.

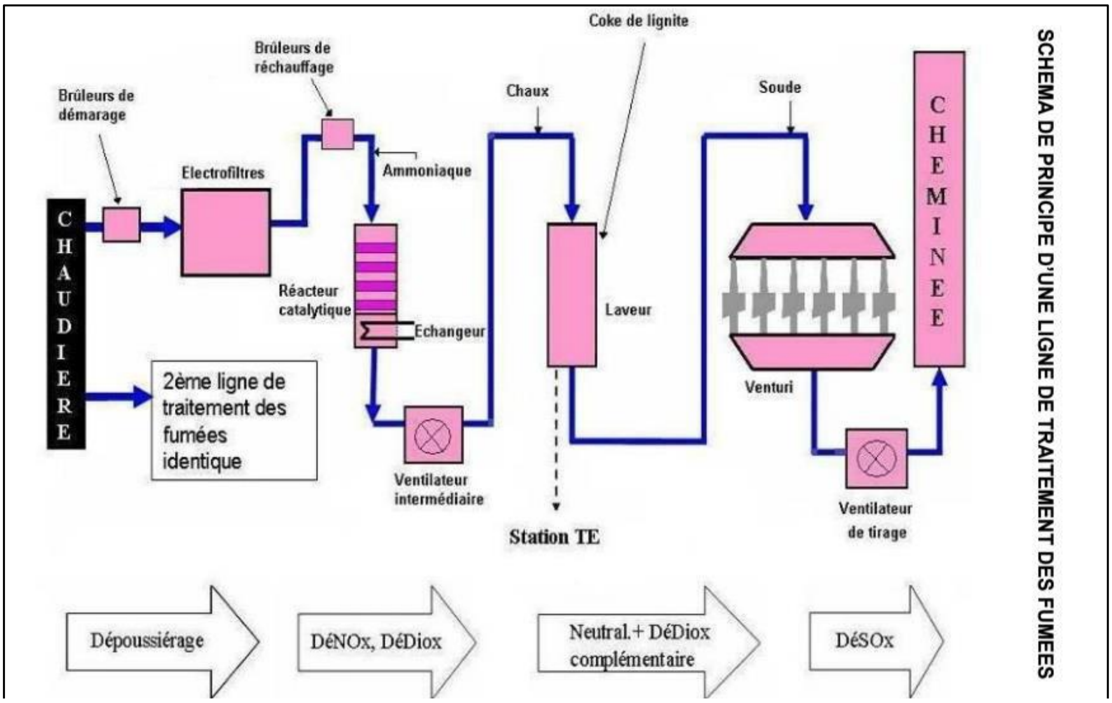


Figure 11: OTNOC situations with potentially high dioxin formation, emissions, picture: TW, at REC (NL) 19-10-2019

Therefore, devices are needed which are called Air Pollution Control Devices (APCD). *Figure 11* shows the electro filter for catching dust particles, the DENOX filter in the production process to eliminate nitrogen compounds, the fabric filter, and the various chemical steps like ammonia, and sodium bicarbonate.

In *Figure 12*, number 7 is the location where the semi-continuous (AMESA) measurement equipment vertical is installed.

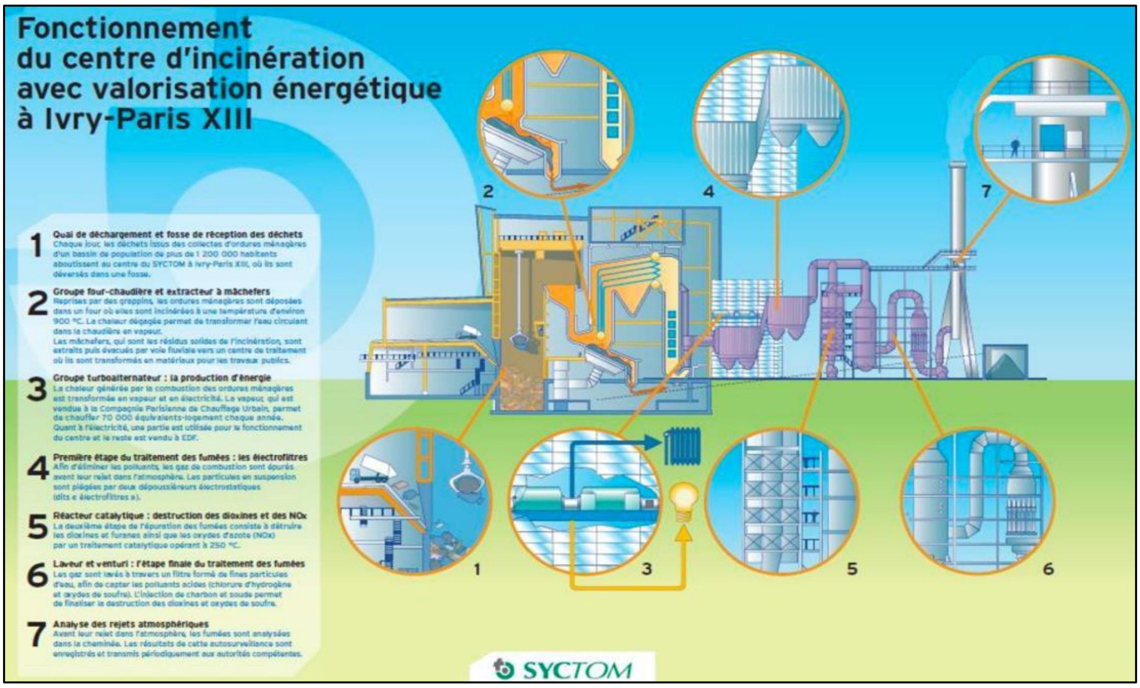
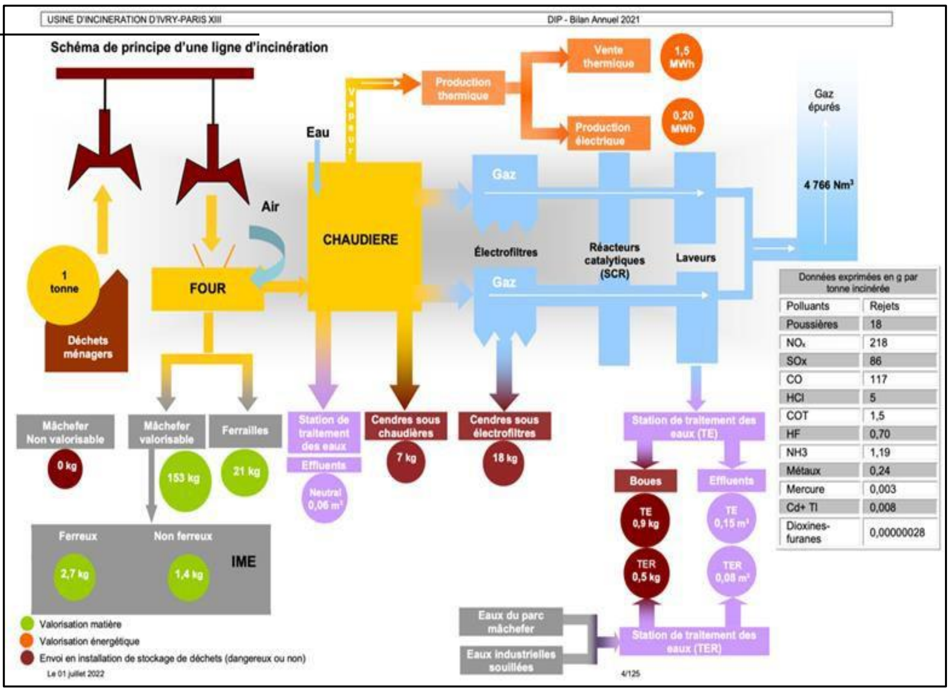


Figure 12: Schematic overview Ivry-Paris XIII, location AMESA equipment, DIP 2021

The input of 100,000 tons of waste results in the emission of one billion cubic metres of exhaust gas, consisting of high amounts of CO_2, also NOx, SOx, heavy metals, hydrochloride (HCl) and hydrofluoric acid (HF), and dioxins. In addition to air emissions, thousands of tons of incinerator residues (like bottom and fly ash) are produced, loaded with much more hazardous compounds such as heavy metals, dioxins (like PCDD/F/dl-PCB), PAH, and PFAS. *Figure 13* gives a technical overview of how the production process functioned at IVRY-PARIS XIII and shows the emissions emitted per ton of burned waste.[11]



Données exprimées en g par tonne incinérée	
Polluants	Rejets
Poussières	18
NO_x	218
SOx	86
CO	117
HCl	5
COT	1,5
HF	0,70
NH3	1,19
Métaux	0,24
Mercure	0,003
Cd+ Tl	0,008
Dioxines-furanes	0,00000028

Figure 13: Technical map waste incineration process Ivry-Paris XIII (DIP 2021)

[11] *Syctom, (2022), USINE D'INCINERATION D'ORDURES MENAGERES D'IVRY-PARIS XIII, DOSSIER D'INFORMATION DU PUBLIC BILAN ANNUEL 2021, Syctom, l'agence métropolitaine des déchets ménagers, 75 013 PARIS, Le 25 août 2022*

2.2. Semi-continuous measurements

Semi-continuous measurements of flue gasses have been required since 2019 for new build waste incinerators (permits issued after 2019), according to the EU regulations. These requirements of the Best Available Techniques (BAT) documents apply to all operating waste incineration plants.[12] The Other Than Normal Operating Conditions (OTNOC), such as start-up and shutdown, are not yet defined in the EU regulations.

The semi-continuous measurements are a step forward in monitoring emissions of hazardous substances from waste incineration, like dioxins (PCDD/F/dl-PCB). The EU regulation is based on short-term measurements of 6 -12 hours a year, which is only 0.1% of the total production time. Besides that, these measurements are pre-announced and taken under ideal production conditions. With semi-continuous measurements, the emissions of waste incineration can be followed and monitored in a much more realistic manner of waste incineration.

Dioxins (PCDD/Fs) are measured according to the European standard specification for sampling PCDDs/PCDFs: XPCEN/TS 1948-5. The gas stream is isokinetically sampled with a >6 mm titanium probe and collected in a replaceable cartridge filled with absorbent material of polyurethane foam, quartz wool and filled with an adsorbent resin called XAD-2.

AMESA is a commercial brand for semi-continuous technical sampling equipment. There are several other brands operating in Europe. The picture on the right in *Figure 14* shows the blue box with the sampling equipment on the horizontal part of the chimney at the waste incinerator REC in the Netherlands. The nozzle or probe of the system is $\geq$ 6 mm and can be blocked by dust particles. If that happens an automatic cleaning procedure will be started. This standard cleaning program takes exactly three (3) minutes. In the automatic data file of the AMESA, this can be read out with the command "VH<VHUGR". During this cleaning program, the sampling of dioxins is interrupted.

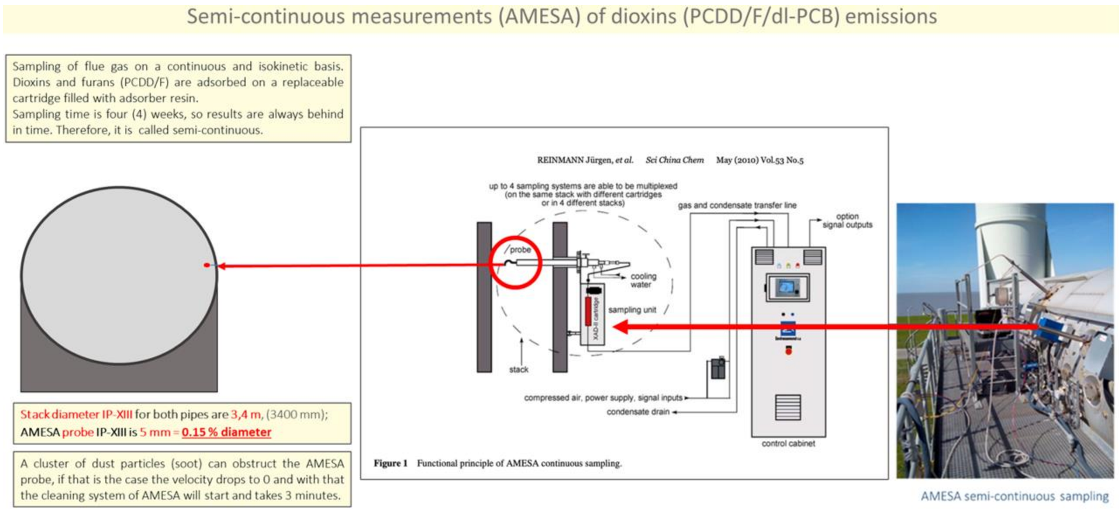


Figure 14: AMESA equipment and location position, Picture TW; AMESA equipment REC (NL)

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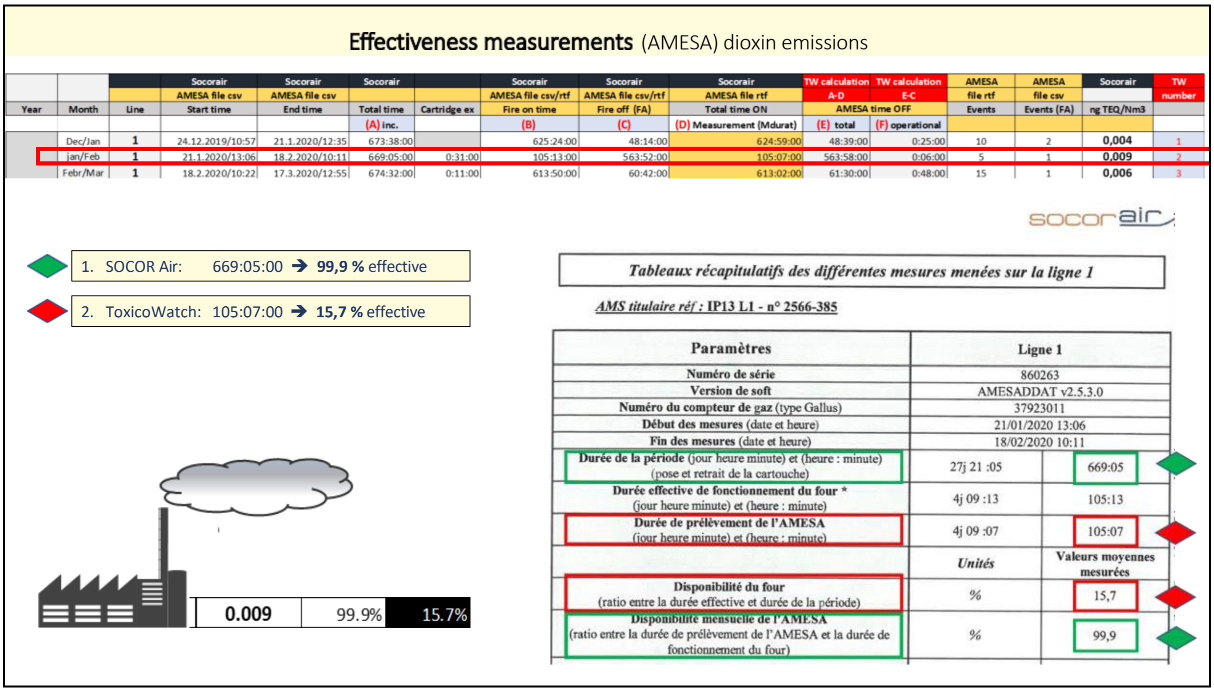
[12] *Neuwahl F., et al. (2019). Best Available Techniques (BAT) Reference Document for Waste Incineration; EUR 29971 EN; doi:10.2760/761437*

2.3. Diminished measurement efficiency

The analyses of the emissions are based on the 26 reports from SOCOR Air from 2019 to 2021[13] and data from the automatic recording system of the AMESA. An important issue in reporting SOCOR Air and ToxicoWatch (TW) is the interpretation of the efficiency of semi-continuous measurements.
To illustrate this, SOCOR Air Table in *Figure 15* below presents a measurement result in the SOCOR Air report from 21.1.2020/13:06 to 18.2.2020/10:11.



Year	Month	Socorair Line	Socorair AMESA file csv Start time	Socorair AMESA file csv End time	Socorair Total time (A) inc.	Cartridge ex	Socorair AMESA file csv/rtf Fire on time (B)	Socorair AMESA file csv/rtf Fire off (FA) (C)	Socorair AMESA file rtf Total time ON (D) Measurement (Mdurat)	TW calculation A-D AMESA time OFF (E) total	TW calculation E-C AMESA time OFF (F) operational	AMESA file rtf Events	AMESA file csv Events (FA)	Socorair ng TEQ/Nm3	TW number
	Dec/Jan	1	24.12.2019/10:57	21.1.2020/12:35	673:38:00		625:24:00	48:14:00	624:59:00	48:39:00	0:25:00	10	2	0,004	1
	jan/Feb	1	21.1.2020/13:06	18.2.2020/10:11	669:05:00	0:31:00	105:13:00	563:52:00	105:07:00	563:58:00	0:06:00	5	1	0,009	2
	Febr/Mar	1	18.2.2020/10:22	17.3.2020/12:55	674:32:00	0:11:00	613:50:00	60:42:00	613:02:00	61:30:00	0:48:00	15	1	0,006	3

Tableaux récapitulatifs des différentes mesures menées sur la ligne 1

AMS titulaire réf : IP13 L1 - n° 2566-385

Paramètres	**Ligne 1**	
Numéro de série	860263	
Version de soft	AMESADDAT v2.5.3.0	
Numéro du compteur de gaz (type Gallus)	37923011	
Début des mesures (date et heure)	21/01/2020 13:06	
Fin des mesures (date et heure)	18/02/2020 10:11	
Durée de la période (jour heure minute) et (heure : minute) (pose et retrait de la cartouche)	27j 21 :05	669:05
Durée effective de fonctionnement du four * (jour heure minute) et (heure : minute)	4j 09 :13	105:13
Durée de prélèvement de l'AMESA (jour heure minute) et (heure : minute)	4j 09 :07	105:07
	Unités	**Valeurs moyennes mesurées**
Disponibilité du four (ratio entre la durée effective et durée de la période)	%	15,7
Disponibilité mensuelle de l'AMESA (ratio entre la durée de prélèvement de l'AMESA et la durée de fonctionnement du four)	%	99,9

Figure 15: Effectiveness measurements (AMESA/SOCOR Air) dioxin emissions

SOCOR Air measures the performance of the AMESA by the time the fire is on. TW measure the efficiency of semi-continuous measurements by the total time the AMESA cartridge is placed in the chimney. A continuous measurement should be continuous (see *Figure 16*).

The SOCOR Air report states an efficiency of the AMESA of 99.9%, measured in the "fire on" command. However, considering the total 4-week period with a total of 669:05:00 hours, then AMESA was only active for 105:07:00 hours, with an efficiency of 15.7%.

The stated efficiency of 99.9% misrepresents the actual efficiency of only 15.7 %, which is a huge difference. When the AMESA is not functioning, it does not mean the activity (burning waste/ or waste on the grid) of the incinerator is stopped. Additional minute-by-minute records of the control room of the incinerator are needed to analyse the "fire-off" status and the cause of blocking the sampling process. However, experience, shows the industry is not very willing to share data on the incinerator process, prioritising economic production goals instead of health issues. From TW experience it is known that political pressure has an important role in approving communication of waste incinerating issues with the public.

In summary, additional minute data is needed from the control room of a waste incinerator, to have more information on the time frames why the AMESA stops functioning with sampling.

[13] *SOCORAIR, Rapports d'essais du suivi en semi-continu des PCDD/F, prélèvements effectués du 24-12-2019 au 21-12-2021, 26 rapports, support AMESA, SUEZ IP13, site d'Ivry sur Seine*

A continuous measurement should be continuous, however, most of the time interruptions/events take place, as seen in many commands given in the provided data. See the timeline of four weeks (672 hours) in the example in *Figure 16*. The efficiency should be measured by the time the cartridge is placed in the chimney. Then one arrives at a very different efficiency of 80% if 5591 hours of no measurements were taken in the chimney.

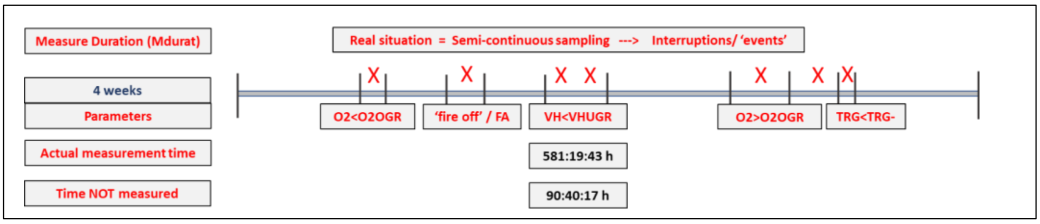


Figure 16: Interruptions/events in a sampling period of 4 weeks that should be continuous in ideal situations.

If one calculates the efficiency of semi-continuous measurements based on the command "fire on", rather than total time, the outcomes shown for example in Figure 17 can be above 100%.

TW compared the efficiency of IVRY-PARIS XIII with REC (NL) on the efficiency correlation of actual time. The efficiency of both IVRY-PARIS XIII lines 1 and 2 is much less than the REC incinerator in NL. This indicates that there is a lot of room for improvement, especially since the semi-continuous measurements do not correspond to the actual emissions, as will be explained in the following chapters. In brief: **The semi-continuous sampling in IVRY-PARIS XIII did not function for nearly 7000 hours in 2020-2021**.

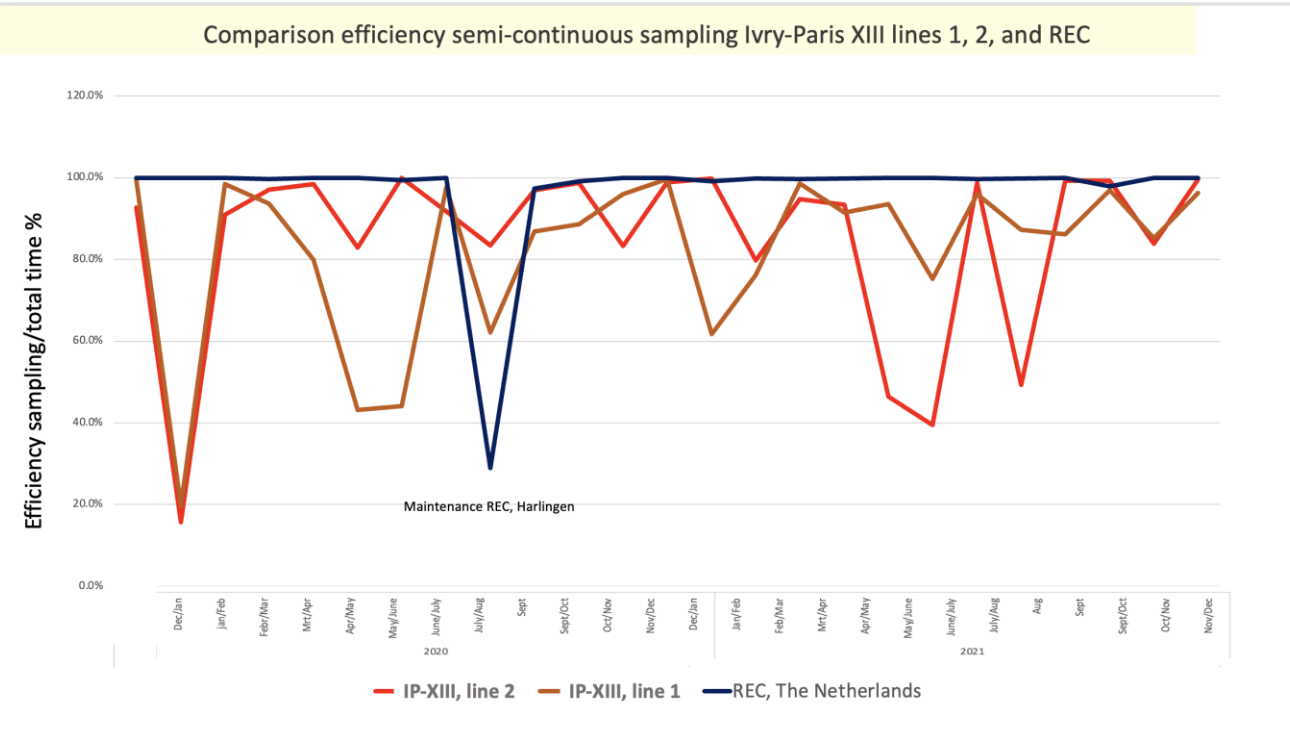


Figure 17: Efficiency semi-continuous sampling Ivry-Paris XIII, line 1,2 vs REC(NL)

It is noteworthy that a five (5)-hour interruption in the Netherlands of the AMESA system resulted in two (2) years of intensive research by the government and TW. In contrast, AMESA interruptions of over 5000 hours in IP XIII are **hardly explained** in the provided reports and data documents provided for this research.

In **Table 1** the log data are summarized of the semi-continuous measurements of the AMESA system (Environment) and dioxin analyses are compiled by SOCOR Air. Calculations and methods made by TW are marked in red with acronyms placed in brackets. The data in Table 1 concerns the semi-continuous measurements from 24-12-2019, starting with line 2 at 10:04 and line 1 at 10:57. These measurements end on 21-12-2021 at 10:51 resp. 11:26. **The total production time of the incinerator IVRY-PARIS XIII is 35 432 hours in 2020-2021. The semi-continuous measurements lasted 28 001 hours**.

IVRY Paris XIII - resumé semi-continuous measurements line 1 and 2 (2019-2021)					
			line 1	line 2	Summary
SOCORAIR/AMESA	Start time		24.12.2019/10:57	24.12.2019/10:04	24.12.2019/10:57
	End time		21.12.2021/11:26	21.12.2021/10:51	21.12.2021/11:26
	Incineration (I)		17460:00:44	17477:34:00	34937:34:44
	Fire on time		14730:57:00	14562:41:00	29293:38:00
	"Fire off" time (FA)		2310:08:44	2895:29:00	5205:37:44
	AMESA (A)	Mdurat	14190:51:00	13810:46:00	28001:37:00
	Offline total (OT)	I - A	**3269:09:44**	**3666:48:00**	6935:57:44
	Operational offline	OT - FA time	**959:01:00**	**1277:24:00**	2236:25:00
	Events		2120	5424	7544
	"Events" "Fire off" (FA)		37	283	320
TW calculations	Fire on time		84.37%	83.32%	83.85%
	"Fire off" time (FA)		13.23%	16.57%	14.90%
	M efficientie total	Mdurat	**81.28%**	**79.02%**	**80.15%**
	M efficientie operationeel		96.33%	94.84%	95.59%
	Offline total (OT)	I-A	**18.72%**	**20.98%**	**19.85%**
	Operational offline	OT-FA time	**5.49%**	**7.31%**	**6.40%**
	Events total		28.10%	71.90%	
	"Events" "Fire off" (FA)		11.56%	88.44%	
	Events/week		41	110	151
SOCORAIR	Dioxins (ng TEQ/Nm3)	MIN	**0.004**	**0.008**	
		MAX	**0.134**	**0.094**	
		AVERAGE	0.044	0.039	
		> 0.01 ng	24 (26)	25 (26)	**94%**
		> 0.05 ng	9 (26)	7 (26)	**31%**

Table 1: IVRY-PARIS XIII resumé semi-continuous measurements line 1 and 2 (2019-2021)

By considering the total sampling time, including the command: "fire-off" time, the efficiency of the semi-continuous measurements is calculated by TW at 82.61 % for line 1 and 75.18 % for line 2. These outcomes are below the limit of monitoring of 85%, as stated in the guidance of GA X 43-139 [14] and mentioned in a report of ADEME.[15] These outcomes are a contrast with the outcome of ADEME and the provided data by SOCAR Air, most of the time referring to figures above 95% and sometimes even above 100% (6/7/2021, line 1).[16.]

In this report, the premise is considered measurements should be taken including OTNOC, start-up, shutdown and even under maintenance time. The official calculations exclude 5,176 hours of "no fire". **When the maintenance hours (670 + 672 hours) are subtracted, 3,834 hours are suspicious for situations of incomplete combustion, or OTNOC. Without the additional data from the control room, no judgement can be made about the potential emissions and certainly not set to zero** as is being done now. Precisely these periods should be investigated and transparently explained to the public. Continuous must really be continuous, under every condition. **Another important difference with ADEME is that 20% of measurements in IVRY-PARIS XIII were above 0.06 ng TEQ/Nm3**, while the average in France appears to be only 6%. And even 31% are above the 0.05 ng TEQ/Nm3 (*Table 1*).

[14] Guidance GA X 43-139, Rapport 20EP092 rév.02, DOC-PROD-200 REV 08(08-19), PAGE 15/53
[15] ADEME (Emmanuel FIANI, Sandra LE BASTARD), RDC Environnement (Xavier LOGEL, Bernard DE CAEVEL), 2017. Equipements de mesure de dioxines en semi continu : bilan des opérations subventionnées par l'ADEME. Rapport. 32 pages.
[16] Rapport d'essais du suivi en semi-continu des PCDD/F-21EP094-Revision00, Prélèvements effectués du 16 fevrier au 15 mars 2021, support AMESA, SUEZ IP13, Site d'Ivry sur Seine (94)

The data and results of the semi-continuous measurements are shown in *Tables 2 and 3* as well in Annex 4. Data semi-continuous measurements IVRY-PARIS XIII are provided by SOCOR Air and AMESA (Environment). Calculations by TW are given in red with characters placed between brackets. These are the calculations of the cartridge change and actual active AMESA time, where any interruption is included. The last two columns give the efficiency time as represented by SOCOR Air and as calculated by TW. An indicative colour shows the degree of the measured level of dioxins in the flue gas: light red for levels between 0.01 and 0.05 ng TEQ/Nm^3 and brown for levels above the 0.05 ng TEQ/ Nm^3. The measurements where multiple cartridges were used are shown in grey. Notable results are also indicated with an indicative colour. For example, a duration time of a cartridge change takes 7 hours at a time when dioxin emissions were high. Drawing attention to these findings is needed for the fact that in 7 hours a lot of dioxins can be emitted and therefore the cartridges must be used continuously to monitor the exact dioxin emissions.

Line 1 - Semi-continuous measurements (AMESA) dioxin emissions, IP XIII 2020 -2021

			Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation	TW calculation	AMESA	AMESA	Socorair	TW
			AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	E-C	file rtf	file csv		number
Year	Month	Line	Start time	End time	Total time	Cartridge ex	Fire on time	Fire off (FA)	Total time ON	AMESA time OFF		Events	Events (FA)	ng TEQ/Nm3	
					(A) inc.		(B)	(C)	(D) Measurement (Mdurat)	(E) total	(F) operational				
2020	Dec/Jan	1	24.12.2019/10:57	21.1.2020/12:35	673:38:00		625:24:00	48:14:00	624:59:00	48:39:00	0:25:00	10	2	0,004	1
	jan/Feb	1	21.1.2020/13:06	18.2.2020/10:11	669:05:00	0:31:00	105:13:00	563:52:00	105:07:00	563:58:00	0:06:00	5	1	0,009	2
	Febr/Mar	1	18.2.2020/10:22	17.3.2020/12:55	674:32:00	0:11:00	613:50:00	60:42:00	613:02:00	61:30:00	0:48:00	15	1	0,006	3
	Mrt/Apr	1	17.3.2020/13:13	14.4.2020/11:56	670:43:00	0:18:00	670:43:00	0:00:00	650:55:00	19:48:00	19:48:00	153	0	0,013	4
	Apr/May	1	14.4.2020/12:21	12.5.2020/10:58	669:12:25	0:25:00	669:11:00	0:01:25	658:55:00	10:17:25	10:16:00	77	2	0,023	5
	May/June	1	12.5.2020/11:15	9.6.2020/10:13	670:57:00	0:17:00	558:43:00	112:14:00	555:58:00	114:59:00	2:45:00	40	3	0,022	6
	June/July	1	09-06-20/10:34	07-07-20/10:51	672:17:00	0:19:00	672:12:00	0:05:00	672:07:00	0:10:00	0:05:00	5	1	0,017	7
	July/Aug	1	7.7.2020/11:21	4.8.2020/11:18	671:57:00	0:30:00	625:41:00	46:16:00	616:58:00	54:59:00	8:43:00	80	2	0,018	8
	Aug	1	4.8.2020/11:47	1.9.2020/11:47	672:05:19	0:29:00	0:00:00	672:05:19	0:00:00	672:05:19	0:00:00	2	1		
	Sept	1	1.9.2020/12:13	29.9.2020/10:53	670:40:00	0:30:00	582:28:00	88:12:00	559:50:00	110:50:00	22:38:00	53	4	0,045	10
	Sept/Oct	1	29.9.2020/11:23	28.10.2020/11:06	695:43:00	0:30:00	695:40:00	0:03:00	674:34:00	21:09:00	21:06:00	646	3	0,052	11
	Oct/Nov	1	28.10.2020/11:28	23.11.2020/14:24	626:55:00	0:23:00	626:52:00	0:03:00	618:44:00	8:11:00	8:08:00	189	2	0,039	12
	Nov/Dec	1	23.11.2020/14:50	22.12.2020/11:15	683:56:00	00:26	683:55:00	0:01:00	569:40:00	114:16:00	114:15:00	17	1	0,200	13
	Dec/Jan	1	22.12.2020/11:56	19.1.2021/11:11	671:15:00	0:41:00	671:15:00	0:00:00	663:46:00	7:29:00	7:29:00	19	0	0,040	14
2021	Jan/Feb	1	19.1.2021/11:36	16.2.2021/09:51	670:14:00	0:25:00	670:13:00	0:01:00	669:15:00	0:59:00	0:58:00	22	1	0,035	15
	Feb/Mar	1	16.2.2021/10:17	15.3.2021/14:58	652:40:00	0:26:00	520:12:00	132:28:00	520:05:00	132:35:00	0:07:00	5	1	0,091	16
	Mrt/Apr	1	15.3.2021/15:24	13.4.2021/11:17	691:53:00	0:26:00	691:53:00	0:00:00	655:13:00	36:40:00	36:40:00	335	0	0,098	17
	Apr/May	1	13.4.2021/11:43	10.5.2021/14:54	692:08:00	0:26:00	692:08:00	0:00:00	646:35:00	45:33:00	45:33:00	26	0	0,054	18
	May/June	1	10.5.2021/15:17	7.6.2021/11:22	668:05:00	0:23:00	309:55:00	358:10:00	309:52:00	358:13:00	0:03:00	6	2	0,086	19
	June/July	1	7.6.2021/11:44	6.7.2021/07:52	692:08:00	0:22:00	273:13:00	0:00:00	273:13:00	418:55:00	418:55:00	5	0	0,096	20
	July/Aug	1	6.7.2021/14:56	2.8.2021/12:22	645:26:00	7:04:00	645:26:00	0:00:00	637:20:00	8:06:00	8:06:00	55	0	0,076	21
	Aug	1	2.8.2021/12:46	30.8.2021/11:07	670:09:00	0:22:00	518:31:00	151:38:00	330:34:00	339:35:00	187:57:00	120	3	0,134	22
	Sept	1	30.8.2021/11:38	27.9.2021/11:44	672:06:00	0:31:00	672:03:00	0:03:00	666:54:00	5:12:00	5:09:00	91	1	0,049	23
	Sept/Oct	1	27.9.2021/12:07	25.10.2021/15:58	675:51:00	0:23:00	675:51:00	0:00:00	671:01:00	4:50:00	4:50:00	38	0	0,044	24
	Oct/Nov	1	25.10.2021/16:21	23.11.2021/10:50	664:21:00	0:23:00	588:26:00	75:55:00	557:12:00	107:09:00	31:14:00	34	4	0,052	25
	Nov/Dec	1	23.11.2021/11:21	21.12.2021/11:26	672:04:00	0:31:00	671:59:00	0:05:00	669:02:00	3:02:00	2:57:00	72	2	0,027	26
					17460:00:44	17:12:00	14730:57:00	2310:08:44	14190:51:00	3269:09:44	959:01:00	2120	37	1,33	

Table 2: Semi-continuous measurement 2020-2021 IVRY-PARIS XIII, Line 1

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Line 2 - Semi-continuous measurements (AMESA) dioxin emissions, IP XIII 2020-2021

			Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation	TW calculation	AMESA	AMESA	Socorair	TW
			AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	E-C	file rtf	file csv		number
Year	Month	Line	Start time	End time	Total time	Cartridge ex	Fire on time	Fire off (FA)	Total time ON	AMESA time OFF		Events	Events (FA)	ng TEQ/Nm3	
					(A) inc.		(B)	(C)	(D) Measurement (Mdurat)	(E) total	(F) operational				
2020	Dec/Jan	2	24.12.2019/10:04	21.1.2020/11:39	673:35:00		673:35:00	0:00:00	670:10:00	3:25:00	3:25:00	61	0	0,052	1
	Dec/Jan	2	21.01.2020/12.22	18.2.2020/10:36	670:13:00	0:43:00	131:30:00	538:43:00	131:24:00	538:49:00	0:06:00	61	0	0,048	2
	Febr/Mar	2	18.2.2020/10:51	17.3.2020/12:26	673:34:00	0:15:00	673:34:00	0:00:00	663:16:00	10:18:00	10:18:00	309	0	0,035	3
	Mrt/Apr	2	17.3.2020/12:45	14.4.2020/11:22	670:37:00	0:19:00	670:37:00	0:00:00	628:33:00	42:04:00	42:04:00	343	0	0,059	4
	Apr/May	2	14.4.2020/11:48	12.5.2020/10:18	670:30:00	0:26:00	542:26:00	128:04:00	535:50:00	134:40:00	6:36:00	81	4	0,079	5
	May/June	2	12.5.2020/10:42	9.6.2020/10:46	670:30:00	0:24:00	289:56:00	382:07:00	289:33:00	380:57:00		20	1	0,040	6
	May/June	2	9.06.2020/11:06	7.7.2020/10:13	671:07:00	0:22:00	670:33:00	0:34:00	295:58:00	375:09:00	374:35:00	8	1	0,020	7
	July/Aug	2	7.7.2020/10:39	4.8.2020/10:47	672:07:00	0:26:00	672:07:00	0:00:00	656:15:00	15:52:00	15:52:00	208	0	0,036	8
	Aug/sept	2	4.8.2020/11:10	1.9.2020/12:23	673:12:00	0:23:00	420:49:00	252:23:00	418:35:00	254:37:00	2:14:00	34	2	0,021	9
	Sept	2	1.9.2020/12:47	29.9.2020/10:07	669:19:00	0:24:00	622:35:00	46:44:00	580:52:00	88:27:00	41:43:00	21	3	0,025	10
	Sept/Oct	2	29.9.2020/10:43	28.10.2020/11:44	697:01:00	0:36:00	695:58:00	1:03:00	617:53:00	79:08:00	78:05:00	65	1	0,008	11
	Oct/Nov	2	28.10.2020/12:09	23.11.2020/15:11	627:01:00	0:25:00	626:46:00	0:15:00	601:31:00	25:30:00	25:15:00	112	1	0,017	12
	Nov/Dec	2	23.11.2020/15:37	22.12.2020/12:05	692:28:00	0:26:00	692:28:00	0:00:00	690:41:00	1:47:00	1:47:00	46	0	0,019	13
	Dec/Jan	2	22.12.2020/12:23	19.1.2021/10:39	670:16:00	0:18:00	418:58:00	251:18:00	413:30:00	256:46:00	5:28:00	269	2	0,021	14
2021	Jan/Feb	2	19.1.2021/11:01	16.2.2021/09:08	670:07:00	0:22:00	587:43:00	82:24:00	510:47:00	159:20:00	76:56:00	55	2	0,027	15
	Febr/Mar	2	16.2.2021/09:39	15.3.2021/14:21	652:42:00	0:31:00	652:42:00	0:00:00	643:31:00	9:11:00	9:11:00	234	0	0,029	16
	Mar/Apr	2	15.3.2021/14:47	13.4.2021/10:45	691:58:00	0:26:00	691:58:00	0:00:00	632:57:00	59:01:00	59:01:00	1802	1	0,055	17
	Apr/May	2	13.4.2021/11:07	10.5.2021/14:02	670:30:00	0:22:00	643:26:00	7:28:00	627:23:00	43:07:00	35:39:00	325	1	0,066	18
	May/June	2	10.5.2021/14:44	7.6.2021/11:53	669:09:00	0:42:00	514:36:00	154:33:00	503:07:00	166:02:00	11:29:00	244	2	0,094	19
	June/July	2	7.6.2021/12:10	6.7.2021/08:51	692:25:00	0:17:00	691:34:00	0:51:00	664:39:00	27:46:00	13:50:00	48	14	0,074	20
	July/Aug	2	6.7.2021/09:18	2.8.2021/12:58	651:40:00	0:27:00	625:39:00	26:01:00	568:12:00	83:28:00	57:27:00	115	1	0,045	21
	Aug	2	2.8.2021/13:20	30.8.2021/11:48	670:28:00	0:22:00	284:19:00	386:09:00	0:00:00	670:28:00	284:19:00	11	1		
	Aug/Sept	2	30.8.2021/12:11	27.9.2021/12:19	672:07:00	00:23:00	671:05:00	1:02:00	579:22:00	92:45:00	91:43:00	317	1	0,037	23
	Oct	2	27.9.2021/12:38	25.10.2021/15:21	674:43:00	0:19:00	134:18:00	538:51:00	653:48:00	19:21:00	0:04:00	251	244	0,031	24
	Oct/Nov	2	25.10.2021/15:47	23.11.2021/11:34	689:45:00	0:26:00	592:46:00	96:59:00	587:33:00	102:12:00	5:13:00	103	1	0,027	25
	Nov/Dec	2	23.11.2021/12:08	21.12.2021/10:51	670:30:00	0:34:00	670:43:00	0:00:00	645:26:00	25:04:00	25:04:00	281	0	0,028	26
					17477:34:00	10:15:00	14562:41:00	2895:29:00	13810:46:00	3665:14:00	1277:24:00	5424	283	0,993	

Table 3: Semi-continuous measurement 2020-2021 Ivry-Paris XIII, Line 2

2.5. Types of incidents in AMESA records

The semi-continuous method is a huge improvement compared to the mandated measurements of 6-12 hours per year. It is called semi-continuous because analytical results will not be immediately available. The sampling in the cartridge is four (4) weeks and analyses with chemical analyses GC-MS by the laboratory will take another two (2) weeks. This means that it will only be known after six (6) weeks, whether the furnace has performed well or not, no immediate feedback in processing is possible, *Figure 20*.

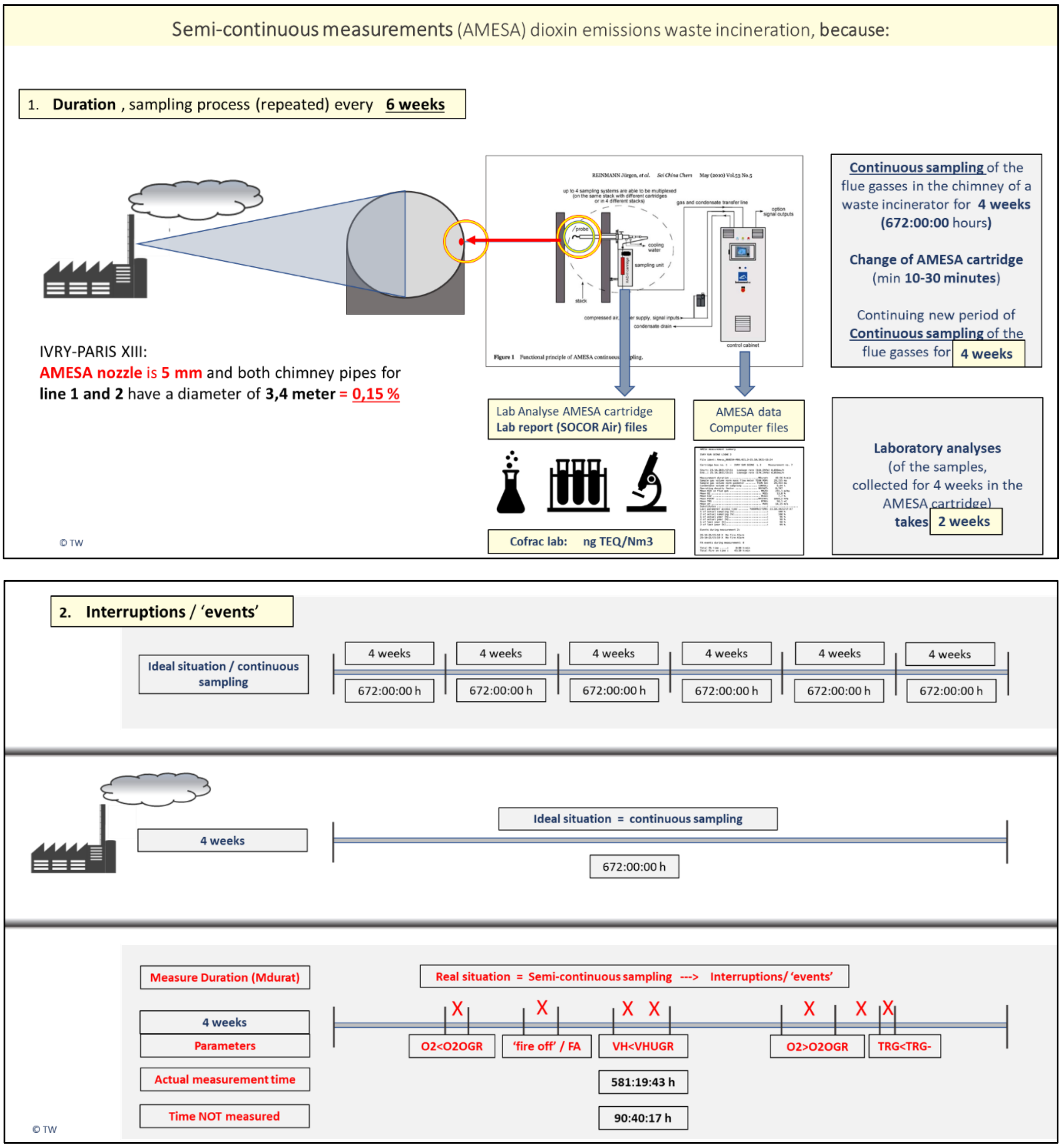

Figure 20: Why Semi-Continuous measurements: 1. duration, 2. interruptions/events

A second important argument for referring to these measurements as semi-continuous is that the sampling is not consistently continuous, as demonstrated at IP XIII. At the REC (NL), some measurement series were truly continuous, but the measurement series at IP XIII is characterised by many interruptions in sampling monitoring, known as “events”. Those interruptions must be seen to the (failures of) technical functioning of the incineration process of the waste incinerator. <u>Sampling</u> must proceed all the time, continuously, even if no waste is incinerated. Dioxins can be emitted at any time, also with no waste and no fire. Start-ups and shutdowns are vulnerable to high dioxin emissions [17, 18, 19] and to conditions when combustion is impaired, the so-called Other Than Normal Operation Conditions (OTNOC).

The interruption of the sampling of flue gases by the command “Fire-off” does not mean combustion has stopped. The command “fire-off” can be given for various reasons (see *Table 4*). If temperatures in the post-combustion zone (PZC) fall below 850°C or the velocity of flue gases drops, sampling will stop. In Annex 5 more conditions are mentioned dioxin measurements will be interrupted. Sampling can even be stopped manually. The limitation of the current continuous sampling tools is that they do not work under all conditions. When AMESA (for a short time/3 minutes) is out of operation, automatically cleaning the AMESA probe and sampling during this timeframe will be stopped as shown in a TW study of the REC, NL, see *Figure 42* on page 41.

OTNOC situations are vulnerable to elevated dioxin emissions. *Tables 4 and 5* show commands, that lead to interruptions of sampling. See for detailed information commands Annex 8.

Sample interruptions		
Manual command	Control room/technician	
No fire command (FA)	Low temperatures	See page 32
Oxygen levels (O2)	unfavourable combustion	
Low Temperature flue gases	Low temperatures combustion	
Velocity flue gases (VH<VHUGR)	ID fan disturbance	See page 36
Power off	Shutdown/electricity failure	
Carbon dioxide levels (CO2)	unfavourable combustion	

Table 4: Sample interruptions

1.	***Manual command**:* f.e. maintenance
2.	***FA***=*No fire*, f.e. power-off auxillairy burners
3.	***O2 > O2OGR or < O2UGR**: if oxygen is below a minimum value*
4.	***TRG < TRGMIN**:* if the temperature of the flue gases falls below a certain value
5.	***VH < VHUGR***; if the velocity comes below a lmit value
6.	***Alarm Power on (Power off:),*** emergency
7.	***CO2 > CO2OGR or < CO2UGR** If the CO2 comes under a certain value*

Table 5: Codes for termination of sampling, SOCOR Air AMESA data IP XIII

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[17] *Arkenbout, A., Esbensen, K.H. (2017). Sampling, monitoring and source tracking of Dioxins in the environment of an incinerator in the Netherlands, Proc. Eighth World Conference On Sampling And Blending, 117 – 124*

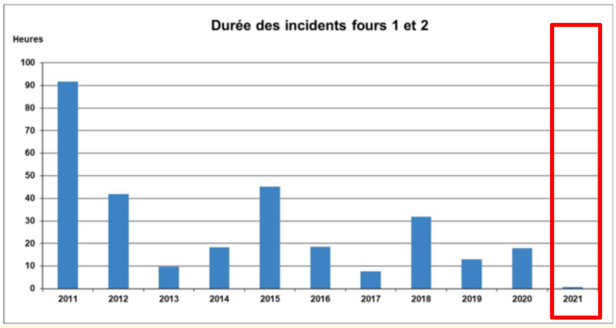
[18] *Hunsinger, H., Seifert, H., Jay, K., 2003. Formation of PCDD/F during start-up of MSWI*

[19] *Li, M. et al. (2018). Emission characteristics and vapour/particulate phase distributions of PCDD/F in a hazardous waste incinerator under transient conditions. R. Soc. open sci. 5: 171079.*

2.6. Minimal explanation in public yearly reports of failures

The graph below, *Figure 21*, in the *Dossier d'information du public* (DIP), page 74, SUEZ shows a graph with a clear decrease in the total duration of incidents, but the number of incidents is still very high. The public information report (DIP) provides a short explanation of only 39 minutes and gives no explanation for the remaining 2994 hours of incidents as registered in the AMESA sampling device.

Figure 21 DIP explanation of only **52 minutes** (0:12:30 + 0:39:30) of failures



FOUR 2	Date début	Heure début	Date fin	Heure fin	Durée d'ouverture des exutoires	Durée arrêt d'urgence	Fiche Incident (FIE)	Cause incident
avril-21	01/04/21	10:24:00	01/04/21	10:44:00	00:12:30	00:20:00	oui	Arrêt du traitement des fumées à la suite d'une variation de pression induite par le nettoyage des catalyseurs.
mai-21	25/05/21	01:19:40	25/05/21	01:39:10	00:00:00	00:19:30	oui	Arrêt du traitement des fumées à la suite d'une coupure électrique du tableau de commande de ce dernier.
					0:12:30	0:39:30		

AMESA logfiles gives **266 hours of failures** (59:01:00 + 166:02:00) and **2046 events of failures**

	Socorair	Socorair	calculation	Socorair	Socorair	Socorair	calculation	calculation	Amesa	Amesa	Socorair
	amesa file csv	amesa file csv	I-J	amesa file csv	amesa file csv	amesa file rtf	H-K	L-J	file rtf	file csv	
Month	Start time	End time	Total time	fire on time	fire off	Total time	AMESA offline		Events	Events (FA)	ng TEQ/Nm3
Mar/Apr	15.3.2021/14:47	13.4.2021/10:45	691:58:00	691:58:00	0:00:00	632:57:00	59:01:00	59:01:00	1802	1	0.055
Apr/May	13.4.2021/11:07	10.5.2021/14:02	670:30:00	643:26:00	7:28:00	627:23:00	43:07:00	35:39:00	325	1	0.066
May/June	10.5.2021/14:44	7.6.2021/11:53	669:09:00	514:36:00	154:33:00	503:07:00	166:02:00	11:29:00	244	2	0.094

Figure 21: DIP 2021 explanation for failures Ivry-Paris XIII, line 2, April and May 2021 (page 73-74)

Every event mentioned in the automatic log files of AMESA is associated with an interruption of sampling. In 2020-2021 there were 786 "events" counted with a command "x" for stopping the sampling. In minor cases, it is correlated to a technical problem of the sampling apparatus, such as blocking the probe with dust particles. *Figure 22* presents the total table, in total 7545 events took place and 3 2 0 times the command "fire off" was given.

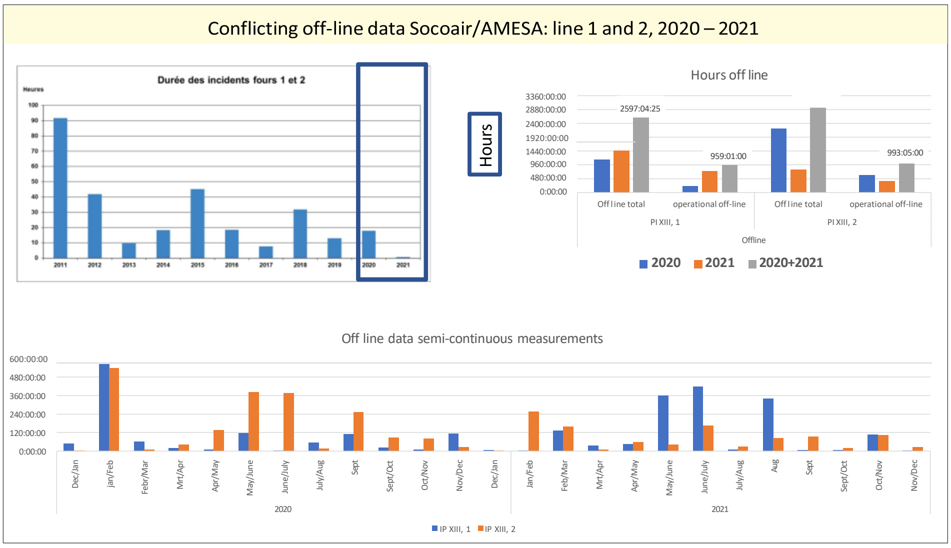


Figure 22: Conflicting off-line data SOCOR Air/AMESA, Line 1,2, 2020-2021

2.7. Comparison continuous measurements IP XIII and REC (NL)

The *Dossier d'information du public* shows the dioxin results complying with the EU limit of 0.1 ng TEQ/Nm³. This emission limit has remained unchanged for 33 years, see Figure 6 on page 11. In the same time frame, the European Food and Safety Authority (EFSA) has set the toxicity of dioxins 35 times higher than first considered in 1997.

In 2023, only small steps have been taken to reduce emissions of dioxins by incinerators. In the Netherlands (NL), the last built waste incinerator (WtE REC, 2011) must comply with a limit of 0.01 ng TEQ/ Nm³ for dioxin (PCDD/F/dl-PCB) emissions. Based on this stricter limit of 0.01 ng TEQ/ Nm³, IVRY-PARIS XIII fulfils only 6% of the two (2) years of semi-continuous monitoring if this new limit would be the standard in the EU. This means that IVRY-PARIS XIII emits dioxins 94 % above this applicated Dutch level to be considered as safer for the environment and human health. Every exceeding measurement by the REC (NL) of this limit of 0.01 ng TEQ/ Nm³ has met an extended public exposure. In special technical commissions, these exceeding emissions are thoroughly discussed and analysed. Remarkably, waste incinerator IVRY-PARIS XIII in a world capital like Paris can have such an 'old' permit for allowing high emissions of dioxins. If the waste incinerator IVRY-PARIS XIII should have to comply with the Dutch limit of 0.01 ng TEQ/ Nm³, IVRY-PARIS XIII had to be closed a long time ago.

In *Figure 23* a comparison is made between the emissions results of IVRY-PARIS XIII and REC/NL. The colour brown in the dioxin results shows levels **above 0.05 ng TEQ/ Nm³** and orange **between 0.01 – 0.05 ng TEQ/ Nm³**.

The DIP 2021 (Suez) notes on page 44 that the concentration of dioxins measured by AMESA during the campaign from 2 to 30 August on line 1 exceeded the regulatory limit value of 0.1 ng iTEQ NATO/Nm3 set by the decree of 20 September 2002, and comments as follows: "During this campaign, the AMESA

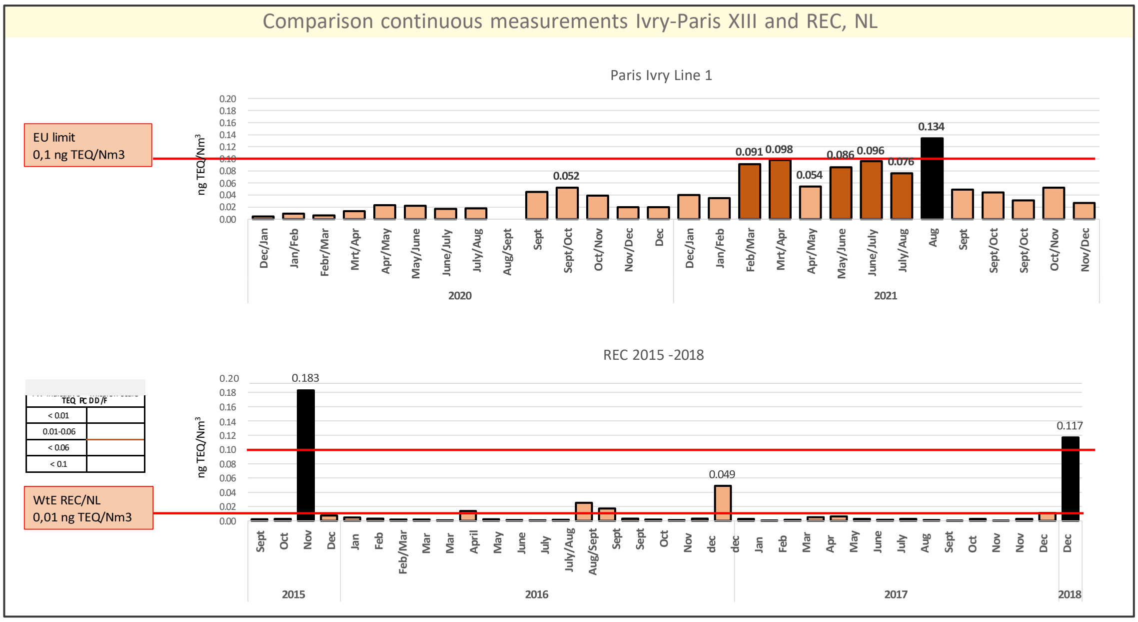


Figure 23: Comparison of continuous measurements IVRY-PARIS XIII with REC (NL)

cartridge was sampled for 2 weeks instead of the 4 weeks required by the regulations. The cartridge sampling was interrupted because the line was shut down for scheduled maintenance. Given this exceedance and following article 28 b-1 of the decree of 20 September 2002, a one-off measurement of dioxins and furans was carried out on October 7 and a second measurement on December 15. These measurements were carried out on a six-hour sample by the Bureau Véritas laboratory, an organisation accredited by the French Accreditation Committee (COFRAC: Accreditation no. 1-6256). The results shown [editor's note: 0.006 on 07/10/2021 and 0.02 on 15/12/2021] in the table below are below the limit value".

3. Technical Data

3.1 Interruption events

The graphs below, *Figures 24 and 25*, shows the totals of events between IVRY-PARIS XIII. As a comparison, the total events in the incinerator REC in the Netherlands are given. It is therefore even more remarkable, that this study by ToxicoWatch is obviously the first to analyse and compare with the performance of other waste incinerators in Europe. Several articles are included in the literature review, but none of the studies makes statements about the efficiency of semi-continuous measurements.

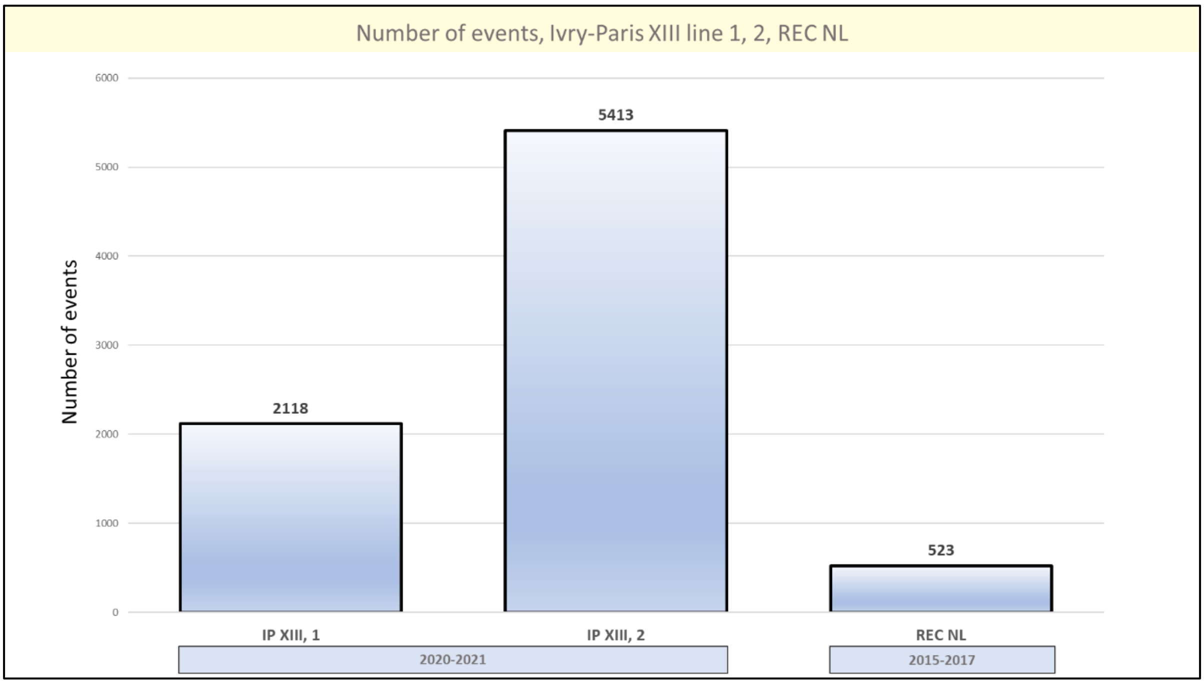


Figure 24: Comparison events IVRY-PARIS XIII line 1, 2 (2020-2021) and REC, NL (2015- 2017)

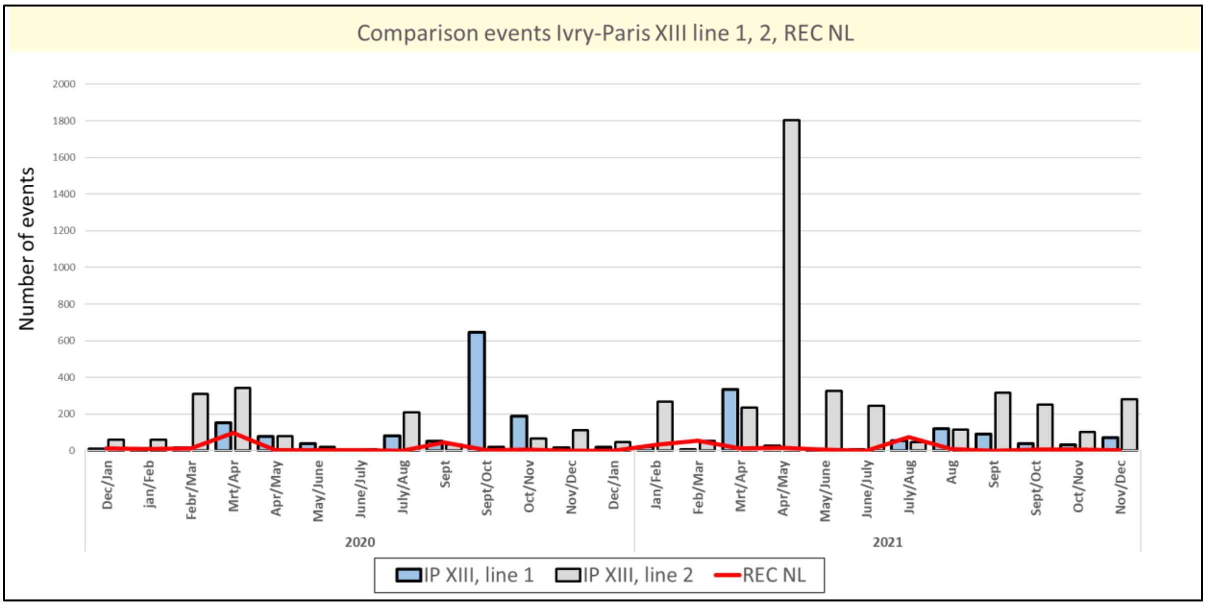


Figure 25: Number of events IVRY-PARIS XIII, line 1, 2 (2019-2021) and REC, NL (2015-2017)

3.2 Offline time data for measurement equipment

Figure 26 shows the off-line hours of the semi-continuous sampling, and no measurements of dioxins could have taken place. See Chapter 2 for the various reasons of these interruptions.

Off-line hours IVRY-PARIS XIII 2020-2021, excl. maintenance

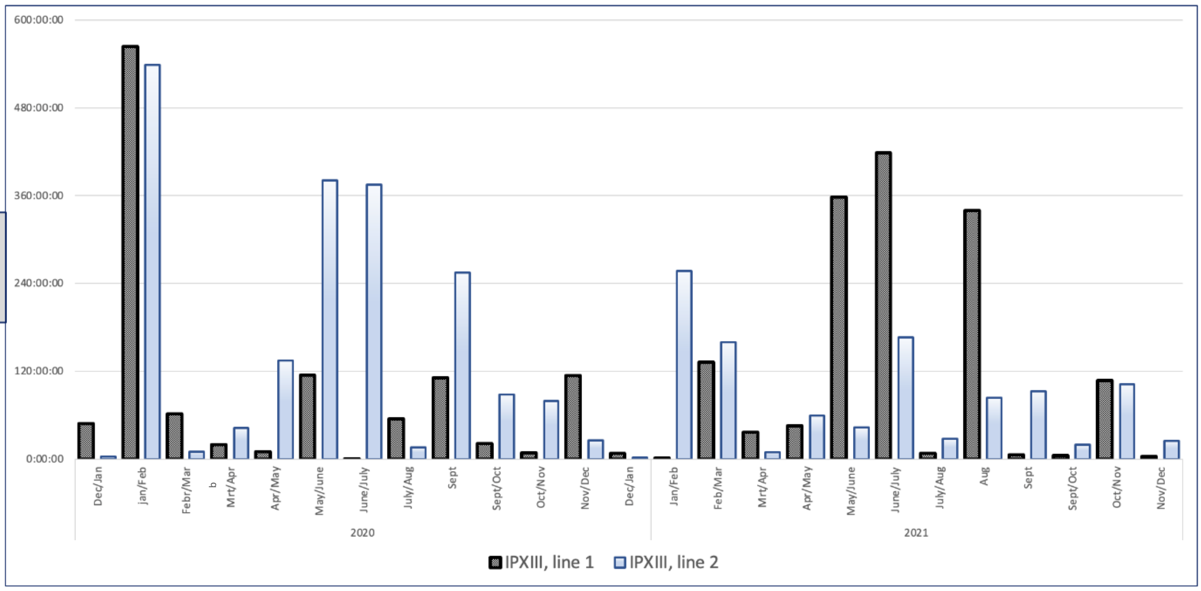


Figure 26: Off-line hours IVRY-PARIS XIII 2020-2021, exclusive maintenance

The graph below in *Figure 27* shows the hours, the semi-continuous sampling was off-line of lines 1 and 2 of IVRY-PARIS XIII and the REC, Netherlands. The maintenance period is excluded. The result of the **5-hour, 45-minute** shutdown in the Netherlands has triggered an in-depth investigation by the government and the incinerator to find the causes of the problem and the high dioxin emissions associated with it. Compared with the results from the Dutch waste incinerator, the results from IVRY-PARIS XIII are extremely worse. The Ivry/Paris XIII incinerator probably has a greater influence on dioxin pollution than previously thought.

Off-line hours IVRY-PARIS XIII 2020-2021, REC NL 2015-2017, excl. maintenance

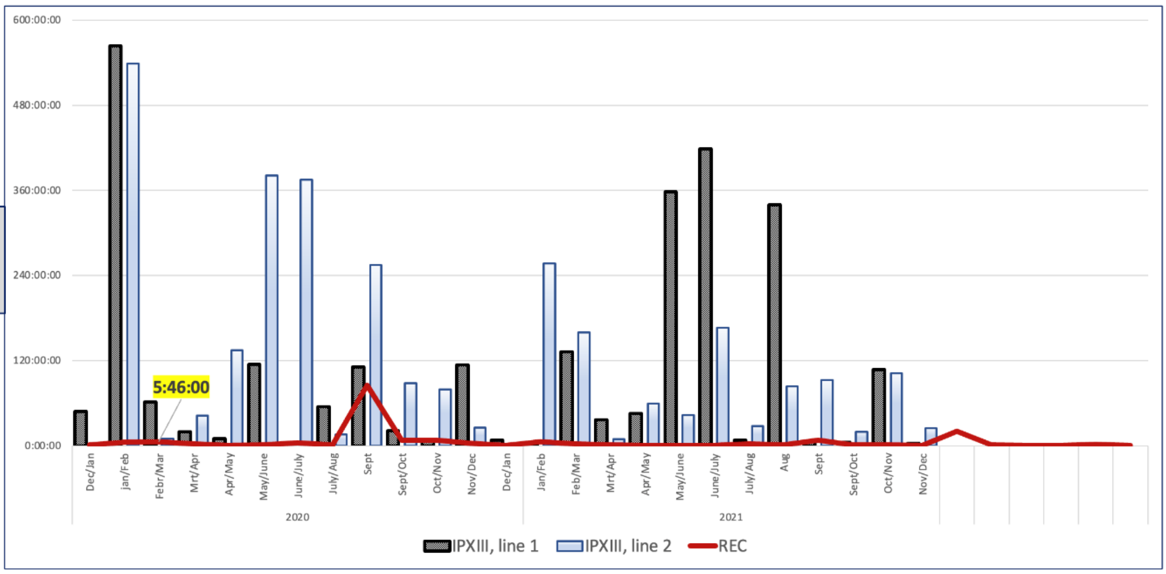


Figure 27: Off-line hours IVRY-PARIS XIII in 2020-2021 vs REC (NL) 2015-2017, exclusive maintenance hours

3.3 Time clusters of high dioxin emissions

Figure 28 presents time clusters of high dioxin emissions. The high emission of dioxins in August 2021 of **0.134 ng TEQ** (above the EU limit) was measured in a sampling time of 330 hours. In this period, 130 interruptions/events have taken place. In this period two (2) cartridges were applied for sampling. No explanation is given in the reports. The sampling efficiency was 49% with 330 hours offline, implicating a much higher level of dioxin.

Figure 28: Results dioxin emissions by data of semi-continuous measurements IVRY-PARIS XIII, Line 1 and 2, 2020-2021

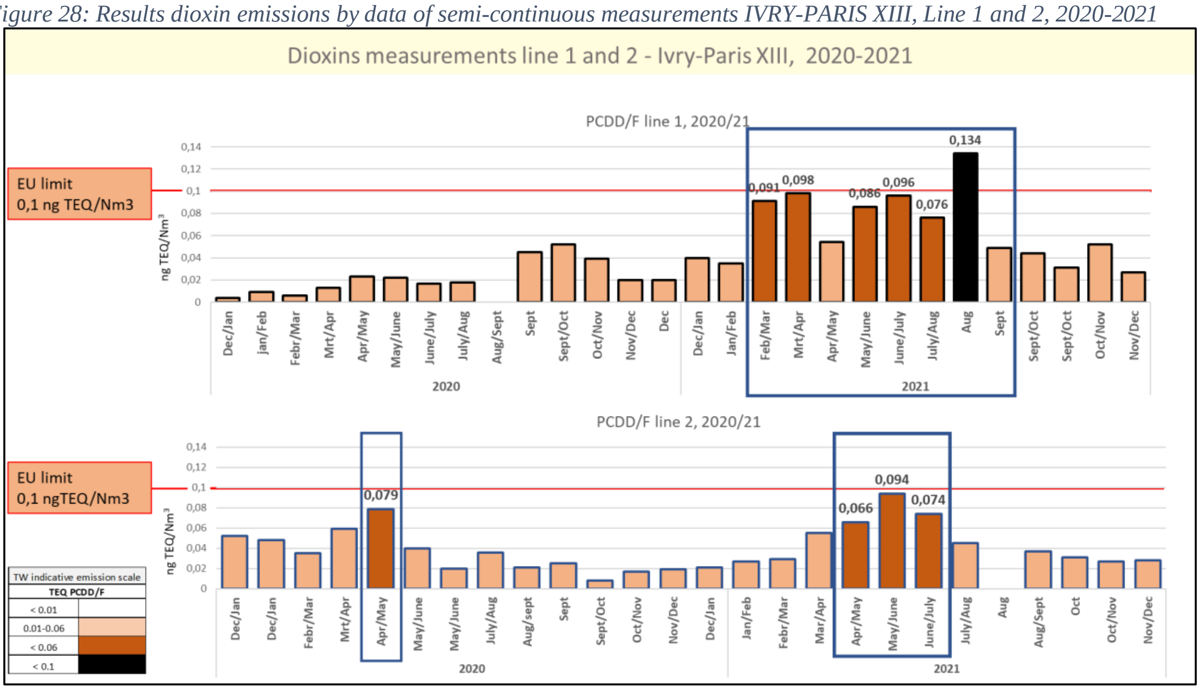


Figure 28: Results dioxin emissions by data of semi-continuous measurements IVRY-PARIS XIII, Line 1 and 2, 2020-2021

Figure 29 shows the off-line hours measured by AMESA of IVRY-PARIS XIII for lines 1 and 2 for two years (2020-2021) compared with the off-line time of the REC (NL) for two years (2015-2017) by AMESA.

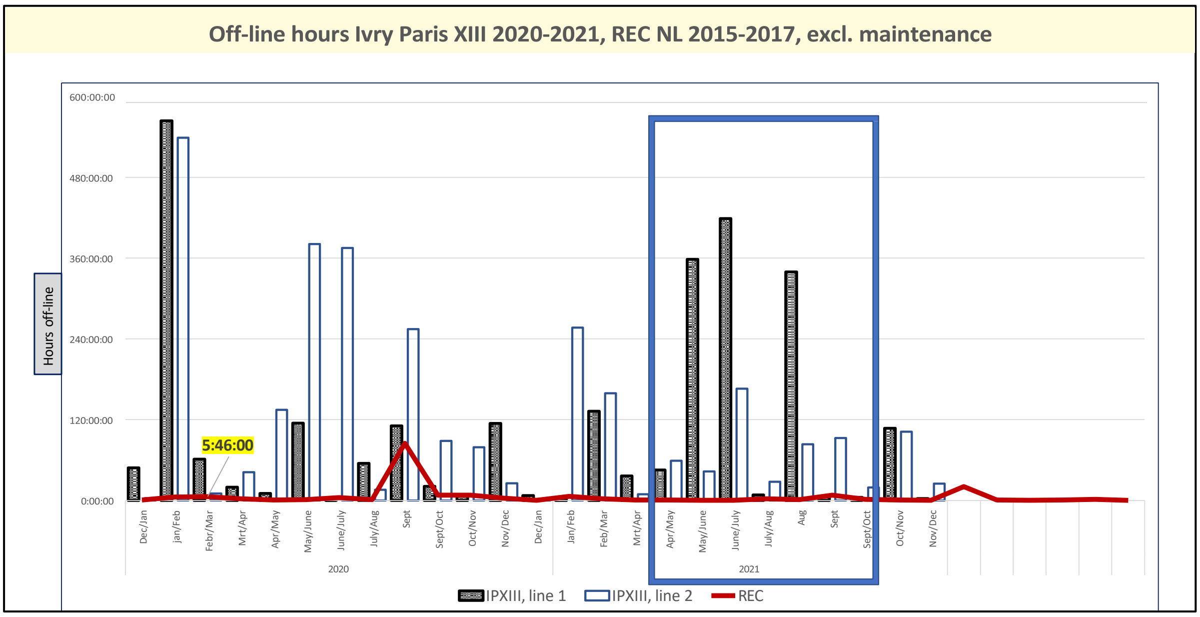
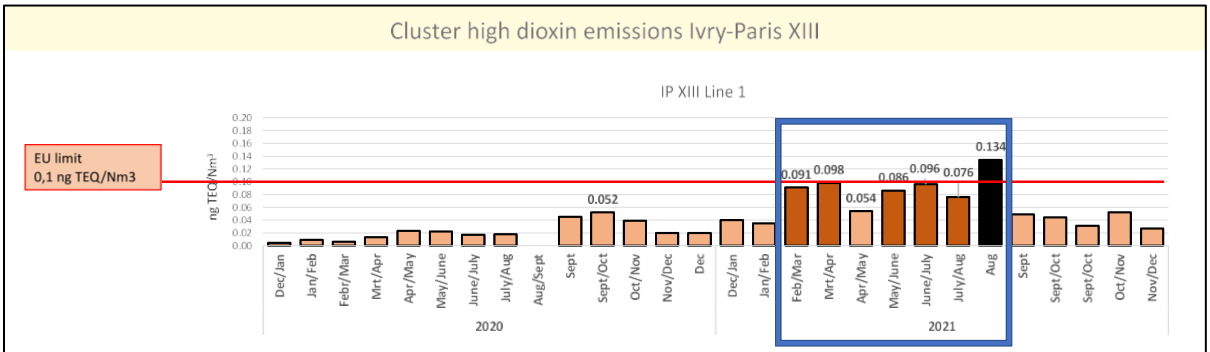


Figure 29: Off-line hours IVRY-PARIS XIII 2020-2021 vs REC (NL) 2015-2017, excl. maintenance

Semi-continuous measurements in the cluster of high dioxin results in February-August 2021, show decreased sampling efficiency, 6 shutdowns and 552 events, *Figure 30*. Nearly 5 times the EU limit of 0.1 ng/ Nm^3 was exceeded, while sampling in that period was 1339:37:00 hours offline.
Additional minute data from the control room of the incinerator of the time the semi-continuous measurement was interrupted, could help to estimate the real impact of the emissions of dioxins. It shows 7 months of unstable incineration.



Line 1 Ivry-Paris XIII

			Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation		AMESA	AMESA	Socorair	TW calculation	
			AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	E-C	file rtf	file csv			
Year	Month	Line	Start time	End time	Total time	Cartridge ex	Fire on time	Fire off (FA)	Total time ON	AMESA time OFF		Events	Events (FA)	ng TEQ/Nm3	E. Fire	E. Time
					(A) inc.		(B)	(C)	(D) Measurement (Mdurat)	(E) total	(F) operational					
2021	Feb/Mar	2021/10:17	15.3.2021/14:58	652:40:00		0:26:00	520:12:00	132:28:00	520:05:00	132:35:00	0:07:00	5	1	0.091	100.0%	79.7%
	Mrt/Apr	2021/15:24	13.4.2021/11:17	691:53:00		0:26:00	691:53:00	0:00:00	655:13:00	36:40:00	36:40:00	335	0	0.098	94.7%	94.7%
	Apr/May	2021/11:43	10.5.2021/14:54	692:08:00		0:26:00	692:08:00	0:00:00	646:35:00	45:33:00	45:33:00	26	0	0.054	93.4%	93.4%
	May/June	2021/15:17	7.6.2021/11:22	668:05:00		0:23:00	309:55:00	358:10:00	309:52:00	358:13:00	0:03:00	6	2	0.086	100.0%	46.4%
	June/July	2021/11:44	6.7.2021/07:52	692:08:00		0:22:00	273:13:00	0:00:00	273:13:00	418:55:00	418:55:00	5	0	0.096	100.0%	39.5%
	July/Aug	2021/14:56	2.8.2021/12:22	645:26:00		7:04:00	645:26:00	0:00:00	637:20:00	8:06:00	8:06:00	55	0	0.076	98.7%	98.7%
	Aug	'021/12:46	30.8.2021/11:07	670:09:00	0:11:00	0:22:00	518:31:00	151:38:00	330:34:00	339:35:00	187:57:00	120	3	0.134	63.8%	49.3%
		Totals		4712:29:00			3651:18:00	642:16:00	3372:52:00	1339:37:00		552	6	0.091	93%	72%

7 hours for cartridge exchange

Low efficiency AMESA

Figure 30: Data February - August 2021, high dioxin emissions and low sampling efficiency

In August 2022, Collectif 3R requested additional data for these periods. Data of raw minute-by-minute of parameters measured in the control room of the incinerator as dust (PM_{10}, $PM_{2.5}$); CO; C_xH_y; SOx; NOx; HCl; HF; temperatures in furnaces, in post-combustion-zones (PCZ), in filters, and the temperature in the chimney). However, **SYCTOM did not respond to these requests.**
Collectif 3R then seized the CADA (national commission in charge of facilitating access to public documents for citizens) concerning TW request advice sent to SYCTOM.

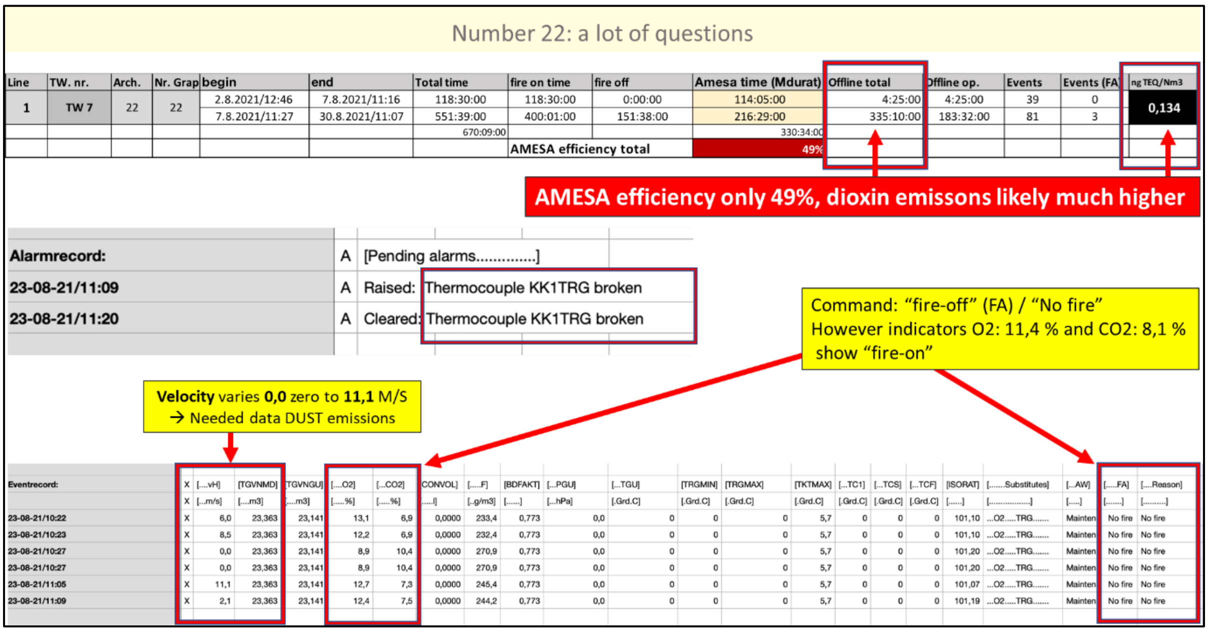
The CADA issued a favourable opinion on the Collectif 3R request.

The SYCTOM told the CADA:

- ***that they still refuse to provide access to the raw minute-by-minute data over the 6 periods requested*** *as this "would require the removal of technical constraints and the production of large quantities of data, since it would require the extraction of lines of data for each of the parameters requested, representing a total of nearly 2.5 million records".*

- *"That the communication of raw data, i.e. without corrections, does not allow for a useful analysis of the operation of an incinerator such as the one operated by SYCTOM, since such an evaluation, as well as comparisons with other comparable facilities, is based on corrected data, as provided for in the regulations in force."*

The EU limit value of 0.134 ng TEQ/ Nm^3 was observed to have been exceeded during the measurement period from 2 - 30 August 2021, see the datasheet below, *Figure 31*.
The 120 events present serious OTNOC situations while the efficiency of this semi-continuous measurement drops to 49%. The command “TRG<TRGUHGR” Low temperature in the chimney) and four
 times the “fire-off” commands blocked the sampling for about 335 hours. In *Figure 31* is highlighted the command “no fire”, while the data for oxygen (O_2), shows 11.4% and carbon dioxide (CO_2) 8.1%, these are typical values of optimal combustion/fire conditions.


Number 22: a lot of questions

Line	TW. nr.	Arch.	Nr. Grap	begin	end	Total time	fire on time	fire off	Amesa time (Mdurat)	Offline total	Offline op.	Events	Events (FA)	ng TEQ/Nm3
1	TW 7	22	22	2.8.2021/12:46	7.8.2021/11:16	118:30:00	118:30:00	0:00:00	114:05:00	4:25:00	4:25:00	39	0	0,134
				7.8.2021/11:27	30.8.2021/11:07	551:39:00	400:01:00	151:38:00	216:29:00	335:10:00	183:32:00	81	3	
						670:09:00			330:34:00					
							AMESA efficiency total		49%					

Alarmrecord:	A	[Pending alarms.............]
23-08-21/11:09	A	Raised: Thermocouple KK1TRG broken
23-08-21/11:20	A	Cleared: Thermocouple KK1TRG broken

Eventrecord:	X	[....vH]	[TGVNMD]	[TGVNGU]	[....O2]	[...CO2]	[CONVOL]	[.....F]	[BDFAKT]	[...PGU]	[...TGU]	[TRGMIN]	[TRGMAX]	[TKTMAX]	[...TC1]	[...TCS]	[...TCF]	[ISORAT]	[.......Substitutes]	[...AW]	[.....FA]	[....Reason]
	X	[...m/s]	[....m3]	[....m3]	[.....%]	[.....%]	[.....l]	[..g/m3]	[......]	[...hPa]	[.Grd.C]	[.Grd.C]	[.Grd.C]	[.Grd.C]	[.Grd.C]	[.Grd.C]	[.Grd.C]	[......]	[.................]	[.....]	[.......]	[..........]
23-08-21/10:22	X	6,0	23,363	23,141	13,1	6,9	0,0000	233,4	0,773	0,0	0	0	0	5,7	0	0	0	101,10	...O2.....TRG.......	Mainten	No fire	No fire
23-08-21/10:23	X	8,5	23,363	23,141	12,2	6,9	0,0000	232,4	0,773	0,0	0	0	0	5,7	0	0	0	101,10	...O2.....TRG.......	Mainten	No fire	No fire
23-08-21/10:27	X	0,0	23,363	23,141	8,9	10,4	0,0000	270,9	0,773	0,0	0	0	0	5,7	0	0	0	101,20	...O2.....TRG.......	Mainten	No fire	No fire
23-08-21/10:27	X	0,0	23,363	23,141	8,9	10,4	0,0000	270,9	0,773	0,0	0	0	0	5,7	0	0	0	101,20	...O2.....TRG.......	Mainten	No fire	No fire
23-08-21/11:05	X	11,1	23,363	23,141	12,7	7,3	0,0000	245,4	0,773	0,0	0	0	0	5,7	0	0	0	101,07	...O2.....TRG.......	Mainten	No fire	No fire
23-08-21/11:09	X	2,1	23,363	23,141	12,4	7,5	0,0000	244,2	0,773	0,0	0	0	0	5,7	0	0	0	101,19	...O2.....TRG.......	Mainten	No fire	No fire

Figure 31: Data semi-continuous measurement August 2, 2021

3.4 Double cartridge use - Multiple logfiles and interruption times

The sampling of line 1 in August 2021 is registered by the AMESA automatic system with two separate log files, indicating a second cartridge was involved in the measurement. The explanation given by SYCTOM[20] about these double cartridge log files, is a human failure, caused by a technician accidentally pressing the 'reset' button. This unusual event of restarting/resetting the semi-continuous measurements has more than once taken place, in total six (6) times. In 2021, in line 1 7.8.2021/11:16 and at line 2 four times: 10.6.2021/18:37 (dioxins 0.074 ng TEQ), 23.10.2021/16:18, 27.10.2021/10:42 and 23.11.2021/11:34, See *Table 6*.

If the other examples in the table shown below all are due to technicians pushing on the button is unknown. Changing cartridges occur sometimes for various reasons. In Harlingen, this happen twice when the cartridges were damaged by 'explosions' in the furnace, according to management REC/NL. If different cartridges were used, a problem arise: how to mix the XAD-2 fluid to get a real estimation of dioxin emissions of the sample period monitored in two (2) different cartridges in time.

	Socorair	Socorair		Socorair		Socorair	Socorair	Socorair	TW calculation	TW calculation	AMESA		Socorair	AMESA	TW calculation	
	AMESA file csv	AMESA file csv				AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	E-C				Cartridge	E. Fire	E. Time
Line	Start time	End time		Total time	time	Fire on time	Fire off (FA) time	Total time ON	AMESA time OFF		Events	FA	ng TEQ/Nm3	handlings		
			total time	(A) incineration	difference	(B)	(C)	(D) Measurement (Mdurat)	(E) total	(F) operational				Time		
1	23.11.2020/14:50	9.12.2020/00:59		370:09:00		370:09:00	0:00:00	256:30:00	113:39:00	113:39:00	17	0				
	9.12.2020/09:27	22.12.2020/11:15		313:47:00		313:46:00	0:01:00	313:10:00	0:37:00	0:36:00	10	1				
1	**23.11.2020/14:50**	**22.12.2020/11:15**	**692:25:00**	**683:56:00**	**8:29:00**	**683:55:00**	**0:01:00**	**569:40:00**	**114:16:00**	**114:15:00**	27	1	**0.200**	**08:28:00**	**83.3%**	**83.3%**
2	7.6.2021/12:10	10.6.2021/18:37		78:26:00		5:45:00	72:41:00	64:30:00	13:56:00		24	14				
	10.6.2021/18:52	6.7.2021/08:51		613:59:00		613:59:00	0:00:00	600:09:00	13:50:00	13:50:00	15	0				
2	**7.6.2021/12:10**	**6.7.2021/08:51**	**692:41:00**	**692:25:00**	**0:16:00**	**619:44:00**	**72:41:00**	**664:39:00**	**27:46:00**	**13:50:00**	39	14	**0.074**	**00:15:00**	**96.1%**	**96.0%**
1	2.8.2021/12:46	7.8.2021/11:16		118:30:00		118:30:00	0:00:00	114:05:00	4:25:00	4:25:00	39	0				
	7.8.2021/11:27	30.8.2021/11:07		551:39:00		400:01:00	151:38:00	216:29:00	335:10:00	183:32:00	81	3				
1	**2.8.2021/12:46**	**30.8.2021/11:07**	**670:22:21**	**670:09:00**	**0:13:21**	**518:31:00**	**151:38:00**	**330:34:00**	**339:35:00**	**187:57:00**	120	3	**0.134**	**00:11:00**	**63.8%**	**49.3%**
2	27.9.2021/12:38	23.10.2021/16:18		627:39:00		88:48:00	538:51:00	608:22:00	19:17:00		249	244				
	23.10.2021/17:51	25.10.2021/15:21		45:30:00		45:30:00	0:00:00	45:26:00	0:04:00	0:04:00	2	0				
2	**27.9.2021/12:38**	**25.10.2021/15:21**	**675:14:00**	**673:09:00**	**2:05:00**	**134:18:00**	**538:51:00**	**653:48:00**	**19:21:00**	**0:04:00**	251	244	**0.044**	**01:33:00**	**100%**	**97%**
2	25.10.2021/15:47	27.10.2021/10:42		42:55:00		42:55:00	0:00:00	41:01:00	1:54:00	1:54:00	5	0				
	27.10.2021/18:46	23.11.2021/11:34		640:47:00		543:48:00	96:59:00	540:32:00	100:15:00	3:16:00	96	1		**00:15:00**		
	27.10.2021/10:57	27.10.2021/17:00		6:03:00		6:03:00	0:00:00	6:00:00	0:03:00	0:03:00	2	0		**01:46:00**		
2	**25.10.2021/15:47**	**23.11.2021/11:34**	**691:47:00**	**689:45:00**	**2:02:00**	**592:46:00**	**96:59:00**	**587:33:00**	**102:12:00**	**5:13:00**	103	1	**0.027**	**02:01:00**	**99%**	**85%**

	data AMESA logfiles
	TW somations/SOCOR Air

Table 6: Restarting AMESA, multiple logfiles and interruption times.

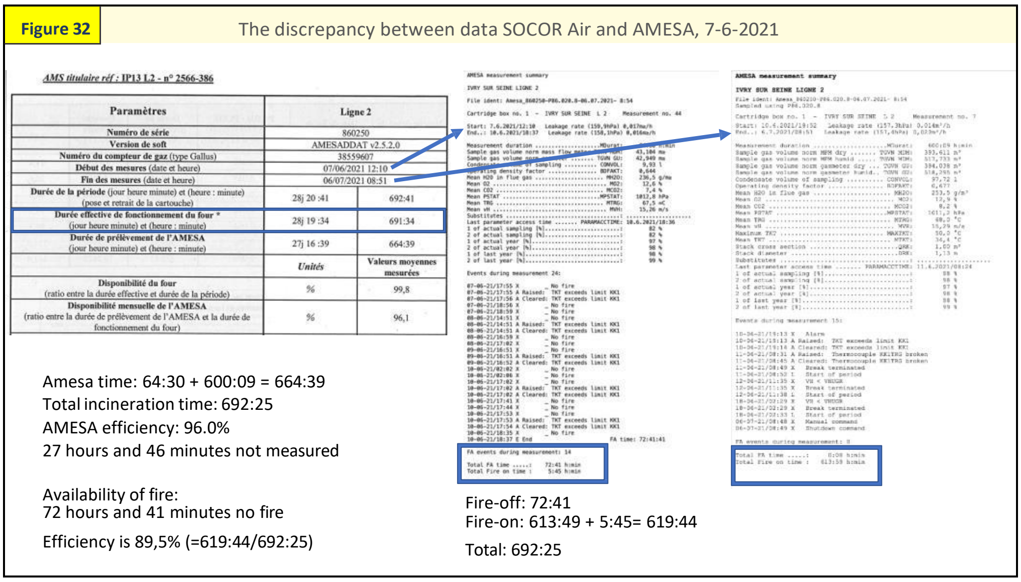
The last measurement in 2021 at line 2 has 3 different log files, starting 25.10.2021/15:47, 27.10.2021/10:57 and 27.10.2021/18:46. A cartridge change time was an average of 24 minutes for line 1, while the average time for the restart of the AMESA automatically system takes more than two hours (2:37:04 h). Annex 2 shows the original AMESA data files with the various times in this measurement when the buttons are pressed from early morning to late at night.

[20] *Lettre ref: IV LE-S T22-820 0003/Chrono no 44110, 30-9-2022*

3.5 Discrepancies between SOCOR Air and AMESA reports

Example: June/July 2021

Figure 32 shows the actual operating time of the incinerator of 691:34 hours. The line is marked with an asterisk to indicate data is provided by SYCTOM. However, the AMESA data show another outcome of operating time. Again, two separate log files first at 5:45 and the second run at 613:59 hours, making together 619.44 hours. The “fire-off” time of 72: 1:00 hours conflicts with data of SOCOR Air with an efficiency of 99.8% for the “fire-on”.



Paramètres	Ligne 2	
Numéro de série	860250	
Version de soft	AMESADDAT v2.5.2.0	
Numéro du compteur de gaz (type Gallus)	38559607	
Début des mesures (date et heure)	07/06/2021 12:10	
Fin des mesures (date et heure)	06/07/2021 08:51	
Durée de la période (jour heure minute) et (heure : minute) (pose et retrait de la cartouche)	28j 20 :41	692:41
Durée effective de fonctionnement du four * (jour heure minute) et (heure : minute)	28j 19 :34	691:34
Durée de prélèvement de l'AMESA (jour heure minute) et (heure : minute)	27j 16 :39	664:39
	Unités	Valeurs moyennes mesurées
Disponibilité du four (ratio entre la durée effective et durée de la période)	%	99,8
Disponibilité mensuelle de l'AMESA (ratio entre la durée de prélèvement de l'AMESA et la durée de fonctionnement du four)	%	96,1

Figure 32: The discrepancy in data from SOCOR Air and AMESA, 7-6-2021

Figure 32 shows the actual operating time of the incinerator, i.e. 691:34 hours. The line in the table is marked with an asterisk to indicate that the data is supplied by SYCTOM. However, the AMESA data shows a different chiffre of operating time: 619:44 (613:59 + 5:45) and explicitly a shutdown time of 72:41:00 hours. During this "fire off" period, a total of 14 stops in the AMESA sampling were effected by the "FO" (no fire) command. If these events are related to multiple shutdowns, dioxin emissions are likely.

However, during these events, the AMESA was blocked for more than 28 hours, and no measurement was possible. The dioxin emissions were likely higher than the measured 0.074 ng TEQ/ Nm^3. The efficiency of the AMESA is 96.0%, 28 hours are not sampled. See *Figure 33*, while the velocity in the nozzle/AMESA probe was zero, data from the control room show the velocity of the flue gasses is 14-16 m/s, as well the O2 data show by 12-14% that combustion is operating. No explanation is given in SOCOR Air.[21]

[21] *Rapport d’essais du suivi en semi-continu des PCDD/F-21EP098-Revision00, Prélèvements effectués du 7 juin au 6 juillet 2021, support AMESA, SUEZ IP13, Site d’Ivry sur Seine (94)*

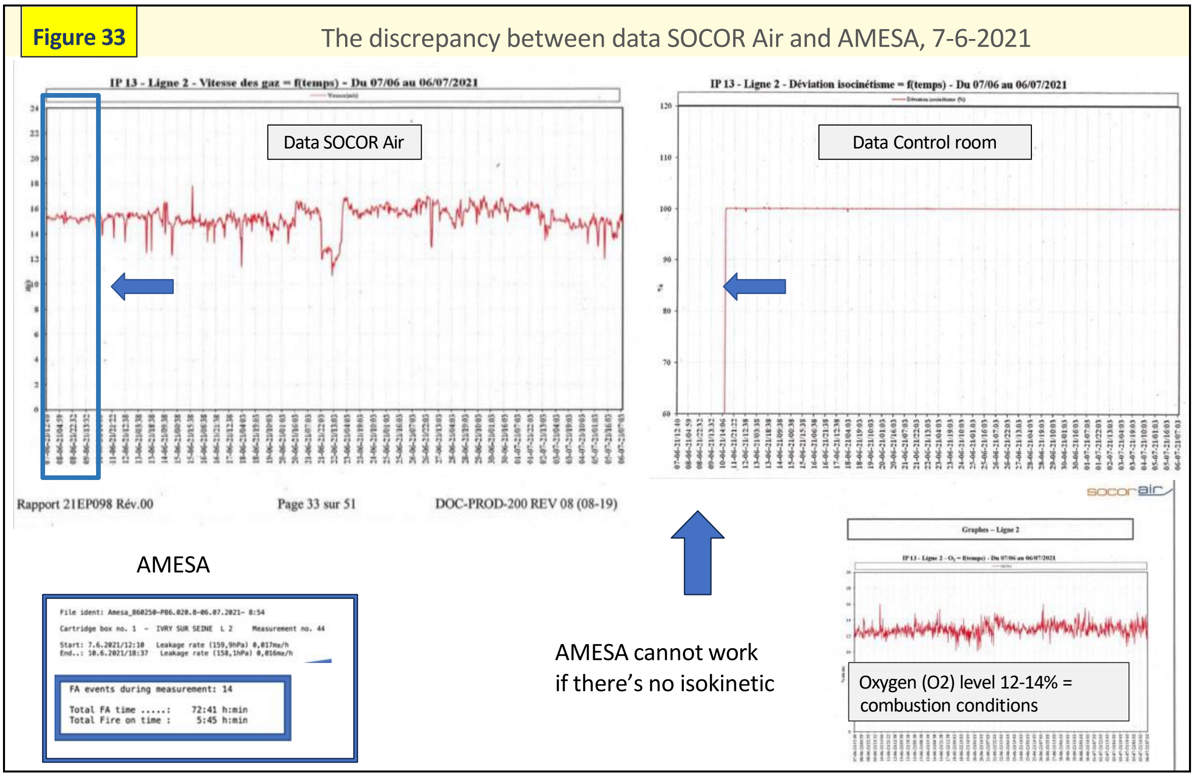


Figure 33: Discrepancy between data SOCOR Air and AMESA 7-6-2021

Example August 2021

In the SOCOR Air and AMESA data for August 2021, a difference is to be noted in the time at which "fire on" is mentioned.

SOCOR Air gives 0:00, while AMESA gives a total sample time for the "fire on" time of 386:09 (hours: minutes), although AMESA has a measurement time of 0:00. Furnace 1 was also 'offline' for 329 hours and 5 minutes, which is a typical phenomenon when problems occur on one furnace, they spill over to the other furnaces.

This underlines the need for continuous operation of AMESA, see *Figure 34*.

discrepancy “fire-on” time between data SOCOR Air and AMESA, 2-8-2021

Data SOCOR Air

Tableaux récapitulatifs des différentes mesures menées sur la ligne 2

AMS titulaire réf : IP13 L2 - n° 2566-386

Paramètres	Ligne 2	
Numéro de série	860250	
Version de soft	AMESADDAT v2.5.2.0	
Numéro du compteur de gaz (type Gallus)	38559607+40884318	
Début des mesures (date et heure)	02/08/2021 13:20	
Fin des mesures (date et heure)	30/08/2021 11:48	
Durée de la période (jour heure minute) et (heure : minute) (pose et retrait de la cartouche)	27j 22 :28	670:28
Durée effective de fonctionnement du four * (jour heure minute) et (heure : minute)	0j 00 :00	0:00
Durée de prélèvement de l'AMESA (jour heure minute) et (heure : minute)	0j 00 :00	0:00
	Unités	**Valeurs moyennes mesurées**
Disponibilité du four (ratio entre la durée effective et durée de la période)	%	Arrêt technique ligne 2
Disponibilité mensuelle de l'AMESA (ratio entre la durée de prélèvement de l'AMESA et la durée de fonctionnement du four)	%	Arrêt technique ligne 2
Conformité du taux annuel de disponibilité > 85 %	%	Conforme
Disponibilité annuelle du DECS à partir de 22/12/2020	%	96,5
Dioxygène - O_2 (MIRFT)	*% sec*	12,4
Dioxyde de carbone - CO_2 (MIRFT)	*% sec*	8,2
Humidité absolue des gaz (AMESA)	*g/m³*	244
Température moyenne des gaz (AMESA)	*°C*	23,5
Vitesse au point de mesure (AMESA)	*m/s*	13,8
Débit volumique sur gaz secs (AMESA)	*m_0^3/h*	Arrêt technique ligne 2
Débit volumique sur gaz secs (Calcul)	*m_0^3/h à 11% O_2*	Arrêt technique ligne 2
Volume de gaz normé prélevé	*m_0^3*	Arrêt technique ligne 2
Numéro de mesure	n°	46
Référence de la cartouche	-	S-IP13-L2-A

* Données fournies par le client

Data AMESA cartridge

```
AMESA measurement summary

IVRY SUR SEINE LIGNE 2

File ident: Amesa_860250-P86.021.3-30.08.2021-11:51
Sampled using P86.020.8

Cartridge box no. 1  -  IVRY SUR SEINE  L 2     Measurement no. 46

Start: 2.8.2021/13:20   Leakage rate (161,7hPa) 0,032m≥/h
End..: 30.8.2021/11:48   Leakage rate (163,8hPa) 0,026m≥/h

Measurement duration ....................MDurat:      0:00 h:min
Sample gas volume norm MFM dry ....... TGVN MDM:     0,000 m≥
Sample gas volume norm MFM humid ..... TGVN MDM:     0,000 m≥
Sample gas volume norm gasmeter dry ... TGVN GU:     0,000 m≥
Sample gas volume norm gasmeter humid.. TGVN GU:     0,000 m≥
Condensate volume of sampling .......... CONVOL:      0,00 l
Operating density factor ............... BDFAKT:     0,719
Mean H2O in flue gas ..................... MH2O:     243,9 g/m≥
Mean O2 ................................... MO2:      12,4 %
Mean CO2 ................................. MCO2:       8,2 %
Mean PSTAT ...............................MPSTAT:    1016,5 hPa
Mean TRG ................................. MTRG:      23,5 =C
Mean vH ................................... MVH:     13,83 m/s
Maximum TKT ............................ MAXTKT:      43,4 =C
Mean TKT ................................. MTKT:      33,9 =C
Stack cross section .......................QRK:      1,00 m≤
Stack diameter ............................DRK:      1,13 m
Substitutes ..................................: .....................
Last parameter access time ....... PARAMACCTIME: 19.8.2021/11:30
1 of actual sampling [%]......................:         91 %
2 of actual sampling [%]......................:         99 %
1 of actual year [%]..........................:         96 %
2 of actual year [%]..........................:         98 %
1 of last year [%]............................:         98 %
2 of last year [%]............................:         99 %

Events during measurement 11:

02-08-21/13:20 X   No fire
14-08-21/16:50 X   Power on 14-08-21/16:46:25  (Power off 14-08-21/09:39:53)  FA time: 284:19:48
17-08-21/11:53 L   Start of period
17-08-21/11:53 X   VH < VHUGR
19-08-21/11:16 X   Shutdown command
19-08-21/11:34 L   Start of period
19-08-21/11:34 X   VH < VHUGR
19-08-21/11:35 X   Shutdown command
19-08-21/11:44 L   Start of period
19-08-21/11:44 X   VH < VHUGR
30-08-21/11:46 X   Shutdown command

FA events during measurement: 1

Total FA time .....:   284:19 h:min
Total Fire on time :   386:09 h:min
```

Figure 34: Discrepancy "fire-on" time between data SOCOR Air and AMESA 2-8-2021

Example September 2021

SOCOR Air shows in *Figure 35* the fire was at 673:57:00 hours. However, the AMESA data, in two separate registers (No. 48 and No. 7) record 88:48 hours in the former and 45:30 hours in the latter, totalling 134:18 hours, due to 244 "FA" ("fire off") events. AMESA sampled 653:48 hours out of a total of 673:43 hours. Thus, 19:95 hours were not measured.

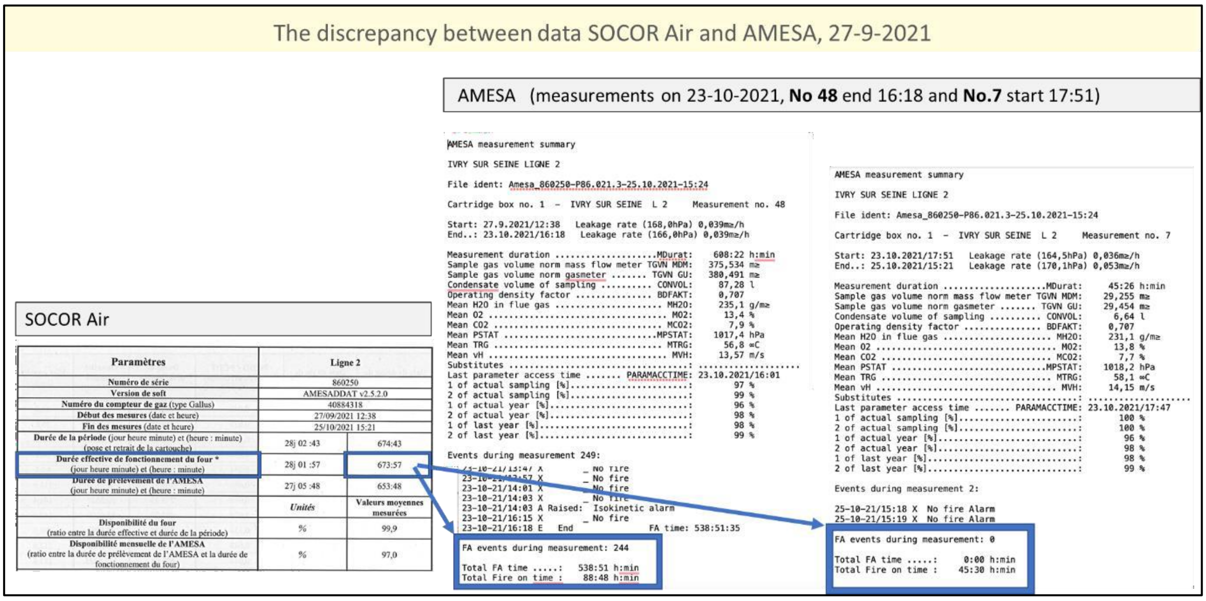


Figure 35: Discrepancy between data SOCOR Air and AMESA, 27-09-2021

Example October 2021

In October/November 2021, sampling was blocked for 107:09 hours (*Table* 7), with 34 events (*Figure 36*, left) and 4 occurrences of the "FA" command ("fire off") of 75:55 hours (*Figure 36*, right).

The efficiency of the semi-continuous measurements *(Table7*: column "E.Time") decreased to a calculated value of 83.9%, which does not comply with the normative minimum limit of 85%. However, SOCOR Air (*Table 8*) sets the efficiency of the semi-continuous sampling at 93.9%. The result of the dioxin analyses in this period was 0.052 ng TEQ/ Nm^3.

588:26:00	75:55:00	557:12:00	107:09:00	31:14:00	34	4	4	0.052	94.7%	83.9%

Table 7: AMESA data at 4 "fire-off" events.

[22] *Ratio of sampling time to operating time >85%, guidance GA X 43-139, Rapport 20EP092 rév.02, DOC-PROD-200 REV 08(08-19), PAGE 15/53*

The discrepancy between data SOCOR Air and AMESA 26-10-2021

```
AMESA measurement summary

IVRY SUR SEINE  LIGNE 1

File ident: Amesa_860263-P86.021.3-23.11.2021-10:53
Sampled using P86.021.3

Cartridge box no. 1  -  IVRY SUR SEINE  L 1     Measurement no. 10

Start: 26.10.2021/18:29   Leakage rate (131,5hPa) 0,000m≥/h
End..: 23.11.2021/10:50   Leakage rate (133,9hPa) 0,002m≥/h

Measurement duration ....................MDurat:    557:12 h:min
Sample gas volume norm MFM dry ....... TGVN MDM:   384,483 m≥
Sample gas volume norm MFM humid ..... TGVN MDM:   511,371 m≥
Sample gas volume norm gasmeter dry ... TGVN GU:   378,926 m≥
Sample gas volume norm gasmeter humid.. TGVN GU:   503,980 m≥
Condensate volume of sampling .......... CONVOL:     98,27 l
Operating density factor ............... BDFAKT:     0,737
Mean H2O in flue gas ..................... MH2O:     265,3 g/m≥
Mean O2 ................................... MO2:      11,8 %
Mean CO2 ................................. MCO2:       8,4 %
Mean PSTAT ..............................MPSTAT:    1004,5 hPa
Mean TRG ................................. MTRG:      10,5 ∞C
Mean vH ................................... MVH:     13,61 m/s
Maximum TKT ............................ MAXTKT:      38,5 ∞C
Mean TKT ................................. MTKT:      27,6 ∞C
Stack cross section .......................QRK:      1,00 m≤
Stack diameter ............................DRK:      1,13 m
Substitutes ..................................: ....................
Last parameter access time ....... PARAMACCTIME: 8.11.2021/12:52
1 of actual sampling [%]......................:        95 %
2 of actual sampling [%]......................:        95 %
1 of actual year [%]..........................:        98 %
2 of actual year [%]..........................:        99 %
1 of last year [%]............................:        99 %
2 of last year [%]............................:        99 %

Events during measurement 34:
```

```
Events during measurement 34:

27-10-21/13:17 X   Manual command
27-10-21/13:19 X   Break terminated
27-10-21/13:23 L   Start of period
27-10-21/22:19 X   No fire
29-10-21/07:29 X   Break terminated  FA time: 33:10:20
29-10-21/07:33 L   Start of period
07-11-21/01:23 X   Alarm
07-11-21/01:23 A Raised:  Isokinetic alarm
07-11-21/01:58 X   Break terminated
07-11-21/02:02 X   Alarm
07-11-21/15:48 X   Break terminated
07-11-21/15:52 X   Alarm
07-11-21/15:53 A Raised:  Thermocouple KK1TRG broken
07-11-21/15:59 A Cleared: Thermocouple KK1TRG broken
07-11-21/16:02 X   Break terminated
07-11-21/16:05 X   Alarm
08-11-21/08:49 A Raised:  Thermocouple KK1TRG broken
08-11-21/09:00 A Cleared: Thermocouple KK1TRG broken
08-11-21/09:01 X   Break terminated
08-11-21/09:05 X   Alarm
08-11-21/09:07 A Cleared: Isokinetic alarm
08-11-21/09:07 X   Break terminated
08-11-21/09:11 L   Start of period
08-11-21/10:38 X   No fire
08-11-21/10:41 X   Break terminated  FA time: 0:02:29
08-11-21/10:44 L   Start of period
17-11-21/21:34 X   No fire
19-11-21/16:14 X   Break terminated  FA time: 42:40:40
19-11-21/16:18 L   Start of period
23-11-21/06:54 X   No fire
23-11-21/06:56 X   Break terminated  FA time: 0:01:30
23-11-21/06:59 L   Start of period
23-11-21/10:47 X   Manual command
23-11-21/10:47 X   Shutdown command

FA events during measurement: 4

Total FA time .....:    75:55 h:min
Total Fire on time :   588:26 h:min
```

Figure 36: AMESA-data: measurement summary and left events during measurement

	Unités	Valeurs moyennes mesurées
Disponibilité du four (ratio entre la durée effective et durée de la période)	%	89,0
Disponibilité mensuelle de l'AMESA (ratio entre la durée de prélèvement de l'AMESA et la durée de fonctionnement du four)	%	93,9
Conformité du taux annuel de disponibilité > 85 %	%	Conforme
Disponibilité annuelle de l'AMESA à partir de 22/12/2020	%	98,4

Table 8: Extract from the SOCOR AIR report "Rapport d'essais du suivi en semi-continu des PCDD/F - 21 EP 103-Révision 00, Prélèvements effectués du 25 octobre au 23 novembre 2021, support AMESA" relating to the Ivry/Paris XIII incinerator.

3.6 Issues connected with isokinetic sampling

The command “VH<VHUGR” occurs very frequently in semi-continuous data files of IVRY-PARIS XIII. It stands for the lower velocity limit. Below this level, the sampling will be stopped. The sampling tube may have become clogged by a dust particle, causing the velocity (VH) in the probe to fall below a set velocity limit (“VHUGR”). An automatic program will be started to clean the tube with a flush to remove the blocking particles. During this process, dioxin sampling is interrupted for exactly three (3) minutes.

The velocity is produced by the ID fan and has in IVRY-PARIS XIII a speed of 12-15 m/s. Remarkably the limit of velocity in IVRY-PARIS XIII is set at a value of 6 m/s, which leads to a lot of interruptions in sampling of the flue gases and inevitably leads to underreporting of dioxin emissions. In the Netherlands, the velocity value was set at 1.5 m/s to prevent unnecessary stops during sampling.

In the SOCOR AIR documents is mentioned that the diameter of the probe in Paris Ivry XIII is 5 millimetres, while the EU regulations of semi-continuous sampling require probes > 6 mm. This could be also a reason for the many blocking problems with dust particles in the probe. No explanation is given in the provided reports about the use of a smaller probe than prescribed.

There are two emergency fans in case the ID fan fails. The capacity and associated velocities of these auxiliary fans are known as how often they are set in line. Flue gas velocity at the incinerator REC (NL) is set with a much higher velocity of 17 m/s to dilute the toxic substances in the air.

Figure 37 shows a sampling interruption of 36 hours during the full operation of the incinerator due to the interruption of the command “VH<VHUGR”. This long interruption of sampling gives a substantial bias in the measurements of dioxins. The interrupted measured emission level of dioxins was 0.098 ng TEQ/Nm^3, just a little bit under the limit of 0.1 ng TEQ/ Nm^3.

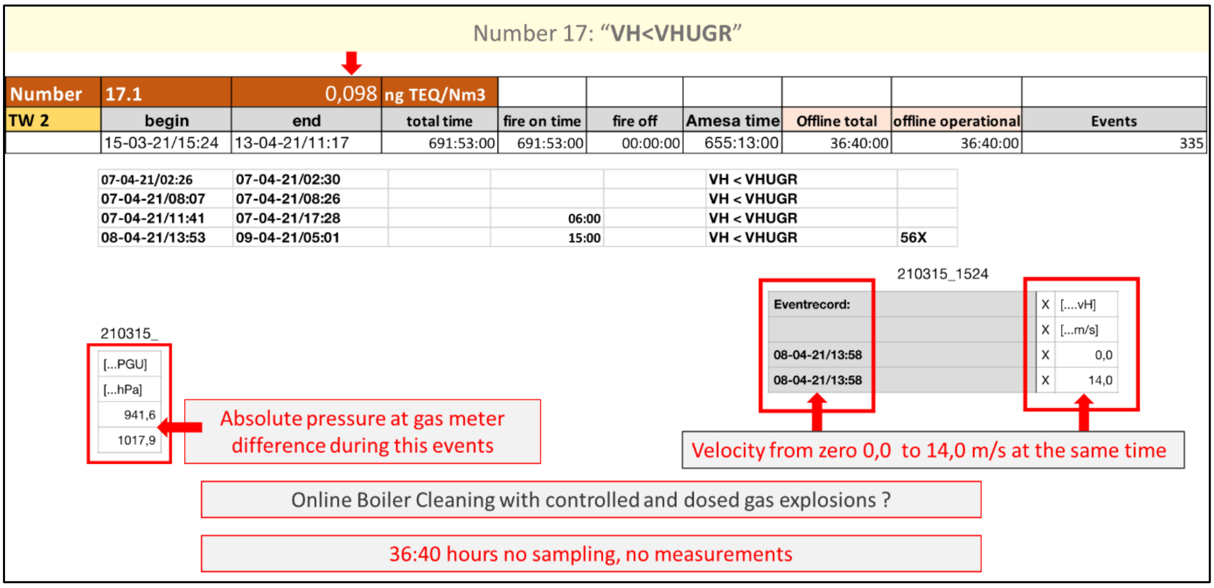


Figure 37: Measurement 15/03/2021 to 13/04/2021 nearly exceeding the dioxin limit.

3.7 Start-ups & shutdowns

Start-up conditions are problematic events in waste incineration production processes concerning the emissions of hazardous substances. In the literature, start-up events are described as moments with high dioxin emissions, which only stabilise to normal levels after about 15 days.[23] A graph of the total number of shutdowns/start-ups observed in IVRY-PARIS XIII and the REC (NL) is presented in *Figure 38*.

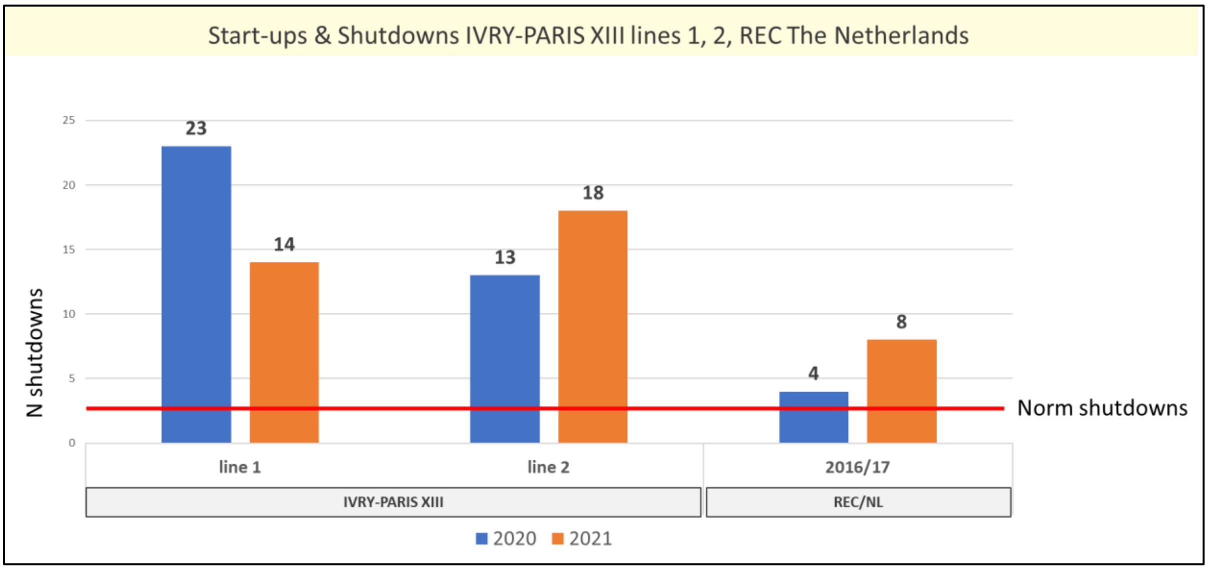


Figure 38: Shutdowns at IVRY-PARIS XIII, Lines 1,2, vs REC (NL)

The start-up of the incinerator IVRY-PARIS XIII is initiated with untreated wood from **short oak offcuts**.[24] The flue gas treatment lines are equipped with burners supplied with **natural gas**. These burners are for the start-up and for maintaining temperatures above 850°C in the post-combustion zone (PZC), see Annex 5. Besides wood and natural gas, "***non-road diesel fuel***" is also being used in the two emergency compressors which ensure the supply of air to the incinerator. Not clear is the quality of this fuel oil of non-road diesel and how this contributes to the dioxin emissions, no analytical data is provided.

The *Dossier d'information du public* (DIP)[25] mentions 24 and 21 start-ups and shutdown frequency in resp. 2020 and 2021. The difference could be explained DIP assuming cold start-ups, with a furnace shut down for more than 48 hours. A hot start-up, less than 8 hours, will not be registered by DIP. In the Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control)[26] the need to reduce the frequency of OTNOC to reduce emissions to the air is underlined in BAT 18.[27] A frequency of 3 start-ups per year is considered a norm for normal operating incinerators, [28,29] which is significantly less than the many start-ups observed at IVRY-PARIS XIII.

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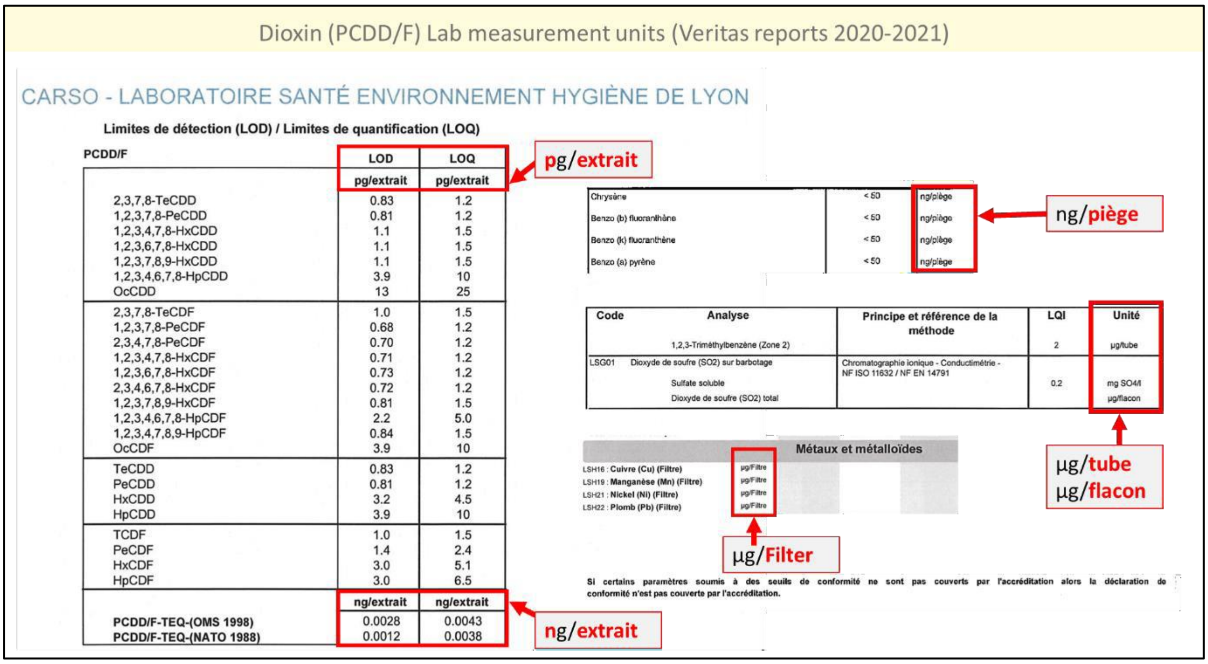
[23] *Hung et al. Continuous sampling of MSWI dioxins, Chemosphere, Volume 145, 2016, Pages 119-124,*
[24] *Dossier d'information du public 2021, page 15*
[25] *Dossier d'information du public 2021, page 25*
[26] *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010L0075*
[27] *Neuwahl F. et al (2019. Best Available Techniques (BAT) Reference Document for Waste Incineration; EUR 29971 EN*
[28] *Tejima, H, Nishigaki, M, Fujita, Y, Matsumoto, A, Takeda, N and Takaoka, M, 2007. Characteristics of dioxin emission at startup and shutdown of MSW incinerators, Chemosphere, 66:1123–1130.*
[29] *David T. Suess D.T. (2009). Development of Startup and Shutdown Permit Limits Based Upon Historical Data from Combustion Sources Monitored by Continuous Emission Monitoring Systems*

3.8 Measurements of start-ups at IVRY-PARIS XIII

The shutdowns and start-ups of IVRY PARIS XIII are monitored by Bureau Veritas, which is accredited by COFRAC (COmité FRançais d'ACcréditation). In 2020-2021, eight shutdowns and four start-ups were sampled and measured. In addition to dioxins (PCDD/F) and dioxin-like PCBs (dl-PCBs) PAH, heavy metals and volatile organic substances as benzene are also measured. It was not possible to carry out sampling according to the EN-13824-1 guidelines. Therefore, the measurement results were not accredited and are expressed in units such as "part, extract, flask", see *Figure 39* below. This makes it impossible to interpret these measurement results. In addition, it is also not clear at what point of the start-up or shutdown the sampling took place. As explained in the next chapter, the moment of sampling is essential. Also, it is not clear in this when the different APCD filters (Air Pollution Control Devices) are powered up and/or shut down.

It is important to monitor start-ups and shutdowns, as these events are highly susceptible to dioxin emissions. However, it does not appear to be technically possible to work according to the guidelines, nor to provide an alternative calculation. This leaves the main sources of dioxin emissions out of the picture.



PCDD/F	LOD pg/extrait	LOQ pg/extrait
2,3,7,8-TeCDD	0.83	1.2
1,2,3,7,8-PeCDD	0.81	1.2
1,2,3,4,7,8-HxCDD	1.1	1.5
1,2,3,6,7,8-HxCDD	1.1	1.5
1,2,3,7,8,9-HxCDD	1.1	1.5
1,2,3,4,6,7,8-HpCDD	3.9	10
OcCDD	13	25
2,3,7,8-TeCDF	1.0	1.5
1,2,3,7,8-PeCDF	0.68	1.2
2,3,4,7,8-PeCDF	0.70	1.2
1,2,3,4,7,8-HxCDF	0.71	1.2
1,2,3,6,7,8-HxCDF	0.73	1.2
2,3,4,6,7,8-HxCDF	0.72	1.2
1,2,3,7,8,9-HxCDF	0.81	1.5
1,2,3,4,6,7,8-HpCDF	2.2	5.0
1,2,3,4,7,8,9-HpCDF	0.84	1.5
OcCDF	3.9	10
TeCDD	0.83	1.2
PeCDD	0.81	1.2
HxCDD	3.2	4.5
HpCDD	3.9	10
TCDF	1.0	1.5
PeCDF	1.4	2.4
HxCDF	3.0	5.1
HpCDF	3.0	6.5
	ng/extrait	ng/extrait
PCDD/F-TEQ-(OMS 1998)	0.0028	0.0043
PCDD/F-TEQ-(NATO 1988)	0.0012	0.0038

Chrysène	< 50	ng/piège
Benzo (b) fluoranthène	< 50	ng/piège
Benzo (k) fluoranthène	< 50	ng/piège
Benzo (a) pyrène	< 50	ng/piège

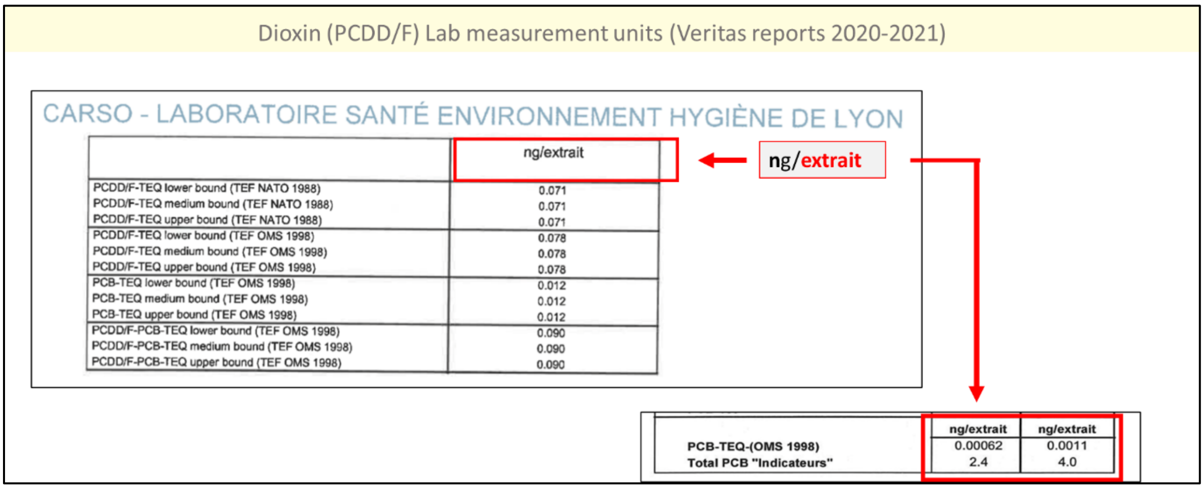
Code	Analyse	Principe et référence de la méthode	LQI	Unité
	1,2,3-Triméthylbenzène (Zone 2)		2	µg/tube
LSG01	Dioxyde de soufre (SO2) sur barbotage; Sulfate soluble; Dioxyde de soufre (SO2) total	Chromatographie ionique - Conductimétrie - NF ISO 11632 / NF EN 14791	0.2	mg SO4/l; µg/flacon

Métaux et métalloïdes	
LSH16 : Cuivre (Cu) (Filtre)	µg/Filtre
LSH19 : Manganèse (Mn) (Filtre)	µg/Filtre
LSH21 : Nickel (Ni) (Filtre)	µg/Filtre
LSH22 : Plomb (Pb) (Filtre)	µg/Filtre

Si certains paramètres soumis à des seuils de conformité ne sont pas couverts par l'accréditation alors la déclaration de conformité n'est pas couverte par l'accréditation.

Figure 39: Dioxin (PCDD/F) lab measurement units (Veritas report 2020-2021)

Measurement of dioxin emissions (PCDD/F) during the start-up is performed in 125 minutes, while the start-up procedure lasts about 32-50 hours. No data is given at which moment of the start-up measurement is undertaken. No elaboration of the results, no explanation of the results in tubes, flacon or extrait. It is not clear how these comprehensive reports can be used to evaluate the effectiveness of reducing hazardous substances such as dioxins (PCDD/F), PAH, VOC, and heavy metals. In addition, it should be emphasised, that significantly more start-ups and shutdowns have taken place than these monitored events, *Figure 40*.[30]



	ng/extrait
PCDD/F-TEQ lower bound (TEF NATO 1988)	0.071
PCDD/F-TEQ medium bound (TEF NATO 1988)	0.071
PCDD/F-TEQ upper bound (TEF NATO 1988)	0.071
PCDD/F-TEQ lower bound (TEF OMS 1998)	0.078
PCDD/F-TEQ medium bound (TEF OMS 1998)	0.078
PCDD/F-TEQ upper bound (TEF OMS 1998)	0.078
PCB-TEQ lower bound (TEF OMS 1998)	0.012
PCB-TEQ medium bound (TEF OMS 1998)	0.012
PCB-TEQ upper bound (TEF OMS 1998)	0.012
PCDD/F-PCB-TEQ lower bound (TEF OMS 1998)	0.090
PCDD/F-PCB-TEQ medium bound (TEF OMS 1998)	0.090
PCDD/F-PCB-TEQ upper bound (TEF OMS 1998)	0.090

	ng/extrait	ng/extrait
PCB-TEQ-(OMS 1998)	0.00062	0.0011
Total PCB "Indicateurs"	2.4	4.0

Figure 40: Dioxin (PCDD/F) TEQ values, Ivry-Paris XIIIstart-up on 3-9-2021, of line 2

[30] *Mesures de émissions atmosphériques, démarrage du four no. 2. Rapport: 9275363/22.1.4.R, bureau Veritas, 02/09/2021, page 115/134*

3.9 Start-up measurements at the REC incinerator (Netherlands)

Start-up measurements can be divided into four phases: Flushing, (cleaning the interior of the incinerator), Pre-heating (PCZ must be at 850^0 Celsius), Waste feeding, and Regular combustion, see *Figure 41*.

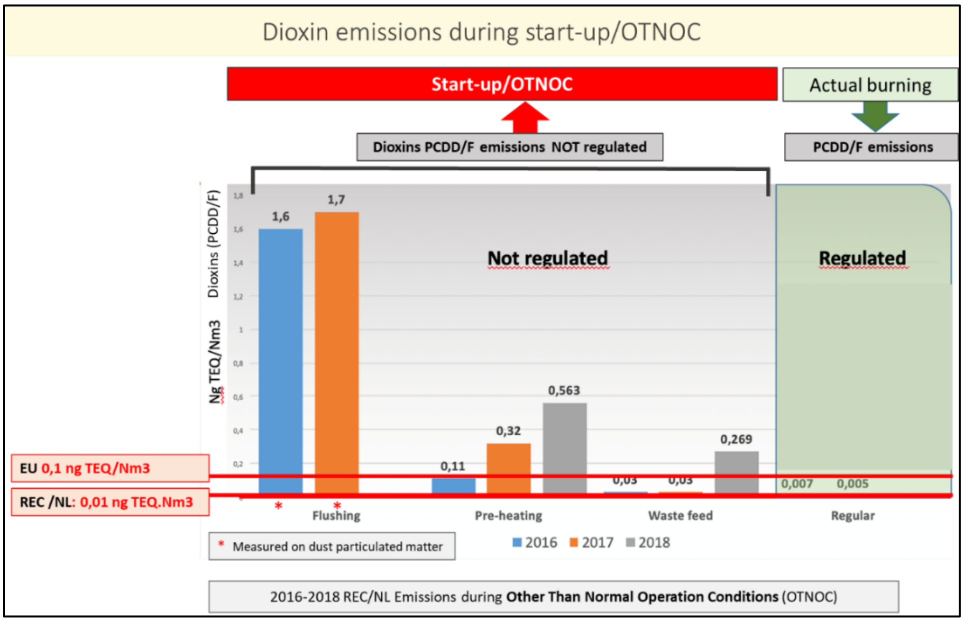


Figure 41: Start-up stages in a waste incineration process

Remarkably, the highest dioxin emissions are measured in the first phase, when the incinerator is only cleaned. The EU Directive 2010/75/EU requires all filters to be used during incineration[31]. In the cleaning phase, no waste is burnt and the waste incinerator REC in the Netherlands used this to discharge unfiltered dust out of the chimney. However, this violates the rule prohibiting the emission of unfiltered contaminated dust into the environment [32]. Research by ToxicoWatch at the REC incinerator in the Netherlands showed emissions of dust just when sampling by AMESA was stopped (see Figure 42). After extensive discussion in technical working groups, this clean-up method was made structurally impossible. This was also expressed in a recommendation in the technical working groups of the Stockholm-Basel Conferences, to improve the Best Available Techniques for waste incineration to minimise dioxin emissions to the environment.

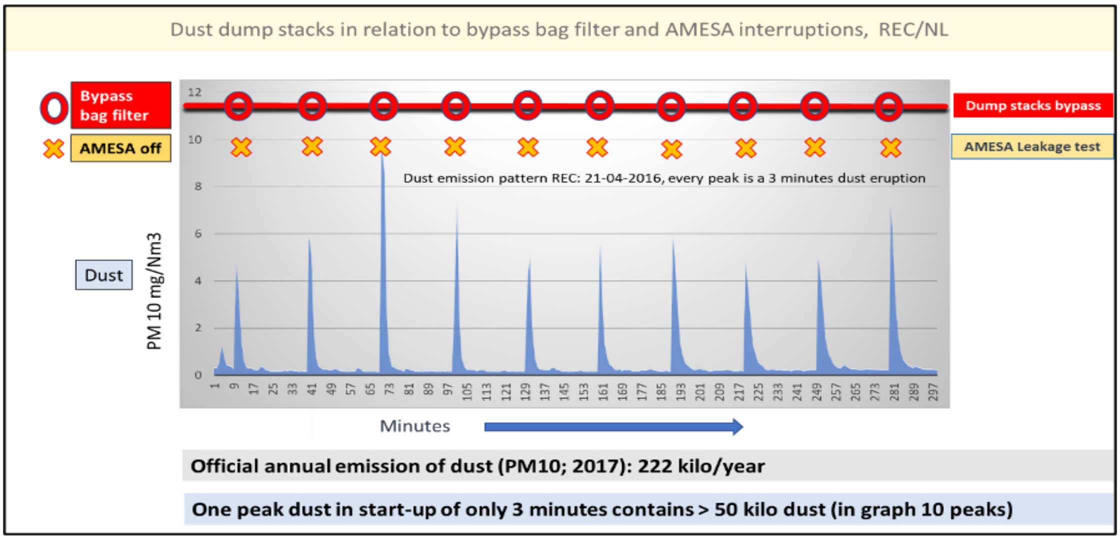


Figure 42: Dust dump stacks in relation to bypass bag filter and AMESA interruptions, REC/NL

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[31] *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010L0075*

[32] *Neuwahl F. et al (2019. Best Available Techniques (BAT) Reference Document for Waste Incineration; EUR 29971 EN*

3.10 Corrected and uncorrected dust data

Figure 43 shows an example of dust emissions during a start-up of corrected and uncorrected data from the REC incinerator in The Netherlands, all conform to the legal rules. It demonstrates the importance of studying the raw data to evaluate dioxin emissions.

The measurements of dust (total particulate matter) must comply with the monitoring standard – EN 13284-1, with an emission limit of 5 mg/ Nm^3 for the EU. The two graphs in the figure show the difference between corrected and uncorrected (raw) data on dust emissions. The graph at the right shows the officially reported dust emissions during the start-up. The second graph is uncorrected and on the right of the data table, where dust emissions by auxiliary gas burners have been omitted (natural gas). However, during heating up, dioxins will be formed, de-novo synthesis from PAH, in the soot stuck at the inside.

This publication is allowed by official regulation because start-ups are (still yet) excluded from EU regulations. Just because no waste is there to be burned, or at least that is the rationale behind this policy. The second graph shows clearly the start-up is problematic in the emission of dust with substances of very high concern (SVHC). This figure highlights the biased results when the results are legally corrected. Even 'clean' fuelling with natural gas accelerates dust emissions with dioxins during start-ups of waste incinerators.

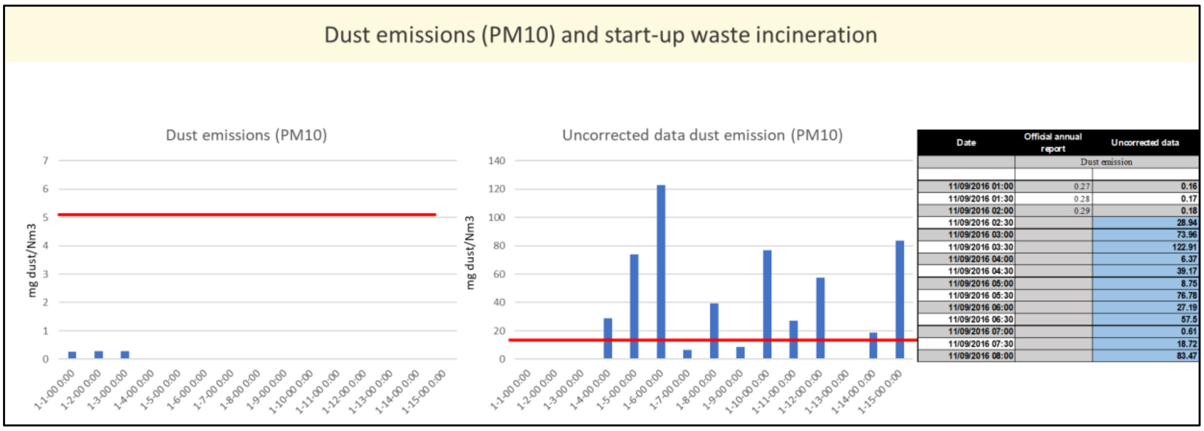

Figure 43: Dust emissions (PM10) and restarts at the REC incinerator (Netherlands)

4. Conclusion

The essence of the EU regulation of emissions of hazardous substances, no harm should be done to people and the environment. In principle, this is zero persistent organic pollutants (POP) emissions. In practice, this means the utmost effort should be made to minimise emissions of hazardous substances, like POPs, as much as possible (minimisation obligation). The management of a waste incineration plant should therefore cooperate by requests to provide transparent raw minute data for research. On behalf of obtaining insight information of substances of very high concern (SVHC)/POP emissions in the flue gasses spreading into the environment.

The perception the emissions of SVHC/POPs from waste incinerators are controlled every day, every hour, and every minute by AMESA equipment or other comparative semi-continuous measurement equipment is not correct. It is true, that the introduction of semi-continuous measurements, for monitoring dioxins of the flue gasses, is a major step forward. This measurement method is far more accurate than the EU-required short-term measurements of only 6-12 hours per year, pre-announced and under ideal production conditions. This study shows semi-continuous measurements of the flue gasses, however, also only during normal production conditions. During outages, also referred to as Other than Normal Operating Conditions, OTNOC, the semi-continuous measurement equipment falls out of order. It is precisely these periods of OTNOC times, that are characterised by unfavourable combustion conditions, that are prone to emissions of SVHC/POPs such as dioxins. Partly because of this performance, these measurements are referred to as semi-continuous. In other words, if semi-continuous measurements are not sampled/monitored during production processes, that are known for the release of SVHC, the analysis results of the semi-continuous measurements (AMESA) give an incorrect safety picture.

Findings ToxicoWatch study semi-continuous measurements 2020-2021 results, IVRY-PARIS XIII:

1. The total production time for 2020-2021 was 34.937 hours, of which 28.001 hours were measured.
2. In total 6.936 hours were not sampled/measured due to recorded 7.864 faults.
3. The discontinuous measurements and interruptions take place during OTNOC.
4. Command: "Fire-off" was given 320 times.
5. In 2 years, 43 start-ups took place outside regular maintenance shutdowns/start-ups.
6. Unserviceable data shutdown and restart phases due to the use of incorrect units of measurement.
7. Critical notes on the methodology of emission measurements.

The BREV-2019 requires all efforts and best available techniques (BAT) to be applied to reduce emissions of substances of very high concern into the environment to protect human health. Waste incinerator management can contribute to the requirement of minimisation of hazardous substance emissions by allowing research of direct data, uncorrected, from the control room in the time of lack of data from semi-continuous measurements (AMESA). This study shows that appropriate monitoring, analysis, and independent studies of transparent data from industry are urgently needed to make real efforts to reduce hazardous emissions from incinerators to zero.

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List of Figures

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Annex

Hidden Emissions Waste Incinerator IVRY-PARIS XIII

AMESA semi-continuous measurements
2020 - 2021

Annex 1: AMESA data, August 2021

Parametres	Ligne 1
Numtro de sfrie	860263
Version de soft	AMF.SADDAT v2.5.2.0
Numfro du compteur de 2az (type Gallus)	38322344+40884324
°'but des mesures (date et heurc)	02/08/2021 12'46
Fin des mesures (date cl heurel	30/08/2021 11:07

[redacted] [redacted]

TW7.1	begin	end	total time	fire on time	fireoff	Amesatime	Offllnetotal	offllne operational
Total	02-08-21/12:46	07-08-21/11:16	118:30:00	118:30:00	00:00:00	114:05:00	''	4:25:001
				100%	**0%**	**96%**	**4%**	4%
Specific	06-08-21/04:34	06-08-21/07:14						oj·'
	06-08-21/09:39	06-08-21/10:59						
	07-08-21/09:04	07-08-21/10:44					2	
	07-08-21/10:54	07-08-21/11:14						

Number **22.28** **0.134** **ng TEQ/Nm3**

TW7.2	begin	end	total time	fire on time	fire off	'
Total	07-08-21/11:27	30-08-21/11:07	551:39:00	240:44:ool	310:S"'	
				44%1		
Specific	07-08-21/18:21	07-08-21/18:58				
	08-08-21/07:58	21-08-21/19:13				
	21-08-21/20:50	22--08-21/03:55				
	22-08-21/06:14	22-08-21/06:50				
	21-08-21/20:50	23-08-21/18:24				
stop		30-08-21/11,o-				

!Arch INr. Graplbegin

lil_i, ['

Annex 2: details of AMESA data for October 2021 on the 25-10-2021, line 2

Three different sheets are diffused for this measurement. It is probably the same cartridge, it suffit to press the button. If different cartridges have been used, a issue arises as to how to mix the XAD-2 liquid to obtain a true estimate of dioxin emissions.

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AMESA measurement summary

IVRY SUR SEINE LIGNE 2

File ident: Amesa_860250-P86.021.3-23.11.2021-11:38

Cartridge box no. 1  -  IVRY SUR SEINE  L 2     Measurement no. 8

Start: 25.10.2021/15:47   Leakage rate (164,9hPa) 0,038m≥/h
End..: 27.10.2021/10:42   Leakage rate (164,7hPa) 0,034m≥/h

Measurement duration ....................MDurat:     41:01 h:min
Sample gas volume norm mass flow meter TGVN MDM:    25,064 m≥
Sample gas volume norm gasmeter ....... TGVN GU:    25,369 m≥
Condensate volume of sampling .......... CONVOL:      5,64 l
Operating density factor ............... BDFAKT:     0,762
Mean H2O in flue gas ..................... MH2O:     228,5 g/m≥
Mean O2 ................................... MO2:      13,8 %
Mean CO2 ................................. MCO2:       7,7 %
Mean PSTAT ..............................MPSTAT:    1019,0 hPa
Mean TRG ................................. MTRG:      67,0 ∞C
Mean vH ................................... MVH:     13,77 m/s
Substitutes ...................................: ....................
Last parameter access time ....... PARAMACCTIME: 27.10.2021/10:34
1 of actual sampling [%].......................:       100 %
2 of actual sampling [%].......................:       100 %
1 of actual year [%]...........................:        96 %
2 of actual year [%]...........................:        98 %
1 of last year [%].............................:        98 %
2 of last year [%].............................:        99 %

Events during measurement 5:

27-10-21/08:47 X  No fire Alarm
27-10-21/08:48 X  No fire Alarm
27-10-21/10:38 X  No fire Alarm
27-10-21/10:39 X  No fire Alarm
27-10-21/10:39 X  No fire Alarm

FA events during measurement: 0

Total FA time .....:     0:00 h:min
Total Fire on time :    42:55 h:min
```

```
AMESA measurement summary

IVRY SUR SEINE LIGNE 2

File ident: Amesa_860250-P86.021.3-23.11.2021-11:38

Cartridge box no. 1  -  IVRY SUR SEINE  L 2     Measurement no. 9

Start: 27.10.2021/10:57   Leakage rate (164,1hPa) 0,032m≥/h
End..: 27.10.2021/17:00   Leakage rate (170,0hPa) 0,051m≥/h

Measurement duration ....................MDurat:      6:00 h:min
Sample gas volume norm mass flow meter TGVN MDM:     3,666 m≥
Sample gas volume norm gasmeter ....... TGVN GU:     3,722 m≥
Condensate volume of sampling .......... CONVOL:      0,76 l
Operating density factor ............... BDFAKT:     0,619
Mean H2O in flue gas ..................... MH2O:     210,0 g/m≥
Mean O2 ................................... MO2:      13,9 %
Mean CO2 ................................. MCO2:       7,7 %
Mean PSTAT ..............................MPSTAT:    1020,4 hPa
Mean TRG ................................. MTRG:      65,3 ∞C
Mean vH ................................... MVH:     13,43 m/s
Substitutes ...................................: ....................
Last parameter access time ....... PARAMACCTIME: 27.10.2021/10:34
1 of actual sampling [%].......................:        99 %
2 of actual sampling [%].......................:        99 %
1 of actual year [%]...........................:        96 %
2 of actual year [%]...........................:        98 %
1 of last year [%].............................:        98 %
2 of last year [%].............................:        99 %

Events during measurement 2:

27-10-21/16:57 X  No fire Alarm
27-10-21/16:57 X  No fire Alarm

FA events during measurement: 0

Total FA time .....:     0:00 h:min
Total Fire on time :     6:03 h:min
```

```
AMESA measurement summary

IVRY SUR SEINE LIGNE 2

File ident: Amesa_860250-P86.021.3-23.11.2021-11:36
Sampled using P86.021.3

Cartridge box no. 1  -  IVRY SUR SEINE  L 2     Measurement no. 8

Start: 27.10.2021/18:46   Leakage rate (164,0hPa) 0,035m≥/h
End..: 23.11.2021/11:34   Leakage rate (170,1hPa) 0,046m≥/h

Measurement duration ....................MDurat:    540:32 h:min
Sample gas volume norm MFM dry ....... TGVN MDM:   291,317 m≥
Sample gas volume norm MFM humid ..... TGVN MDM:   373,577 m≥
Sample gas volume norm gasmeter dry ... TGVN GU:   295,197 m≥
Sample gas volume norm gasmeter humid.. TGVN GU:   378,553 m≥
Condensate volume of sampling .......... CONVOL:     65,13 l
Operating density factor ............... BDFAKT:     0,787
Mean H2O in flue gas ..................... MH2O:     227,0 g/m≥
Mean O2 ................................... MO2:      13,5 %
Mean CO2 ................................. MCO2:       8,1 %
Mean PSTAT ..............................MPSTAT:    1017,0 hPa
Mean TRG ................................. MTRG:      64,3 ∞C
Mean vH ................................... MVH:     12,05 m/s
Maximum TKT ............................ MAXTKT:      34,7 ∞C
Mean TKT ................................. MTKT:      21,1 ∞C
Stack cross section ........................QRK:      1,00 m≤
Stack diameter .............................DRK:      1,13 m
Substitutes ...................................: ....................
Last parameter access time ....... PARAMACCTIME: 27.10.2021/17:27
1 of actual sampling [%].......................:        99 %
2 of actual sampling [%].......................:       100 %
1 of actual year [%]...........................:        96 %
2 of actual year [%]...........................:        99 %
1 of last year [%].............................:        98 %
2 of last year [%].............................:        99 %

Events during measurement 96:
```

Annex 3: Semi-continuous measurements XP XIII, line 1

Line 1 - Semi-continuous measurements (AMESA) dioxin emissions, IP XIII 2020 -2021

			Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation	TW calculation	AMESA	AMESA	Socorair	TW
			AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	E-C	file rtf	file csv		number
Year	Month	Line	Start time	End time	Total time	Cartridge ex	Fire on time	Fire off (FA)	Total time ON	AMESA time OFF		Events	Events (FA)	ng TEQ/Nm3	
					(A) inc.		(B)	(C)	(D) Measurement (Mdurat)	(E) total	(F) operational				
2020	Dec/Jan	1	24.12.2019/10:57	21.1.2020/12:35	673:38:00		625:24:00	48:14:00	624:59:00	48:39:00	0:25:00	10	2	0,004	1
	Jan/Feb	1	21.1.2020/13:06	18.2.2020/10:11	669:05:00	0:31:00	105:13:00	563:52:00	105:07:00	563:58:00	0:06:00	5	1	0,009	2
	Febr/Mar	1	18.2.2020/10:22	17.3.2020/12:55	674:32:00	0:11:00	613:50:00	60:42:00	613:02:00	61:30:00	0:48:00	15	1	0,006	3
	Mrt/Apr	1	17.3.2020/13:13	14.4.2020/11:56	670:43:00	0:18:00	670:43:00	0:00:00	650:55:00	19:48:00	19:48:00	153	0	0,013	4
	Apr/May	1	14.4.2020/12:21	12.5.2020/10:58	669:12:25	0:25:00	669:11:00	0:01:25	658:55:00	10:17:25	10:16:00	77	2	0,023	5
	May/June	1	12.5.2020/11:15	9.6.2020/10:13	670:57:00	0:17:00	558:43:00	112:14:00	555:58:00	114:59:00	2:45:00	40	3	0,022	6
	June/July	1	09-06-20/10:34	07-07-20/10:51	672:17:00	0:19:00	672:12:00	0:05:00	672:07:00	0:10:00	0:05:00	5	1	0,017	7
	July/Aug	1	7.7.2020/11:21	4.8.2020/11:18	671:57:00	0:30:00	625:41:00	46:16:00	616:58:00	54:59:00	8:43:00	80	2	0,018	8
	Aug	1	4.8.2020/11:47	1.9.2020/11:47	672:05:19	0:29:00	0:00:00	672:05:19	0:00:00	672:05:19	0:00:00	2	1		
	Sept	1	1.9.2020/12:13	29.9.2020/10:53	670:40:00	0:30:00	582:28:00	88:12:00	559:50:00	110:50:00	22:38:00	53	4	0,045	10
	Sept/Oct	1	29.9.2020/11:23	28.10.2020/11:06	695:43:00	0:30:00	695:40:00	0:03:00	674:34:00	21:09:00	21:06:00	646	3	0,052	11
	Oct/Nov	1	28.10.2020/11:28	23.11.2020/14:24	626:55:00	0:23:00	626:52:00	0:03:00	618:44:00	8:11:00	8:08:00	189	2	0,039	12
	Nov/Dec	1	23.11.2020/14:50	22.12.2020/11:15	683:56:00	00:26	683:55:00	0:01:00	569:40:00	114:16:00	114:15:00	17	1	0,200	13
	Dec/Jan	1	22.12.2020/11:56	19.1.2021/11:11	671:15:00	0:41:00	671:15:00	0:00:00	663:46:00	7:29:00	7:29:00	19	0	0,040	14
2021	Jan/Feb	1	19.1.2021/11:36	16.2.2021/09:51	670:14:00	0:25:00	670:13:00	0:01:00	669:15:00	0:59:00	0:58:00	22	1	0,035	15
	Feb/Mar	1	16.2.2021/10:17	15.3.2021/14:58	652:40:00	0:26:00	520:12:00	132:28:00	520:05:00	132:35:00	0:07:00	5	1	0,091	16
	Mrt/Apr	1	15.3.2021/15:24	13.4.2021/11:17	691:53:00	0:26:00	691:53:00	0:00:00	655:13:00	36:40:00	36:40:00	335	0	0,098	17
	Apr/May	1	13.4.2021/11:43	10.5.2021/14:54	692:08:00	0:26:00	692:08:00	0:00:00	646:35:00	45:33:00	45:33:00	26	0	0,054	18
	May/June	1	10.5.2021/15:17	7.6.2021/11:22	668:05:00	0:23:00	309:55:00	358:10:00	309:52:00	358:13:00	0:03:00	6	2	0,086	19
	June/July	1	7.6.2021/11:44	6.7.2021/07:52	692:08:00	0:22:00	273:13:00	0:00:00	273:13:00	418:55:00	418:55:00	5	0	0,096	20
	July/Aug	1	6.7.2021/14:56	2.8.2021/12:22	645:26:00	7:04:00	645:26:00	0:00:00	637:20:00	8:06:00	8:06:00	55	0	0,076	21
	Aug	1	2.8.2021/12:46	30.8.2021/11:07	670:09:00	0:22:00	518:31:00	151:38:00	330:34:00	339:35:00	187:57:00	120	3	0,134	22
	Sept	1	30.8.2021/11:38	27.9.2021/11:44	672:06:00	0:31:00	672:03:00	0:03:00	666:54:00	5:12:00	5:09:00	91	1	0,049	23
	Sept/Oct	1	27.9.2021/12:07	25.10.2021/15:58	675:51:00	0:23:00	675:51:00	0:00:00	671:01:00	4:50:00	4:50:00	38	0	0,044	24
	Oct/Nov	1	25.10.2021/16:21	23.11.2021/10:50	664:21:00	0:23:00	588:26:00	75:55:00	557:12:00	107:09:00	31:14:00	34	4	0,052	25
	Nov/Dec	1	23.11.2021/11:21	21.12.2021/11:26	672:04:00	0:31:00	671:59:00	0:05:00	669:02:00	3:02:00	2:57:00	72	2	0,027	26
					17460:00:44	17:12:00	14730:57:00	2310:08:44	14190:51:00	3269:09:44	959:01:00	2120	37	1,33	

TW indicative emission scale	
TEQ PCDD/F	
< 0.01	
0.01 - 0.05	
> 0.05	
> 0.1	

TW indicative emission scale	
Occurence events	
< 50	
50 - 100	
100 - 300	
300 - 500	
> 500	

Line 2 emi con nuous measurements A A dioxin emissions, P 2020 2021

			Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation	TW calculation	AMESA	AMESA	Socorair	TW
			AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	E-C	file rtf	file csv		number
Year	Month	Line	Start time	End time	Total time	Cartridge ex	Fire on time	Fire off (FA)	Total time ON	AMESA time OFF		Events	Events(FA)	ng TEQ/Nm3	
					(A) inc.		(B)	(C)	(D) Measurement (Mdurat)	(E) total	(F) operational				
2020	Dec/Jan	2	24.12.2019/10:04	21.1.2020/11:39	673:35:00		673:35:00	0:00:00	670:10:00	3:25:00	3:25:00	61	0	0,052	1
	Dec/Jan	2	21.01.2020/12:22	18.2.2020/10:36	670:13:00	0:43:00	131:30:00	538:43:00	131:24:00	538:49:00	0:06:00	61	0	0,048	2
	Febr/Mar	2	18.2.2020/10:51	17.3.2020/12:26	673:34:00	0:15:00	673:34:00	0:00:00	663:16:00	10:18:00	10:18:00	309	0	0,035	3
	Mrt/Apr	2	17.3.2020/12:45	14.4.2020/11:22	670:37:00	0:19:00	670:37:00	0:00:00	628:33:00	42:04:00	42:04:00	343	0	0,059	4
	Apr/May	2	14.4.2020/11:48	12.5.2020/10:18	670:30:00	0:26:00	542:26:00	128:04:00	535:50:00	134:40:00	6:36:00	81	4	0,079	5
	May/June	2	12.5.2020/10:42	9.6.2020/10:46	670:30:00	0:24:00	289:56:00	382:07:00	289:33:00	380:57:00		20	1	0,040	6
	May/June	2	9.06.2020/11:06	7.7.2020/10:13	671:07:00	0:22:00	670:33:00	0:34:00	295:58:00	375:09:00	374:35:00	8	1	0,020	7
	July/Aug	2	7.7.2020/10:39	4.8.2020/10:47	672:07:00	0:26:00	672:07:00	0:00:00	656:15:00	15:52:00	15:52:00	208	0	0,036	8
	Aug/sept	2	4.8.2020/11:10	1.9.2020/12:23	673:12:00	0:23:00	420:49:00	252:23:00	418:35:00	254:37:00	2:14:00	34	2	0,021	9
	Sept	2	1.9.2020/12:47	29.9.2020/10:07	669:19:00	0:24:00	622:35:00	46:44:00	580:52:00	88:27:00	41:43:00	21	3	0,025	10
	Sept/Oct	2	29.9.2020/10:43	28.10.2020/11:44	697:01:00	0:36:00	695:58:00	1:03:00	617:53:00	79:08:00	78:05:00	65	1	0,008	11
	Oct/Nov	2	28.10.2020/12:09	23.11.2020/15:11	627:01:00	0:25:00	626:46:00	0:15:00	601:31:00	25:30:00	25:15:00	112	1	0,017	12
	Nov/Dec	2	23.11.2020/15:37	22.12.2020/12:05	692:28:00	0:26:00	692:28:00	0:00:00	690:41:00	1:47:00	1:47:00	46	0	0,019	13
	Dec/Jan	2	22.12.2020/12:23	19.1.2021/10:39	670:16:00	0:18:00	418:58:00	251:18:00	413:30:00	256:46:00	5:28:00	269	2	0,021	14
2021	Jan/Feb	2	19.1.2021/11:01	16.2.2021/09:08	670:07:00	0:22:00	587:43:00	82:24:00	510:47:00	159:20:00	76:56:00	55	2	0,027	15
	Febr/Mar	2	16.2.2021/09:39	15.3.2021/14:21	652:42:00	0:31:00	652:42:00	0:00:00	643:31:00	9:11:00	9:11:00	234	0	0,029	16
	Mar/Apr	2	15.3.2021/14:47	13.4.2021/10:45	691:58:00	0:26:00	691:58:00	0:00:00	632:57:00	59:01:00	59:01:00	1802	1	0,055	17
	Apr/May	2	13.4.2021/11:07	10.5.2021/14:02	670:30:00	0:22:00	643:26:00	7:28:00	627:23:00	43:07:00	35:39:00	325	1	0,066	18
	May/June	2	10.5.2021/14:44	7.6.2021/11:53	669:09:00	0:42:00	514:36:00	154:33:00	503:07:00	166:02:00	11:29:00	244	2	0,094	19
	June/July	2	7.6.2021/12:10	6.7.2021/08:51	692:25:00	0:17:00	691:34:00	0:51:00	664:39:00	27:46:00	13:50:00	48	14	0,074	20
	July/Aug	2	6.7.2021/09:18	2.8.2021/12:58	651:40:00	0:27:00	625:39:00	26:01:00	568:12:00	83:28:00	57:27:00	115	1	0,045	21
	Aug	2	2.8.2021/13:20	30.8.2021/11:48	670:28:00	0:22:00	284:19:00	386:09:00	0:00:00	670:28:00	284:19:00	11	1		
	Aug/Sept	2	30.8.2021/12:11	27.9.2021/12:19	672:07:00	00:23:00	671:05:00	1:02:00	579:22:00	92:45:00	91:43:00	317	1	0,037	23
	Oct	2	27.9.2021/12:38	25.10.2021/15:21	674:43:00	0:19:00	134:18:00	538:51:00	653:48:00	19:21:00	0:04:00	251	244	0,031	24
	Oct/Nov	2	25.10.2021/15:47	23.11.2021/11:34	689:45:00	0:26:00	592:46:00	96:59:00	587:33:00	102:12:00	5:13:00	103	1	0,027	25
	Nov/Dec	2	23.11.2021/12:08	21.12.2021/10:51	670:30:00	0:34:00	670:43:00	0:00:00	645:26:00	25:04:00	25:04:00	281	0	0,028	26
					17477:34:00	10:15:00	14562:41:00	2895:29:00	13810:46:00	3665:14:00	1277:24:00	5424	283	0,993	

TW indicative emission scale	
TEQ PCDD/F	
< 0.01	
0.01 - 0.05	
> 0.05	
> 0.1	

TW indicative emission scale	
Occurence events	
< 50	
50 - 100	
100 - 300	
300 - 500	
> 500	

Annex 5: Post-Combustion Zone (PCZ)

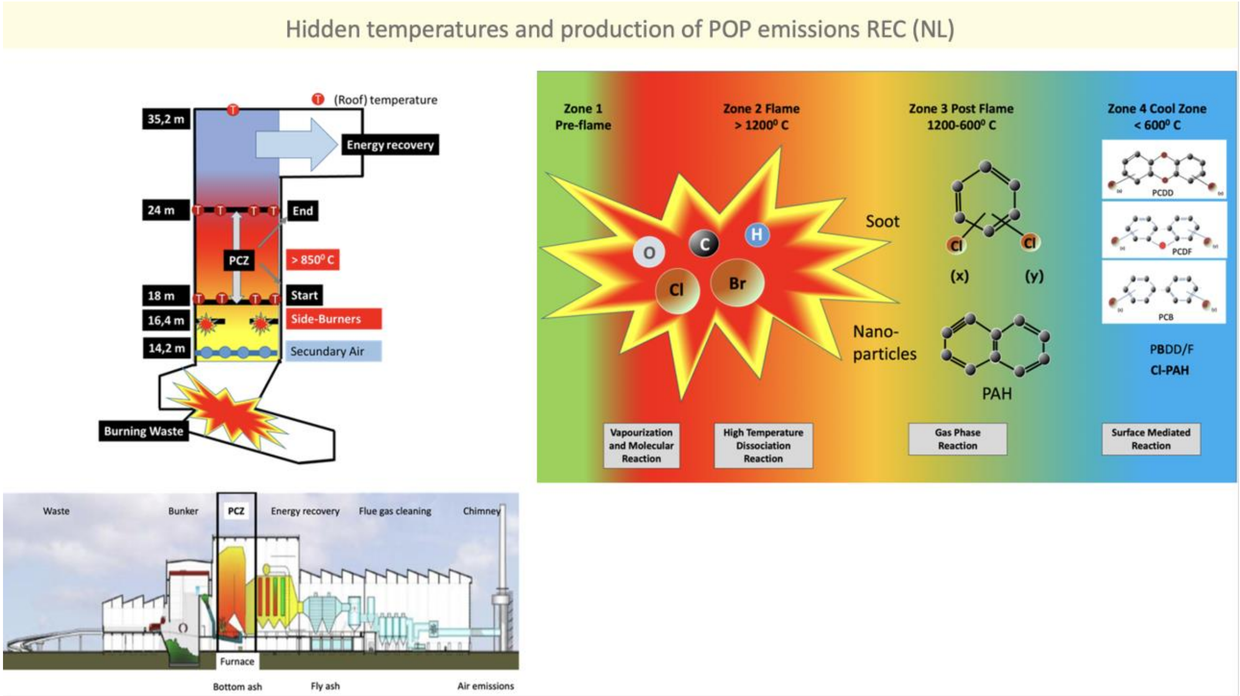

Figure 44: Post-Combustion Zone (PCZ), REC (NL) de-novo syntheses of dioxins concerning temperatures.

Annex 6: NOx emissions

The graphs of the emissions of NOx of IVRY-PARIS XIII, *Figure 45*, are based on the data the incinerator provided for the first half year of 2022. *Figure 46*, puts the NOx results of IVRY-PARIS XIII in the context of the worldwide emissions charts with France at position number 8. The incinerator has a DeNOx installation to reduce the NOx emission to an acceptable level of less than 100 mg NOx/Nm^3. In the graphs below are several unexplained drops in the NOx data stops. It would be interesting to study uncorrected data to determine the reason for these drops. From the experience of other incinerators, this could be an exceeding of the NOx upper limits and that is why the values are set manually to zero.

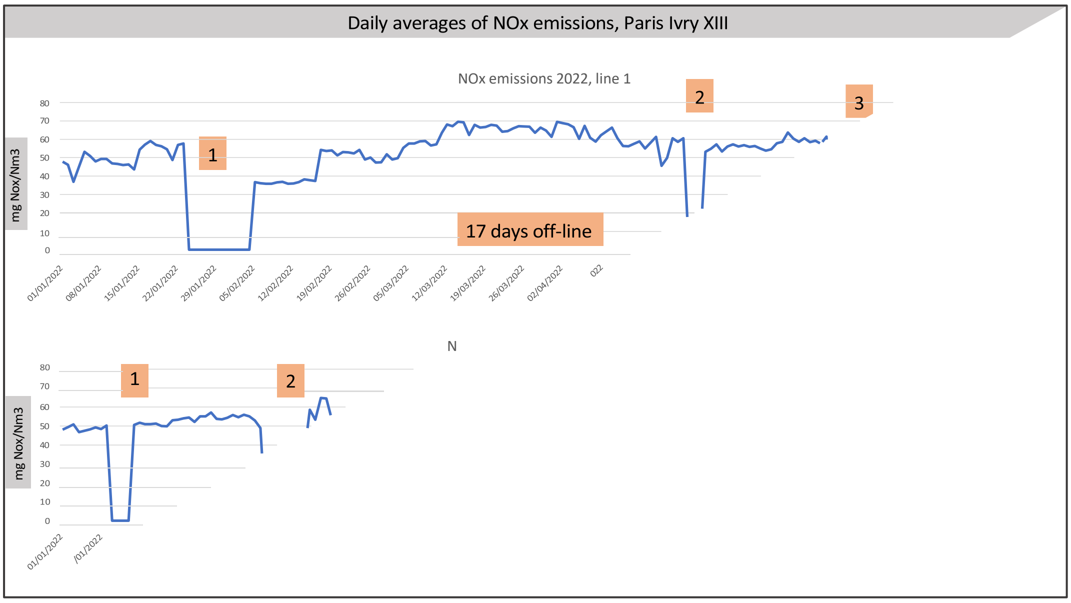

Figure 45: Daily averages of NOx emissions Ivry-Paris XIII, Line 1 and 2, 2022

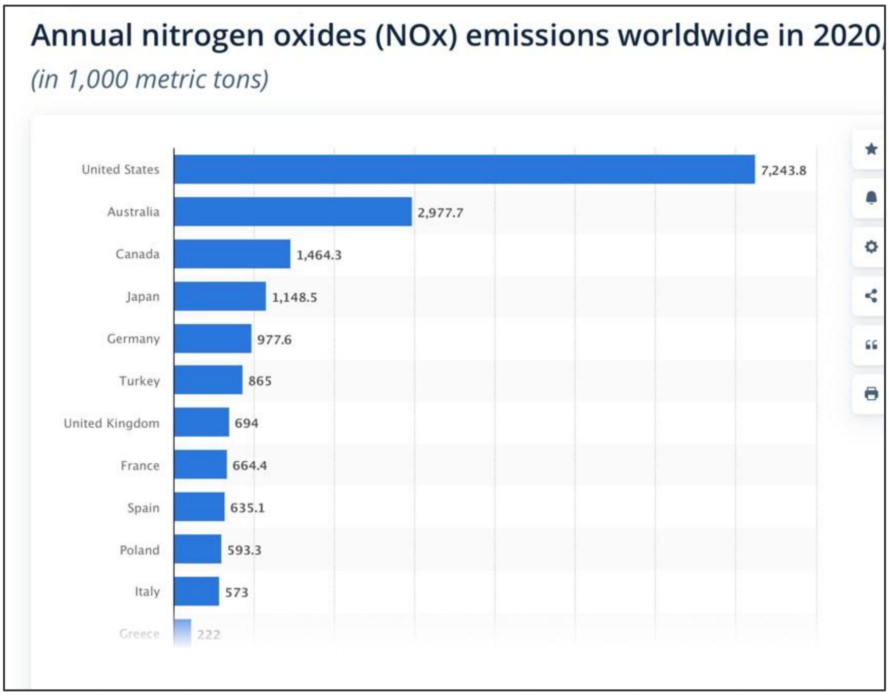

Figure 46: Annual nitrogen oxides (NOx) emissions worldwide in 2020, source: https://www.statista.com/statistics/478831/leading-countries-based-on-nitrogen-oxide-emissions/

Annex 7: Benzene and carbon monoxide emissions

Several volatile organic compounds were also measured in the start-up and shutdown monitoring reports of Veritas[33]. *Table 10* gives the emission result of benzene with 1.75 mg/Nm^3 or 1750 microgram/ Nm^3 in the emission gas of IVRY-PARIS XIII. In the Netherlands, there is a limit of 5 microgram/ Nm^3, with an obligation to minimise emissions.

					gaz sec					
Benzène	SPE 1	1,75	-	-	mg/Nm3 exprimé en C6H6 sur gaz sec	0,443	-	-	kg/h	NON
Chlorobenzène	SPE 1	0,0174	-	-	mg/Nm3 exprimé en C6H5Cl sur gaz sec	0,00439	-	-	kg/h	NON

Table 9: Ivry-Paris XIII data of Benzene in start-up measurement.

Carbon monoxide

Figure 47 is shown the graph of carbon monoxide emissions at the 3-9-2020. It is only indicated in the Veritas reports but not discussed further and no semi-continuous measurement took place at that time. Carbon monoxide is associated with incomplete combustion and hence dioxin formation. In the Netherlands, CO emissions above 150 ppm for a half hour is not allowed. In the air quality directive (2008/EC/50), the EU has set a limit value for carbon monoxide (CO) in the air quality directive (2008/EC/50) of 10 milligrams per cubic metre (mg/m3) for daily 8-hour mean values (conversion factor ppm to mg/Nm^3 = 1.25). [34]

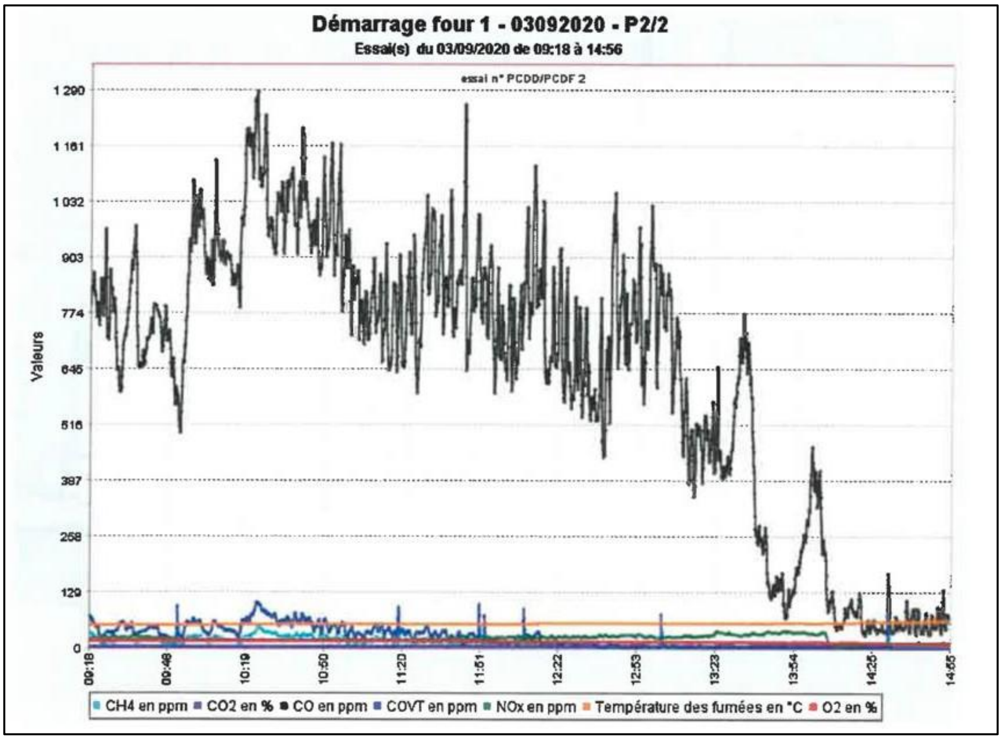

Figure 47: Carbon monoxide, Ivry-Paris XIII, 3 September, 2020

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[33] *Mesures de émissions atmosphériques, démarrage du four no. 1. Rapport : 9275363/11.1.4.R, bureau Veritas, 02/09/2020 au 03/09/2020, page 11/215*

[34] *https://www.eea.europa.eu/data-and-maps/figures/carbon-monoxide-8-hour-mean-limit-value-for-the-protection-of-human-health-5*

Annex 8: Codes used in AMESA.

AMESA-D

Description of record variables (firmware beginning with P86.020.5)

Startrecord..: S

HUMID.......: Current humidity in flue gas [g/m³]

CO2MAX......: CO2 upper limit [%]

TRGUGR......: Flue gas temperature lower limit [°C]

O2OGR.......: O2 upper limit [%]

O2UGR.......: O2 lower limit [%]

VHUGR.......: Flue gas velocity lower limit [m/s]

Start.......: manual, time

End.........: Endmode:

manual, durat, time, onTGVN

DW..........: Effective probe diameter [mm]

QRK.........: Stack cross section [m²]

DRK.........: Stack diameter [m]

Substitutes.: Active substitutes:

F, O2, CO2, TRG, PST, VH

AW..........: Maintenance

lcpres......: Leak check pressure [hPa]

leakr.......: Leakage rate [m³/h]

Endrecord....: E

MDurat......: Current measurement duration [h:min]

TGVNMD......: Sample gas volume norm MFC [dry.m³]

TGVNMD......: Sample gas volume norm MFC [hum.m³]

TGVNGU......: Sample gas volume norm gasmeter [dry.m³]

TGVNGU......: Sample gas volume norm gasmeter [hum.m³]

CONVOL......: Entire condensate volume of sampling [l]

BDFAKT......: Mean operating density factor gasmeter of entire sampling

MH2ORG......: Mean H2O in flue gas of entire sampling [g/m³]

MO2.........: Mean O2 in flue gas of entire sampling [%]

MCO2........: Mean CO2 in flue gas of entire sampling [%]

Paramacctime: Time of last parameter change

End.........: Reason:

manual, durat, time, RC com, TGVN

NEV.........: Number of events during sampling

Substitutes.: Active substitutes:

F, O2, CO2, TRG, PST, VH

AW..........: Maintenance

AVS1........: 1 of actual sampling [%]

AVS2........: 2 of actual sampling [%]

AVTY1.......: 1 of actual year [%]

AVTY2.......: 2 of actual year [%]

AVPY1.......: 1 of last year [%]

AVPY2.......: 2 of last year [%]

ngup........: Number of gas meter pulses

ISORAT......: ISO rate

MPSTAT......: Mean PSTAT [hPa]

MTRG........: Mean flue gas temperature [°C]

MVH.........: Mean flue gas velocity [m/s]

MAXTKT......: Maximum cartridge temperature [°C]

MTKT........: Mean cartridge temperature [°C]

lcpres......: Leak check pressure [hPa] ^

leakr.......: Leakage rate [m³/h]

Runtimerecord: L

vHM.........: Mean flue gas velocity of period [m/s]

TGVNMD......: Mean sample gas volume norm MFC [m³]

TGVNGU......: Mean sample gas volume norm gasmeter [m³]

O2M.........: Mean O2 in flue gas of period [%]

CO2M........: Mean CO2 in flue gas of period [%]

CONVOL......: Entire condensate volume of current sampling

FM..........: Mean humidity of period [g/m³]

BDFAKT......: Operating density factor

PGUM........: Mean Pressure of gasmeter of period [hPa]

TGUM........: Mean Temperature of gasmeter of period [°C]

TRGM........: Mean flue gas temperature of period [°C]

TRGMIN......: Mainimum flue gas temperature of period [°C]

TRGMAX......: Maximum flue gas temperature of period [°C]

TKTM........: Mean cartridge temperature of period [°C]

TKTMAX......: Maximum cartridge temperature of period [°C]

TC1.........: Stack box temperature

TCS.........: Probe temperature

TCF.........: Filter temperature

ISORATM.....: Mean ISO rate

Substitutes.: Active substitutes:

F, O2, CO2, TRG, PST, VH

AW..........: Maintenance

FA..........: No fire

Eventrecord..: X

vH..........: Current flue gas velocity [m/s]

TGVNMD......: Sample gas volume norm MFC [m³]

TGVNGU......: Sample gas volume norm gasmeter [m³]

O2..........: O2 in flue gas [%]

CO2.........: CO2 in flue gas [%]

CONVOL......: Condensate volume

F...........: Humidity [g/m³]

BDFAKT......: Operating density factor

PGU.........: Pressure of gasmeter [hPa]

TGU.........: Temperature of gasmeter [°C]

TRGMIN......: Mainimum flue gas temperature

TRGMAX......: Maximum flue gas temperature

TKTMAX......: Maximum cartridge temperature

TC1.........: Stack box temperature

TCS.........: Probe temperature

TCF.........: Filter temperature

ISORAT......: ISO rate

Substitutes.: Active substitutes:

F, O2, CO2, TRG, PST, VH

AW..........: Maintenance

FA..........: No fire

Reason......: Event:

Break terminated

manual command

No fire

O2 > O2OGR or < O2UGR

TRG < TRGMIN

VH < VHUGR

Alarm

Power on   (Power off:

Cartridge box switching

Remote command

Start of period

Probe purging

CO2 > CO2OGR or < CO2UGR

Remote break flag set

Shutdown command

Alarmrecord..: A

Pending alarms

Time........: Point of time

Type........: raised / cleared