Hidden emissions waste incinerator IVRY-PARIS XIII

AMESA semi-continuous measurements 2020 - 2021

A study on AMESA data of
34 937 hours
measurements

ToxicoWatch, December 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

The biomonitoring study 2021 of ToxicoWatch (TW) in Ivry-Sur-Seine reported high dioxin levels in backyard chicken eggs from private chicken coop owners, as well in samples of vegetation like evergreen tree leaves, and mosses in the area around the waste incinerator IVRY-PARIS XIII. The dioxin patterns found in the eggs are broadly consistent with those given in the emission patterns from the waste incinerator IVRY-PARIS XIII. The question is whether the old burning waste facility is responsible for these high results of dioxins found in the chicken eggs and vegetation. To answer this question, a follow-up study is requested by Collectif 3R (Réduire, Réutiliser, Recycler) on semi-continuous measurements (Adsorption MEthod for SAmpling , AMESA) for dioxins and furans (PCDD/F/dl-PCB) 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 under an ideal production situation. These are semi-continuous measurements since analysis results can be provided only after six (6) weeks. The second reason, why these measurements can be called 'semi-continuous' is that the technical device, in this case, the AMESA equipment, is not operating continuously due to events/calamities of incinerating waste process. These timeframes of events/calamities will be specifically discussed more in detail in this TW report.

The provided data of 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 and 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 2015-20217. However, compared with the REC waste incinerator in the Netherlands, the average dioxin emissions of IVRY-PARIS XIII are 3 to 4 times higher for lines 1 and 2, respectively. In the Netherlands, a moratorium has been imposed on waste incinerators.[1] Therefore, a stricter dioxin (only for PCDD/F) limit of 0.01 ng TEQ/ Nm^3 has been set for the last built waste incinerator REC instead of the 33-year-old EU standard of 0.1 ng TEQ/ Nm^3. If this stricter standard had been applied to the incinerator IVRY-PARIS XIII incinerator, it would have violated regulations almost all year long.

The emission data show that this waste incineration process is extremely vulnerable to disturbances. The sampling instrumentation has been out of service for nearly 7,000 hours during 2 years for these two lines in IVRY-PARIS XIII, meaning 291 days or nearly 10 months in 2 years. Outside maintenance hours, the incinerator has had more than 4,000 hours of problems with 'fire control', meaning 167 days or 5 months in 2 years. If this is linked to low temperatures in the combustion chamber, there is a huge problem. The EU regulation mandates a waste burning temperature of 850° C for at least 2 seconds resident time in the post-combustion zone (PZC). The number of events or failures of sampling in IVRY-PARIS XIII is extremely high compared to the facility in the Netherlands for the same period of two (2) years.

The above-highlighted results of this TW study show indicators of a malfunctioning of the waste incinerator IVRY-PARIS XIII. The question needs to be asked - as well in general - whether *building (new) waste incineration is a sustainable solution*. And more specifically for IVRY-PARIS XIII, should a (newly built) waste incinerator at all be in a modern capital city like Paris? The emission of toxic substances is a serious risk to public health, which is inevitably linked to waste incineration as data show, that is why requesting the dioxin limit to be set to 0,01 ng TEQ/Nm^3 is needed for IVRY-PARIS XIII like REC in the Netherlands. The structurally occurring malfunctions during shutdowns and start-ups could become more transparent and understandable by monitoring and stricter enforcement by the government.

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

Introduction

Dioxins from industrial emissions are unintentionally produced toxic substances, so-called unintentionally produced persistent organic pollutants (POPs/UPOPs). The EU mandates for industrial emissions are only based on short-term 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 undertaken to eliminate or at least do the utmost to reduce these substances of very high concern (SVHC).

In 2021, ToxicoWatch (TW) was commissioned by Collectif 3R (*Réduire, Réutiliser, Recycler*) to carry out biomonitoring research in Paris/Ivry-sur-Seine. Therefore, private chicken coop owners - for the need of backyard chicken eggs - are approached living within a short distance of the waste incinerator IVRY-PARIS XIII. Also, vegetation (leaves of evergreen trees, pine needles, and mosses) in the area around IVRY-PARIS XIII is used as biomarker samples. The results of this TW research in 2021 showed extremely high values of dioxins (PCDD/F/dl-PCB) in eggs and vegetation, especially compared with other TW-biomonitoring studies in Europe related to waste incineration (2014-2022). Due to these alarming results, it was decided to carry out a follow-up study on the technical data of semi-continuous measurements (Adsorption MEthod for Sampling, AMESA) for dioxins and furans, (PCDD/F/dl-PCB) from IVRY-PARIS XIII.

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 with 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 of 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]

[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 questions and answers (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 of 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.

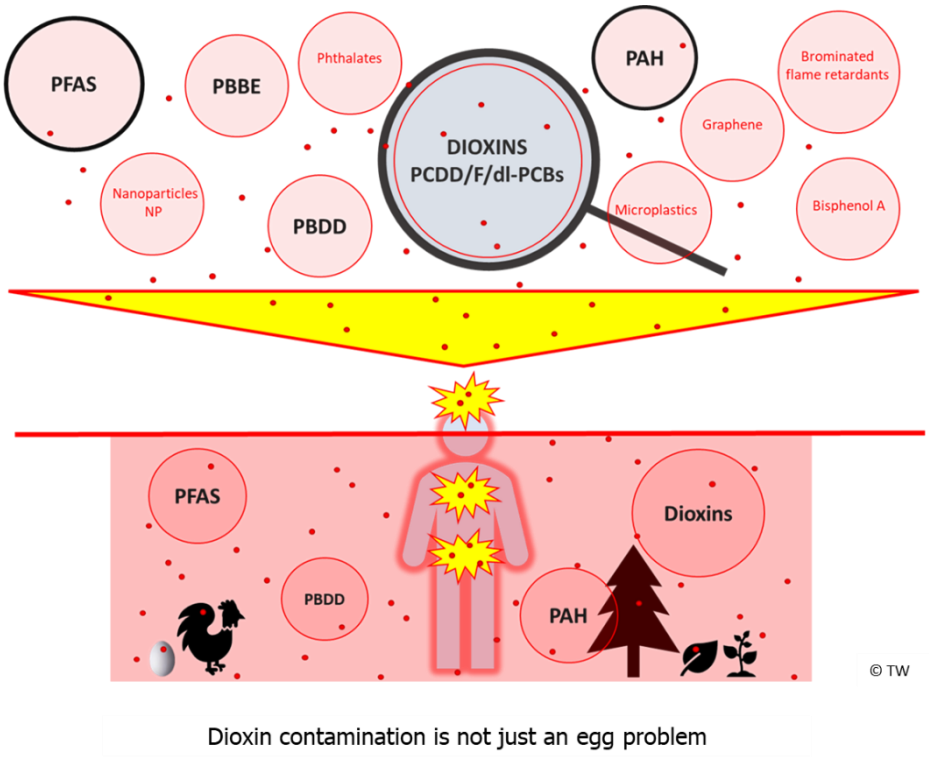


Figure 1: "Dioxin contamination is not just an egg problem", infographic TW

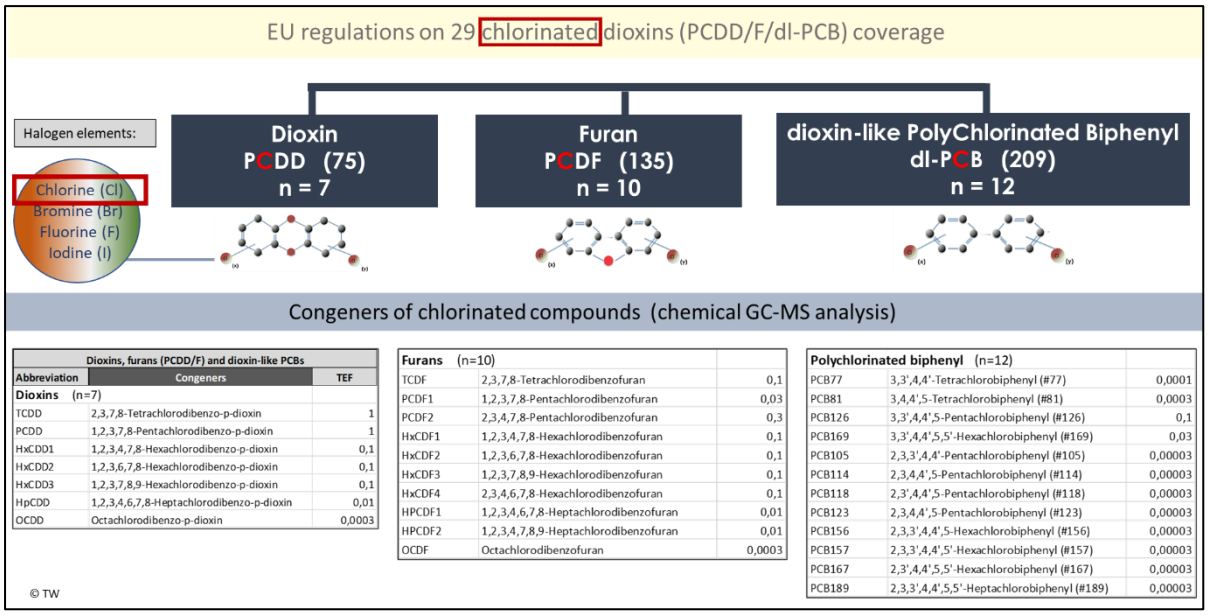
The aim of ToxicoWatch (TW) Foundation, a Public Benefit Organisation (PBO), is to raise public awareness of man-made toxic substances in our environment. One of the main fields of research for TW is biomonitoring emissions of persistent organic pollutants (POPs), such as dioxins and PFAS mostly in relation 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 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/Nm^3** 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.



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

In the Netherlands, there is a moratorium on incinerators. The most recently built waste incinerator in 2011 has a dioxin (PCDD/F) emission limit value 10 times stricter, 0,01 ng TEQ/ Nm^3 than required for other EU countries.

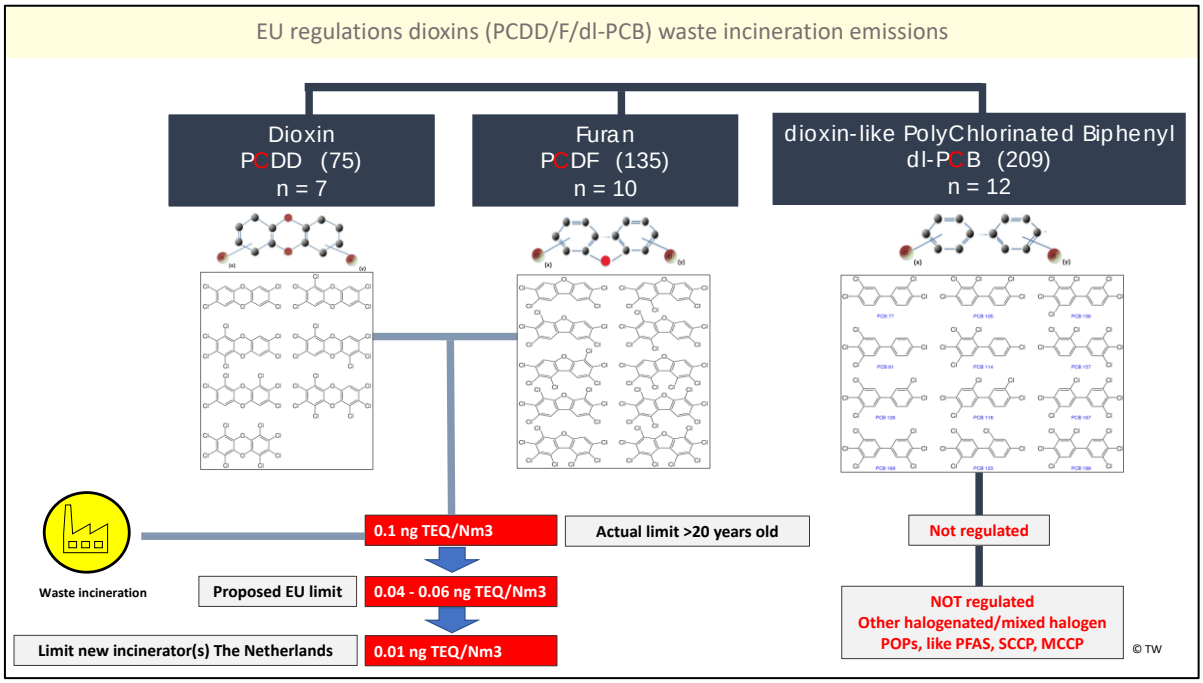
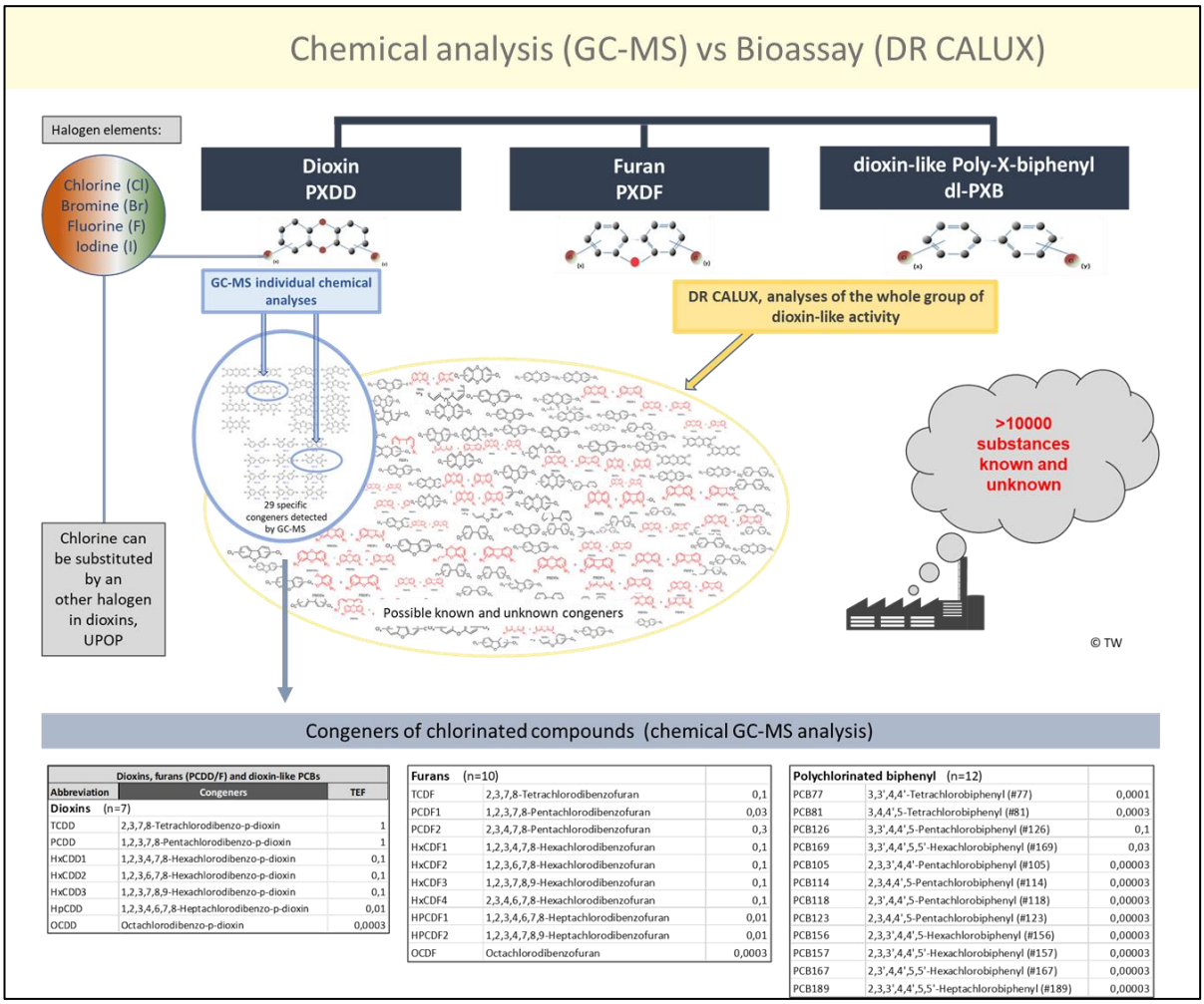


Figure 3: EU Regulation standards in ng TEQ/ Nm3 for dioxin (PCDD/F) emissions waste incinerators

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



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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

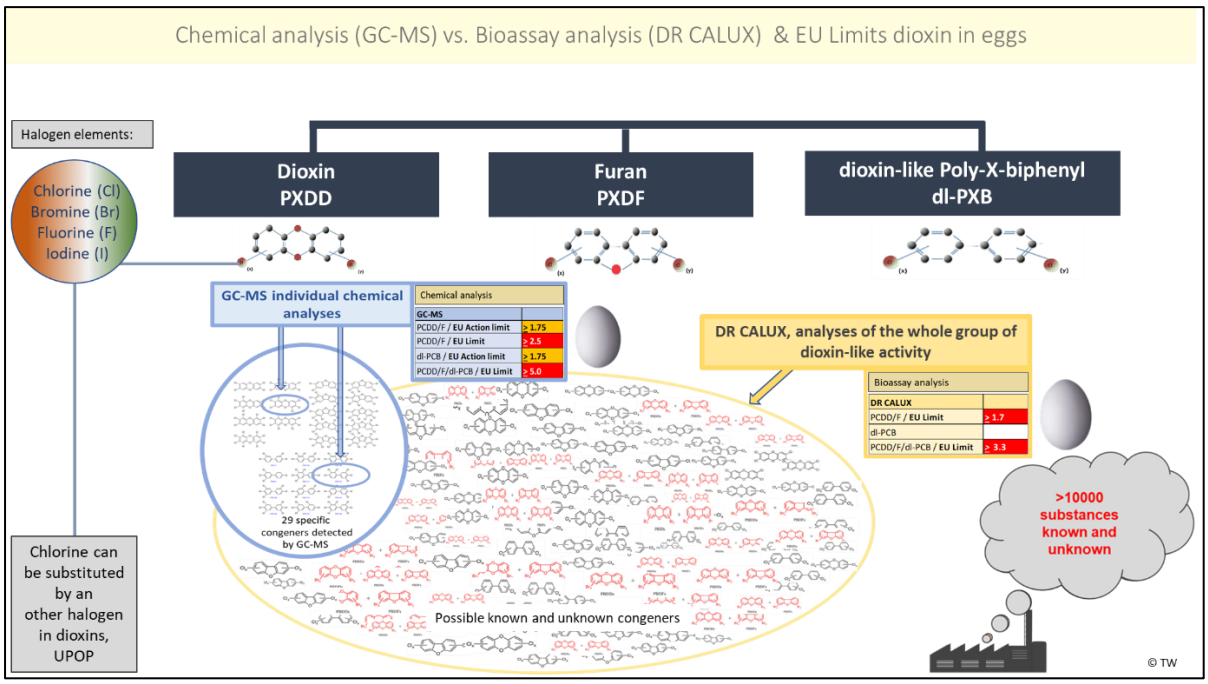


Figure 5: Chemical analysis (GC-MS) vs Bioassay (DR CALUX) and EU limits for food (Eggs)

1.2 French regulatory framework and IVRY-PARIS XIII Incinerator

In the French national regulation, the limit value for dioxins (PCDD/F) in France 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 Authorization 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 throughout max. 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/$Nm^3$for measurements with a duration between 6 and 8 hours
- 0,08 ng TEQ/Nm^3 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)

[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 made a re-evaluation 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 more toxicity than previously in 2001 assumed 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 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.

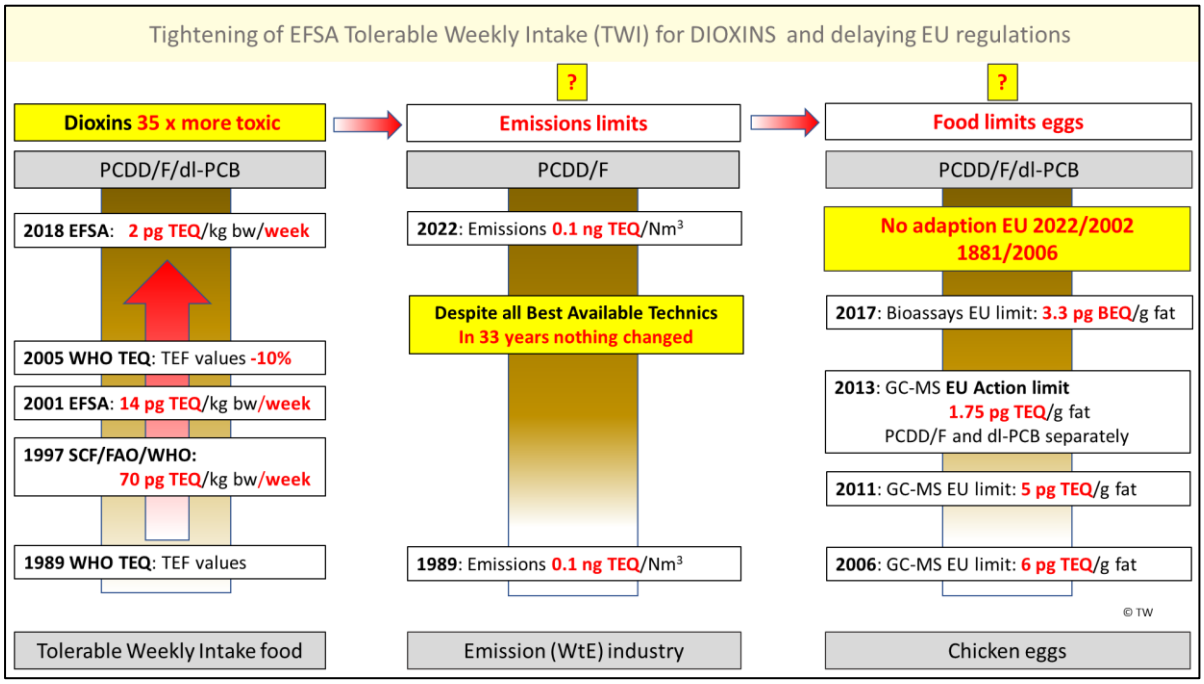


Figure 6: Tightening of EFSA Tolerable Weekly Intake (TWI) for dioxins (PCDD/F/dl-PCB) and delaying EU regulations.

In the EU 2023: **no updating limit over the last 34 years of emission regulations** has taken place since 1989, despite all the development and application of the best available techniques (BAT).

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.

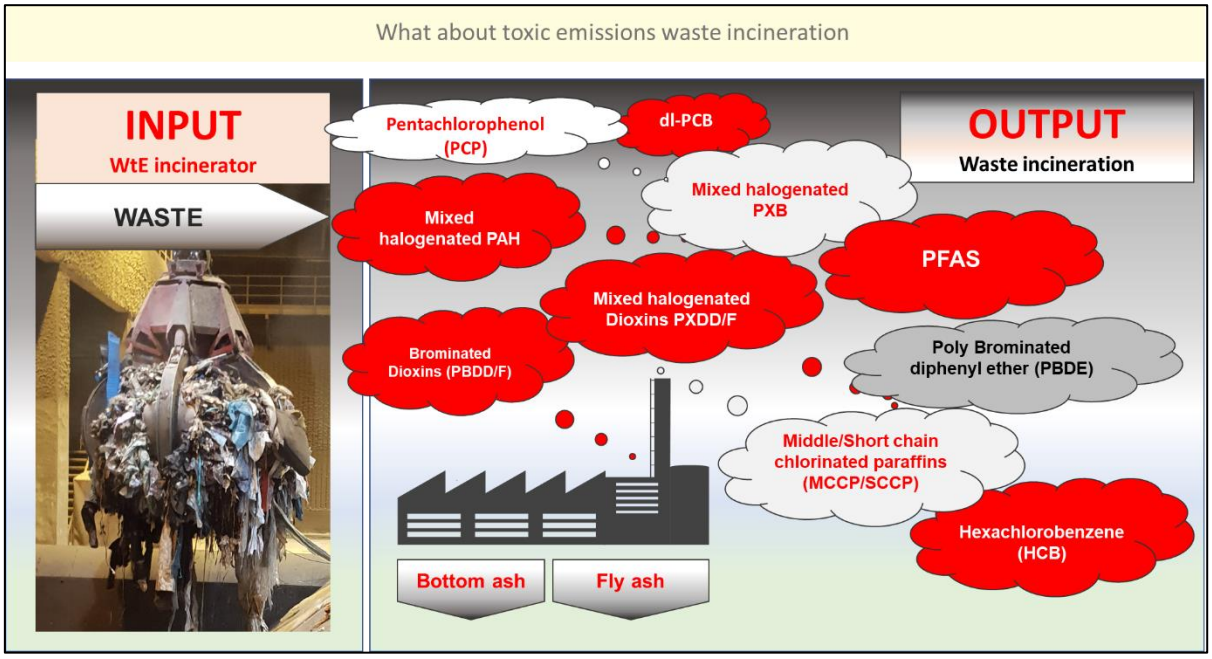


Figure 7: Toxic emissions waste incineration NOT regulated, Picture TW at REC (NL) 19-10-2019.

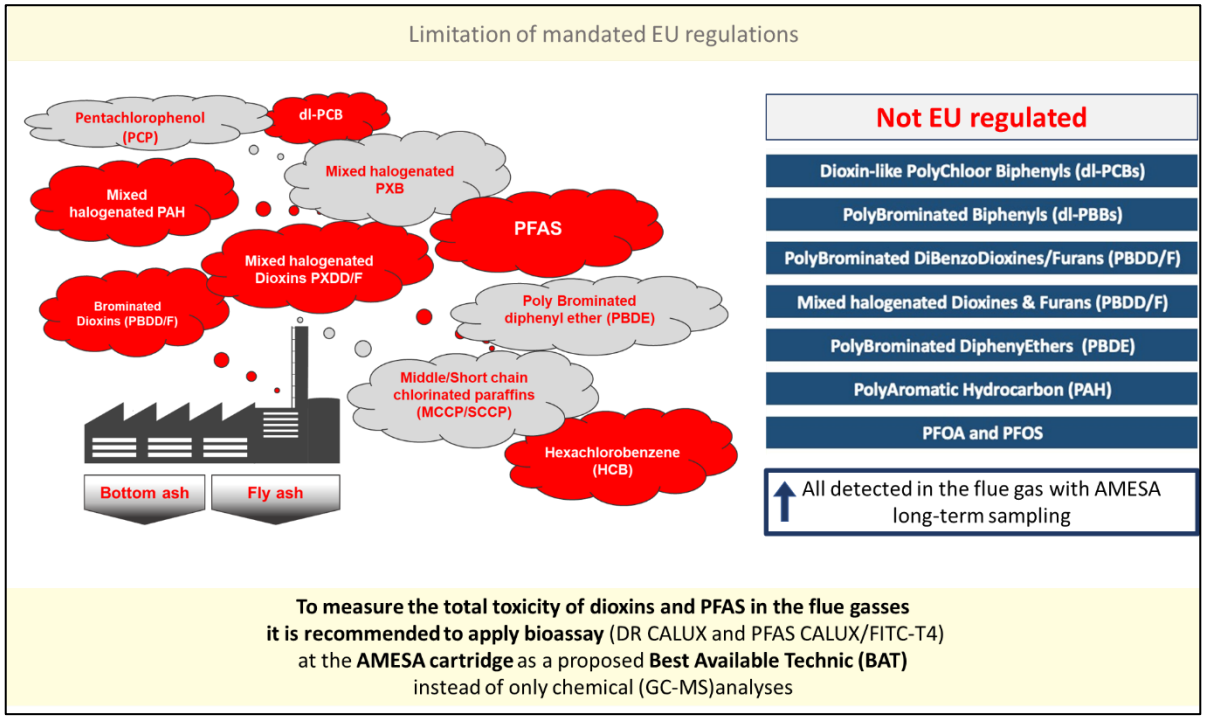


Figure 8: Limited measurements and analyses of hazardous emissions of waste incineration

1.5 Safe limits of persistent organic pollutants (POPs)

Figure 9 shows three groups of persistent organic pollutants (POPs) with 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 current advice for a tolerable intake of dioxins is declared 35 times more stringent than it was set in 2001. However, this EFSA advice has not been implemented into stricter standards for food or emissions, for other persistent organic pollutants (POPs) such as PFAS declared to be more than 2386 times toxic by the EFSA and Bisphenol A, abbreviated as BPA is found to be more than a factor of 10000 toxic in only 7 years.

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.

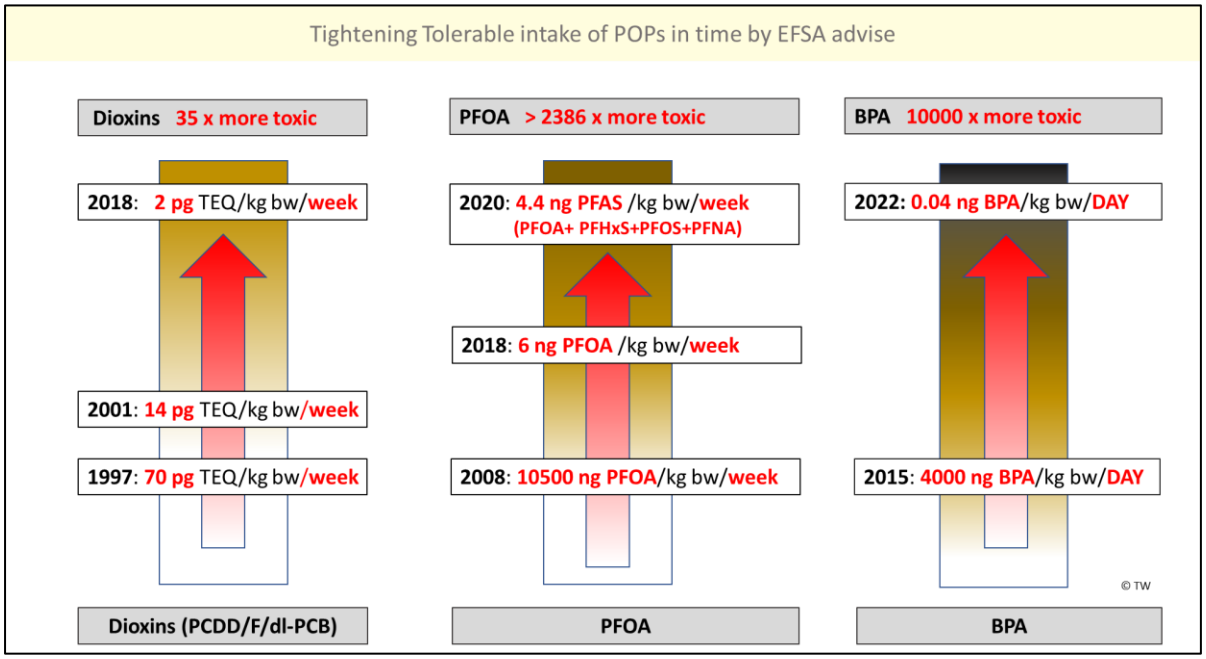


Figure 9: Tightening Tolerable intake of POPs in time by European Food and Safety Authority (EFSA).

"*Tightening the Tolerable intake of POPs in time by EFSA advise*" 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 35x 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.

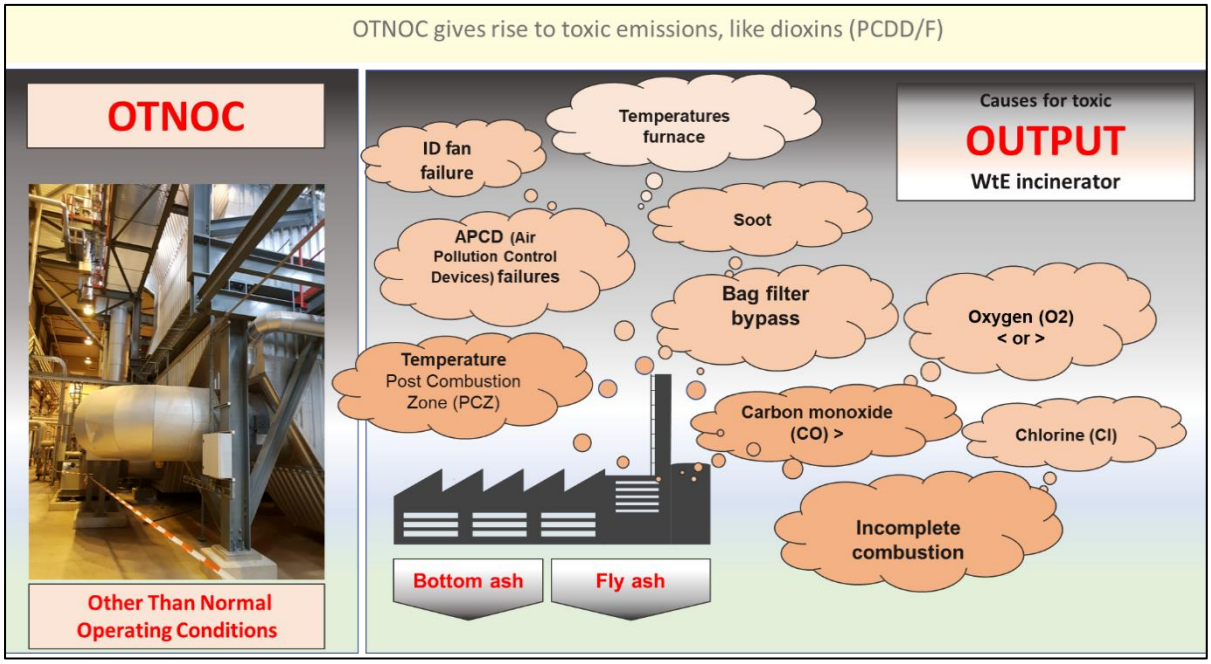


Figure 10: OTNOC situations with potentially high dioxin formation, emissions, picture: TW, at REC (NL) 19-10-2019

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 Dioxin.

[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 are shown 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. 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.

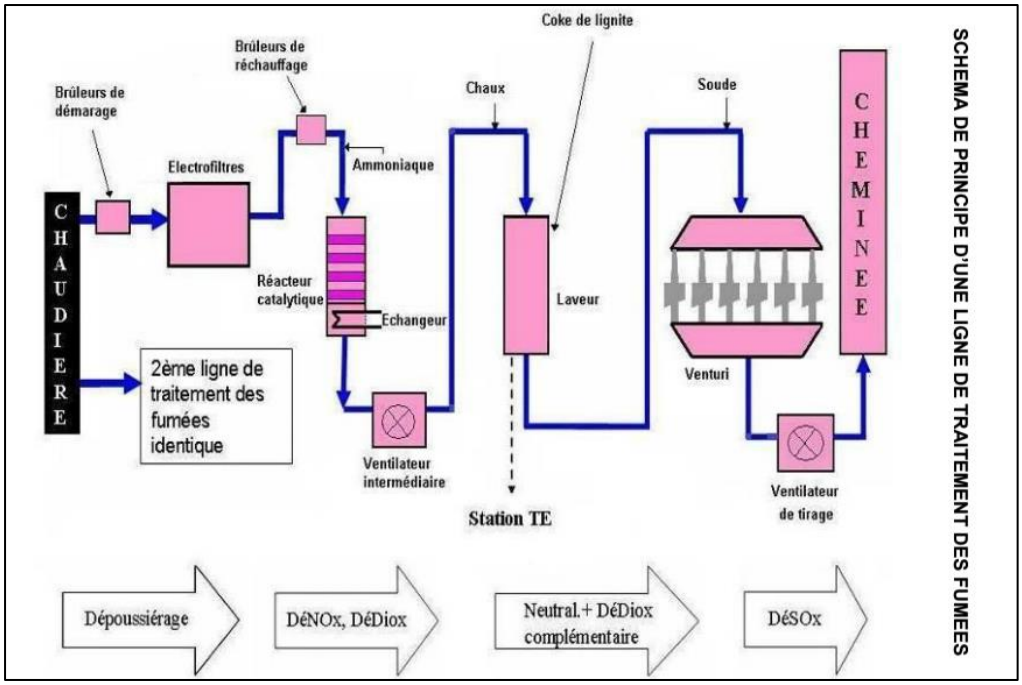


Figure 11: Schematic overview interior Ivry-Paris XIII, DIP

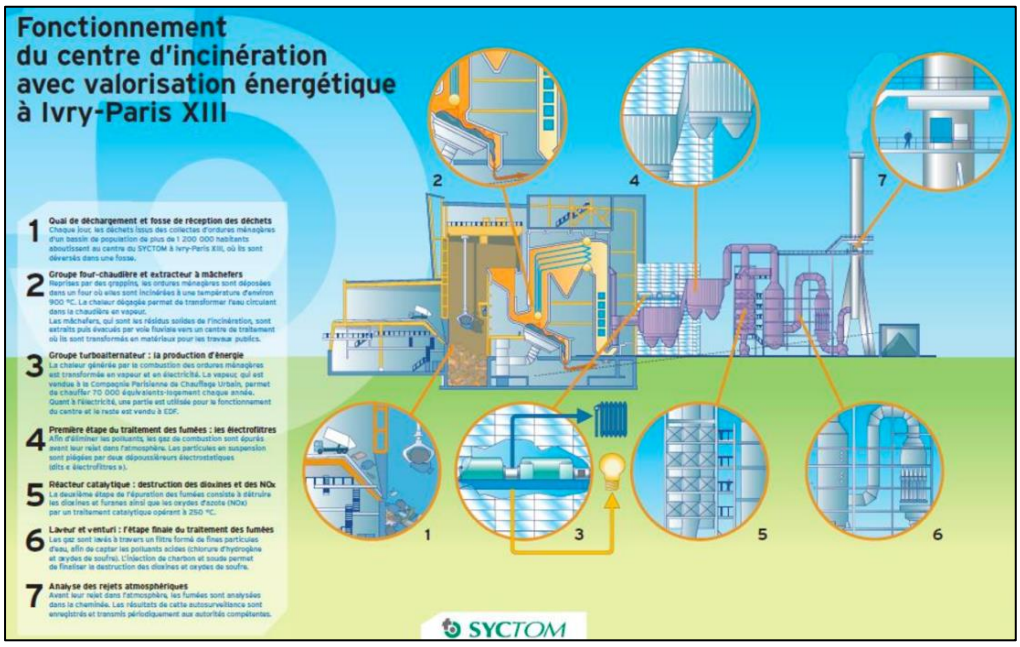


Figure 12: Schematic overview Ivry-Paris XIII, location AMESA equipment, DIP 2021

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. Besides, the emissions to air, 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]

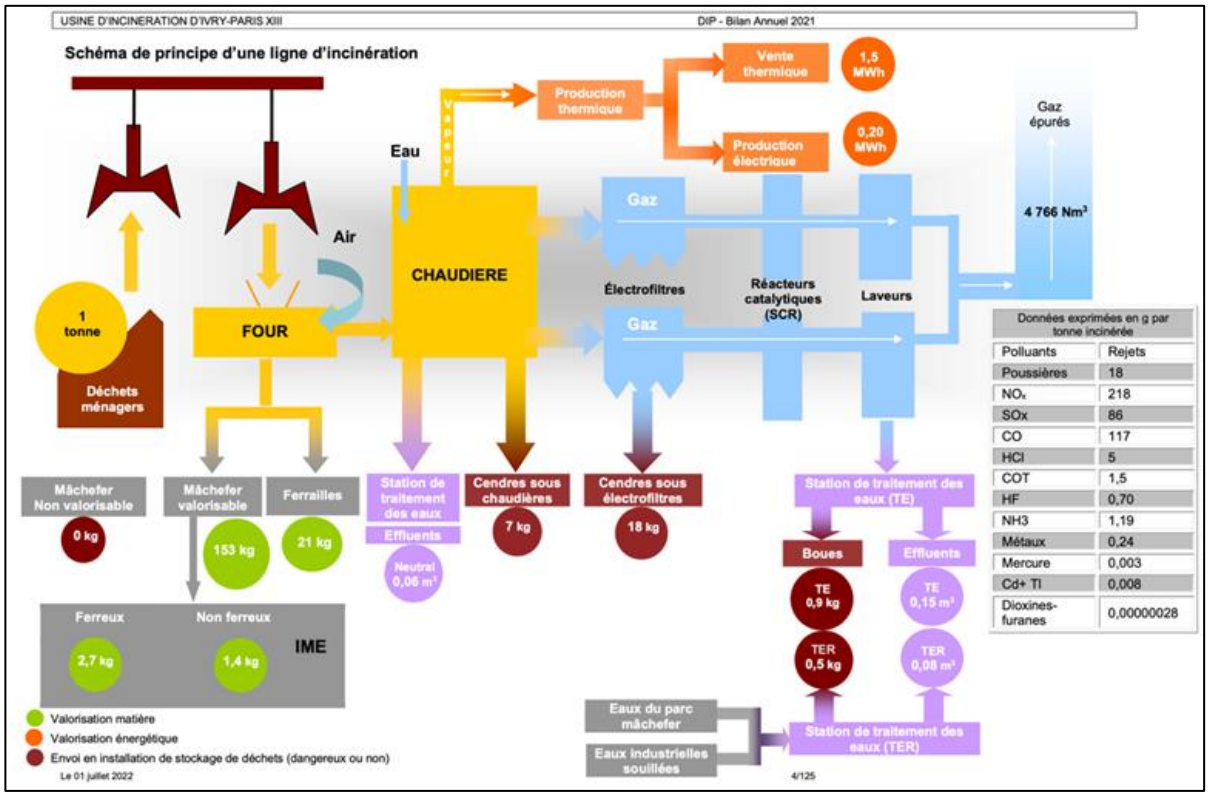


Figure 13: Technical map how waste incineration process functioned at Ivry-Paris XIII (DIP 2021)

[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 the flue gasses have been required since 2019 for newly built waste incinerators with a permit after 2019, according to the EU regulations. These requirements of the Best Available Techniques (BAT) documents are meant for 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. Several other brands are operating in Europe. The picture at 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. Remarkably, the nozzles used in Ivry Paris XIII are for both lines below the mandatory diameter of 6 mm, only 5 mm is applied according to the documents of SOCORair[13] (see also page 37).

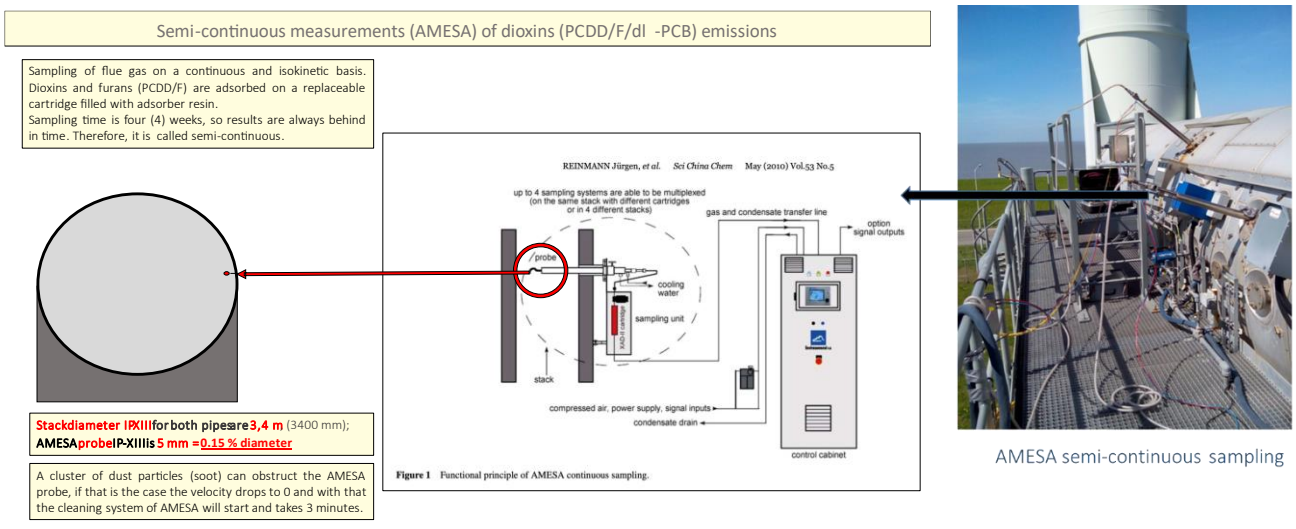


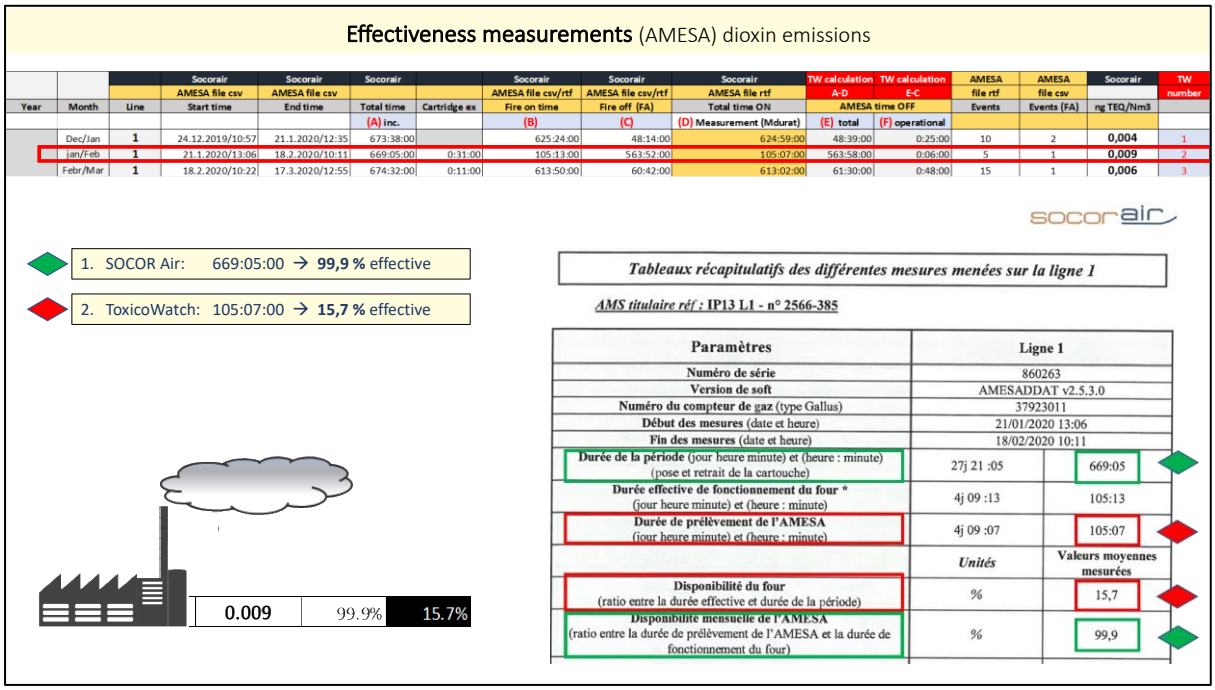
Figure 14: AMESA equipment and location position, Picture TW; AMESA equipment REC (NL)

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

[13] *SOCORair Rapport 20EP093, DOC-PROD-200 REV 08 (08-19), P. 19 and 27*

2.3. Diminished measurement efficiency

The analyses of the emissions are based on the 26 reports from SOCOR Air from 2019 to 2021[14] 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.



Effectiveness measurements (AMESA) dioxin emissions

Year	Month	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

1. SOCOR Air: 669:05:00 → **99,9 %** effective
2. ToxicoWatch: 105:07:00 → **15,7 %** effective

0.009 | 99.9% | 15.7%

socorair

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).

SOCOR Air report noted **an efficiency of AMESA of 99.9%, measured with the 'fire on' condition.** But if the total period of 4 weeks with **a total** of **669:05:00 hours** is considered - showing **only 105:07:00 hours when the AMESA was active**, with **an efficiency of only 15.7 % is evident.** 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.

[14] *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.

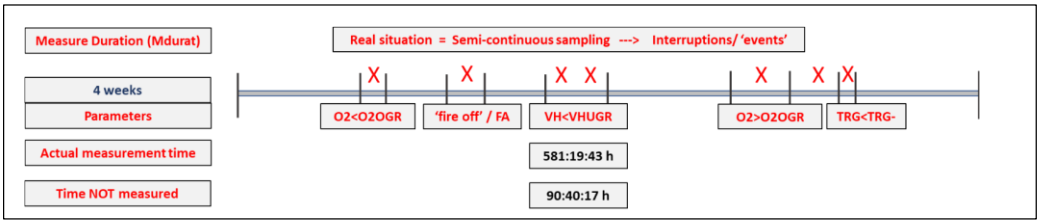


Figure 16: Interruptions/events in a sampling period of 4 weeks that should be continuous in ideal situations.

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. It can be seen that 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. To be short:
The semi-continuous sampling in IVRY-PARIS XIII did not function for nearly 7000 hours in 2020-2021.

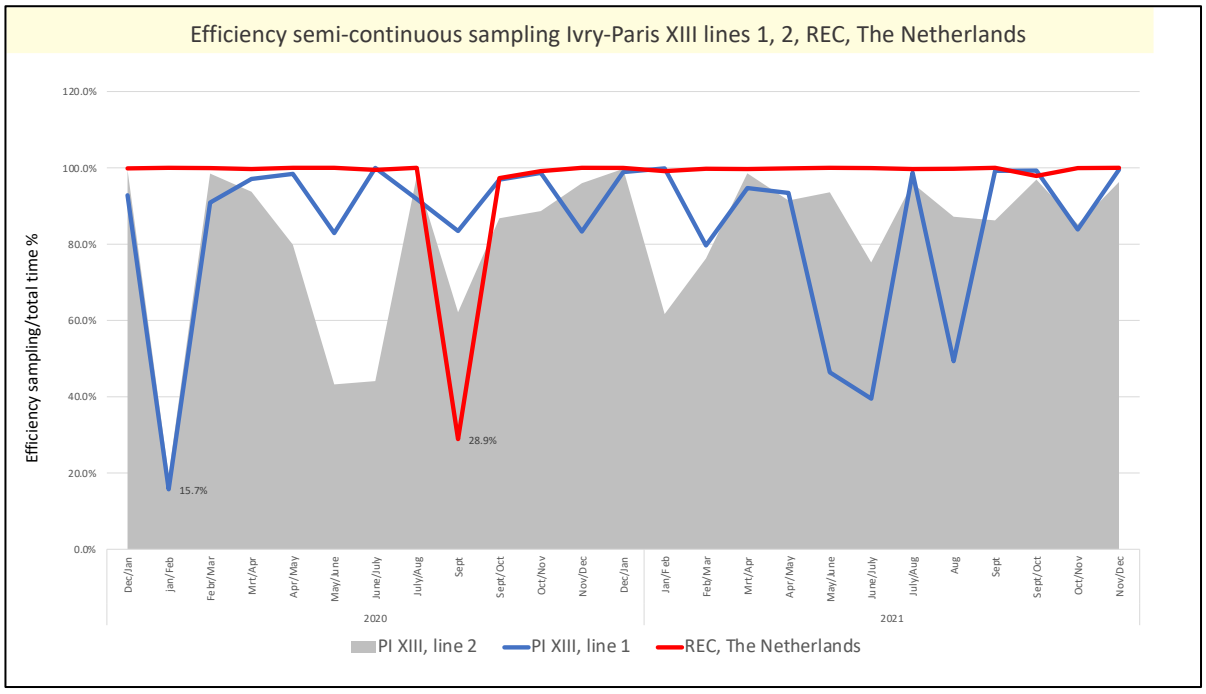


Figure 17: Efficiency semi-continuous sampling Ivry-Paris XIII, line 1,2 vs REC(NL)

Remarkable to notice, 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 totaal	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 81.28 % for line 1 and 79.02 % for line 2. These outcomes are below the limit of monitoring of 85%, as stated in the guidance of GA X 43-139 [15] and mentioned in a report of ADEME.[16] 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).[17] 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 5,205 hours of "no fire". 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 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, and 31% above the 0.05 ng TEQ/Nm3 (Table 2 and 3).

[15] *Guidance GA X 43-139, Rapport 20EP092 rév.02, DOC-PROD-200 REV 08(08-19), PAGE 15/53*
[16] *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.*
[17] *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 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, the duration time of a cartridge of 7 hours on 6-7-2021 is questionable, because dioxin emissions were high at that time. It is important cartridges are exchanged as fast as possible (about 10 minutes) to sample continuous dioxin emissions.

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

IVRY-PARIS XIII 2019-2021 LINE 1

			Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation	AMESA	AMESA	Socorair
			AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	file rtf	file csv	Dioxins
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			PCDD/F/
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	10	2	0,004
	Jan/Feb	1	21.1.2020/13:06	18.2.2020/10:11	669:05:00	00:31:00	105:13:00	563:52:00	105:07:00	563:58:00	5	1	0,009
	Febr/Mar	1	18.2.2020/10:22	17.3.2020/12:55	674:32:00	00:11:00	613:50:00	60:42:00	613:02:00	61:30:00	15	1	0,006
	Mrt/Apr	1	17.3.2020/13:13	14.4.2020/11:56	670:43:00	00:18:00	670:43:00	0:00:00	650:55:00	19:48:00	153	0	0,013
	Apr/May	1	14.4.2020/12:21	12.5.2020/10:58	669:12:25	00:25:00	669:11:00	0:01:25	658:55:00	10:17:25	77	2	0,023
	May/June	1	12.5.2020/11:15	9.6.2020/10:13	670:57:00	00:17:00	558:43:00	112:14:00	555:58:00	114:59:00	40	3	0,022
	June/July	1	09.06.20/10:34	7.7.20/10:51	672:17:00	00:21:00	672:12:00	0:05:00	672:07:00	0:10:00	5	1	0,017
	July/Aug	1	7.7.2020/11:21	4.8.2020/11:18	671:57:00	00:30:00	625:41:00	46:16:00	616:58:00	54:59:00	80	2	0,018
	Aug	1	4.8.2020/11:47	1.9.2020/11:47	672:05:19	00:29:00	0:00:00	672:05:19	0:00:00	672:05:19	2	1	
	Sept	1	1.9.2020/12:13	29.9.2020/10:53	670:40:00	00:30:00	582:28:00	88:12:00	559:50:00	110:50:00	53	4	0,045
	Sept/Oct	1	29.9.2020/11:23	28.10.2020/11:06	695:43:00	00:30:00	695:40:00	0:03:00	674:34:00	21:09:00	646	3	0,052
	Oct/Nov	1	28.10.2020/11:28	23.11.2020/14:24	626:55:00	00:23:00	626:52:00	0:03:00	618:44:00	8:11:00	189	2	0,039
	Nov/Dec	1	23.11.2020/14:50	9.12.2020/00:59	370:09:00	00:26:00	370:09:00	0:00:00	256:30:00	113:39:00	17	0	0,200
	Dec		9.12.2020/09:27	22.12.2020/11:15	313:47:00	8:28:00	313:46:00	0:01:00	313:10:00	0:37:00	10	1	
2021	Dec/Jan	1	22.12.2020/11:56	19.1.2021/11:11	671:15:00	00:41:00	671:15:00	0:00:00	663:46:00	7:29:00	19	0	0,040
	Jan/Feb	1	19.1.2021/11:36	16.2.2021/09:51	670:14:00	00:25:00	670:13:00	0:01:00	669:15:00	0:59:00	22	1	0,035
	Feb/Mar	1	16.2.2021/10:17	15.3.2021/14:58	652:40:00	00:26:00	520:12:00	132:28:00	520:05:00	132:35:00	5	1	0,091
	Mrt/Apr	1	15.3.2021/15:24	13.4.2021/11:17	691:53:00	00:26:00	691:53:00	0:00:00	655:13:00	36:40:00	335	0	0,098
	Apr/May	1	13.4.2021/11:43	10.5.2021/14:54	692:08:00	00:26:00	692:08:00	0:00:00	646:35:00	45:33:00	26	0	0,054
	May/June	1	10.5.2021/15:17	7.6.2021/11:22	668:05:00	00:23:00	309:55:00	358:10:00	309:52:00	358:13:00	6	2	0,086
	June/July	1	7.6.2021/11:44	6.7.2021/07:52	692:08:00	00:22:00	273:13:00	0:00:00	273:13:00	418:55:00	5	0	0,096
	July/Aug	1	6.7.2021/14:56	2.8.2021/12:22	645:26:00	07:04:00	645:26:00	0:00:00	637:20:00	8:06:00	55	0	0,076
	Aug	1	2.8.2021/12:46	7.8.2021/11:16	118:30:00	00:24:00	118:30:00	0:00:00	114:05:00	4:25:00	39	0	0,134
			7.8.2021/11:27	30.8.2021/11:07	551:39:00	00:11:00	400:01:00	151:38:00	216:29:00	335:10:00	81	3	
	Sept	1	30.8.2021/11:38	27.9.2021/11:44	672:06:00	00:31:00	672:03:00	0:03:00	666:54:00	5:12:00	91	1	0,049
	Sept/Oct	1	27.9.2021/12:07	25.10.2021/15:58	675:51:00	00:23:00	675:51:00	0:00:00	671:01:00	4:50:00	38	0	0,044
	Oct/Nov	1	25.10.2021/16:21	23.11.2021/10:50	664:21:00	00:23:00	588:26:00	75:55:00	557:12:00	107:09:00	34	4	0,052
	Nov/Dec	1	23.11.2021/11:21	21.12.2021/11:26	672:04:00	00:31:00	671:59:00	0:05:00	669:02:00	3:02:00	72	2	0,027
	Total		24.12.2019/10:57	21.12.2021/11:26	17460:00:44	25:55:00	14730:57:00	2310:08:44	14190:51:00	3269:09:44	2130	37	

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

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

IVRY-PARIS XIII 2019-2021 LINE 2

			Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation	AMESA	AMESA	Socorair
			AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	file rtf	file csv	Dioxins
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	Total	"Fire OFF"	PCDD/F/
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	61	0	0,052
	Dec/Jan	2	21.01.2020/12:22	18.2.2020/10:36	670:13:00	00:43:00	131:30:00	538:43:00	131:24:00	538:49:00	61	0	0,048
	Febr/Mar	2	18.2.2020/10:51	17.3.2020/12:26	673:34:00	00:15:00	673:34:00	0:00:00	663:16:00	10:18:00	309	0	0,035
	Mrt/Apr	2	17.3.2020/12:45	14.4.2020/11:22	670:37:00	00:19:00	670:37:00	0:00:00	628:33:00	42:04:00	343	0	0,059
	Apr/May	2	14.4.2020/11:48	12.5.2020/10:18	670:30:00	00:26:00	542:26:00	128:04:00	535:50:00	134:40:00	81	4	0,079
	May/June	2	12.5.2020/10:42	9.6.2020/10:46	670:30:00	00:24:00	289:56:00	382:07:00	289:33:00	380:57:00	20	1	0,040
	May/June	2	9.06.2020/11:06	7.7.2020/10:13	671:07:00	00:22:00	670:33:00	0:34:00	295:58:00	375:09:00	8	1	0,020
	July/Aug	2	7.7.2020/10:39	4.8.2020/10:47	672:07:00	00:26:00	672:07:00	0:00:00	656:15:00	15:52:00	208	0	0,036
	Aug/sept	2	4.8.2020/11:10	1.9.2020/12:23	673:12:00	00:23:00	420:49:00	252:23:00	418:35:00	254:37:00	34	2	0,021
	Sept	2	1.9.2020/12:47	29.9.2020/10:07	669:19:00	00:24:00	622:35:00	46:44:00	580:52:00	88:27:00	21	3	0,025
	Sept/Oct	2	29.9.2020/10:43	28.10.2020/11:44	697:01:00	00:36:00	695:58:00	1:03:00	617:53:00	79:08:00	65	1	0,008
	Oct/Nov	2	28.10.2020/12:09	23.11.2020/15:11	627:01:00	00:25:00	626:46:00	0:15:00	601:31:00	25:30:00	112	1	0,017
	Nov/Dec	2	23.11.2020/15:37	22.12.2020/12:05	692:28:00	00:26:00	692:28:00	0:00:00	690:41:00	1:47:00	46	0	0,019
	Dec/Jan	2	22.12.2020/12:23	19.1.2021/10:39	670:16:00	00:18:00	418:58:00	251:18:00	413:30:00	256:46:00	269	2	0,021
2021	Jan/Feb	2	19.1.2021/11:01	16.2.2021/09:08	670:07:00	00:22:00	587:43:00	82:24:00	510:47:00	159:20:00	55	2	0,027
	Febr/Mar	2	16.2.2021/09:39	15.3.2021/14:21	652:42:00	00:31:00	652:42:00	0:00:00	643:31:00	9:11:00	234	0	0,029
	Mar/Apr	2	15.3.2021/14:47	13.4.2021/10:45	691:58:00	00:26:00	691:58:00	0:00:00	632:57:00	59:01:00	1802	1	0,055
	Apr/May	2	13.4.2021/11:07	10.5.2021/14:02	670:30:00	00:22:00	643:26:00	7:28:00	627:23:00	43:07:00	325	1	0,066
	May/June	2	10.5.2021/14:44	7.6.2021/11:53	669:09:00	00:42:00	514:36:00	154:33:00	503:07:00	166:02:00	244	2	0,094
	June	2	7.6.2021/12:10	10.6.2021/18:37	78:26:41	00:15:00	5:45:00	72:41:41	64:30:00	13:56:41	24	14	0,074
	June/July		10.6.2021/18:52	6.7.2021/08:51	613:59:00	00:17:00	613:59:00	0:00:00	600:09:00	13:50:00	15	0	
	July/Aug	2	6.7.2021/09:18	2.8.2021/12:58	651:40:00	00:27:00	625:39:00	26:01:00	568:12:00	83:28:00	115	1	0,045
	Aug	2	2.8.2021/13:20	30.8.2021/11:48	670:28:00	00:22:00	284:19:00	386:09:00	0:00:00	670:28:00	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	317	1	0,037
	Sept/Oct	2	27.9.2021/12:38	23.10.2021/16:18	627:39:35	00:19:00	88:48:00	538:51:35	608:22:00	19:17:35	249	244	0,031
	Oct		23.10.2021/17:51	25.10.2021/15:21	45:30:00	01:33:00	45:30:00	0:00:00	45:26:00	0:04:00	2	0	
	Oct	2	25.10.2021/15:47	27.10.2021/10:42	42:55:00	00:26:00	42:55:00	0:00:00	41:01:00	1:54:00	5	0	0,027
	Oct		27.10.2021/10:57	27.10.2021/17:00	6:03:00	00:15:00	6:03:00	0:00:00	6:00:00	0:03:00	2	0	
	Oct/Nov		27.10.2021/18:49	23.11.2021/11:34	640:47:00	01:49:00	543:48:00	96:59:00	540:54:00	100:53:00	96	1	
	Nov/Dec	2	23.11.2021/12:08	21.12.2021/10:51	670:43:00	00:34:00	669:29:00	0:00:00	645:26:00	25:17:00	281	0	0,028
	Total	2	24.12.2019/10:04	21.12.2021/10:51	17476:14:16	14:04:00	14489:37:00	2967:20:16	13810:46:00	3665:28:16	5415	283	

AMESA time OFF	
Time - TW indicative scale	
0 - 10 min	
10 - 59 min	
1 - 10 hours	
10 - 100 hours	
100 - 500 hours	
> 500 hours	

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

TW indicative emission scale	
TEQ PCDD/F	
< 0.01	
0.01-0.06	
< 0.06	
< 0.1	

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

2.4. Relation interruptions/events and dioxin emissions

In the graphs of Figures 18 and 19 relations are shown between events and measured dioxin levels in lines 1 and 2.

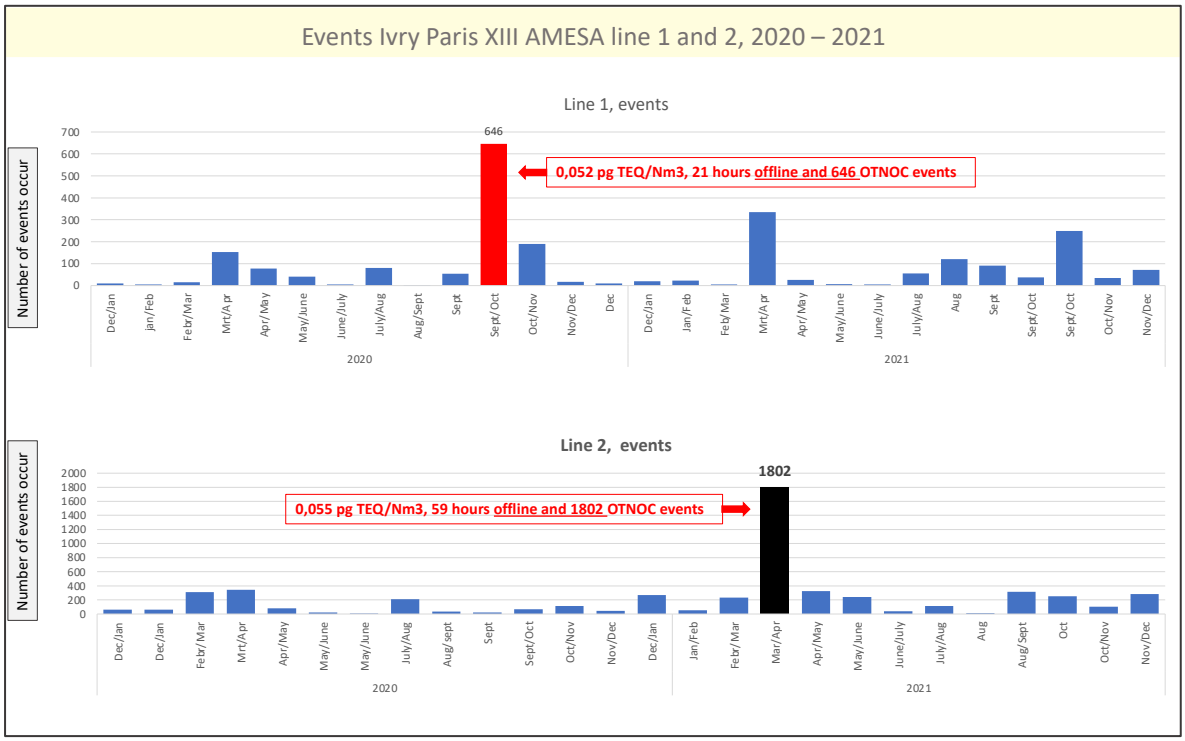


Figure 18: Events IVRY-PARIS XIII, line 1,2 in 2020-2021

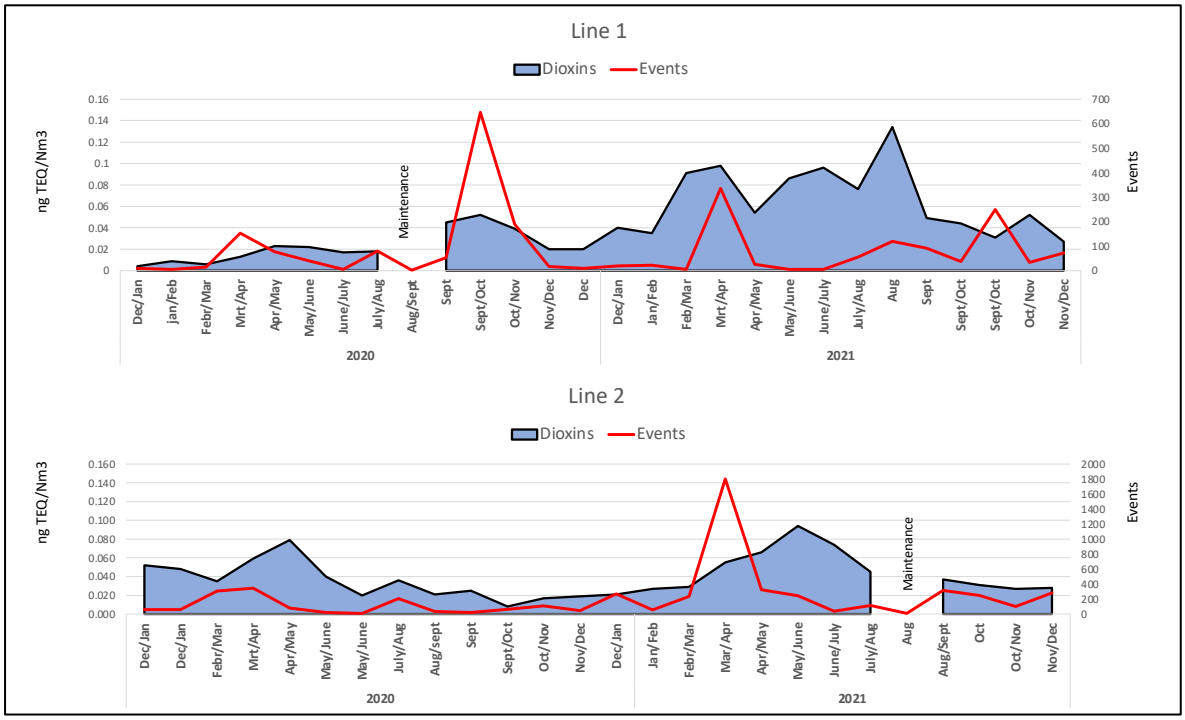


Figure 19: Dioxin emissions compare to the events of IVRY-PARIS XIII

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.

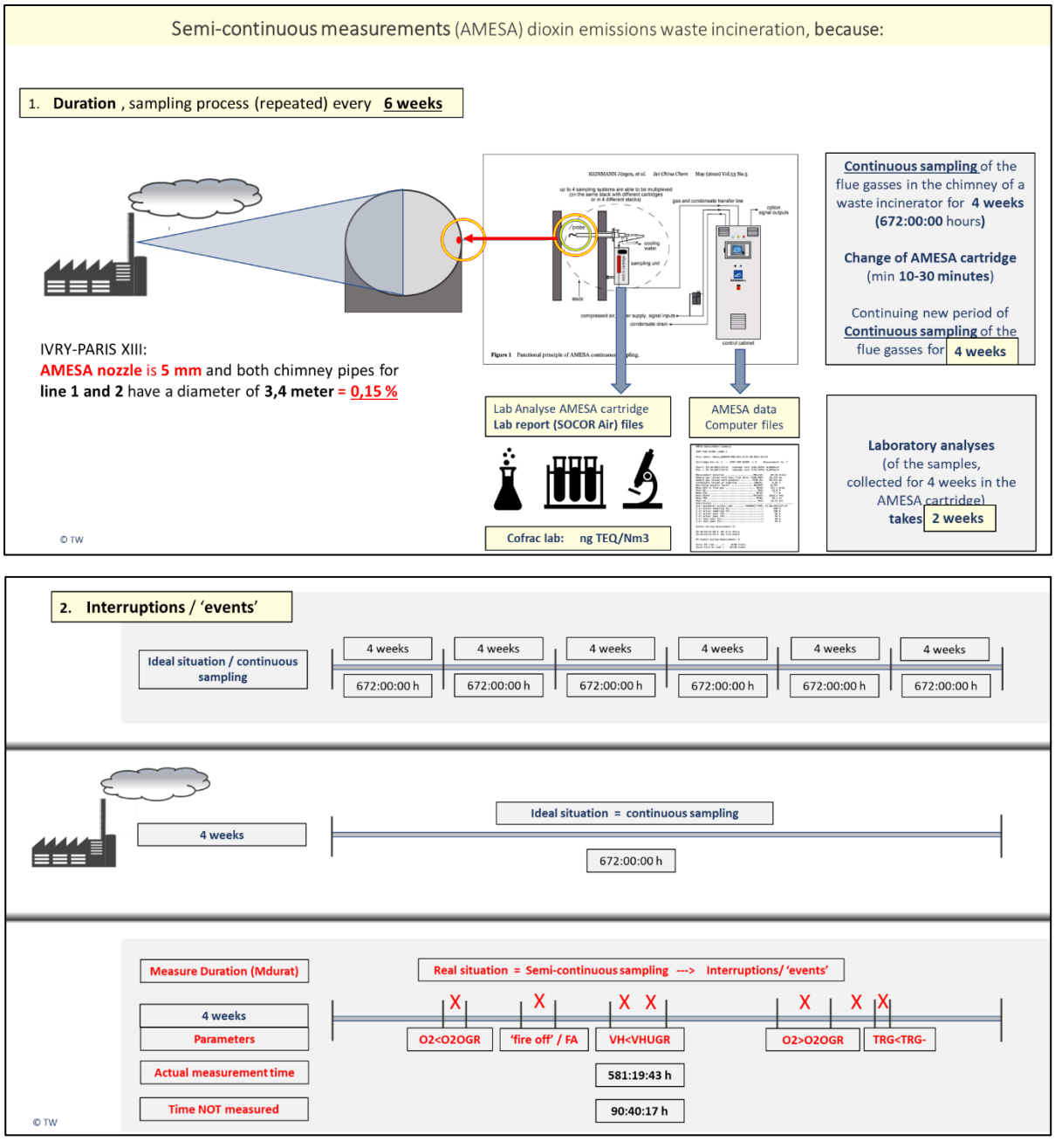


Figure 20: Why Semi-Continuous measurements: 1. duration, 2. interruptions/events

A second important argument for referring to these measurements as semi-continuous is that the sampling is not consistently continuous, as becomes clear at IP XIII. At the REC (NL), some measurement series were truly continuous, but the measurement series at IP XIII are characterised by many interruptions in sampling monitoring, known as "events". Those interruptions are related to failures of the technical functioning of the incineration process of the waste incinerator. Sampling 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[18, 19, 20] and to all conditions, 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). Maybe the temperature in the post-combustion zone (PZC), see Annex 5, goes below 850°C or a drop in the velocity of the flue gases causes a stop for sampling. This does not mean dioxin formation cannot occur. Sampling can even be stopped manually. It is a limitation that continuous sampling can be (forced to be) blocked, i.e., when velocity drops or inhomogeneity, while it should function under all conditions. When AMESA (for a short time/3 minutes) is out of operation, automatically cleaning the AMESA probe and sampling is stopped. Dust eruptions can be carried out without sampling of dioxin emissions 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 below 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*

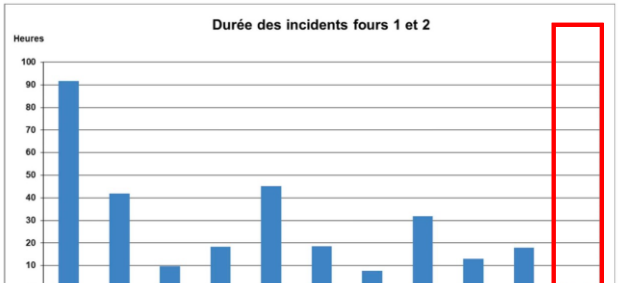
Table 5: Codes for termination of sampling, SOCOR Air AMESA data IP XIII

[18] *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*
[19] *Hunsinger, H., Seifert, H., Jay, K., 2003. Formation of PCDD/F during start-up of MSWI*
[20] *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 7865 "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 320 times the command "fire off" was given.

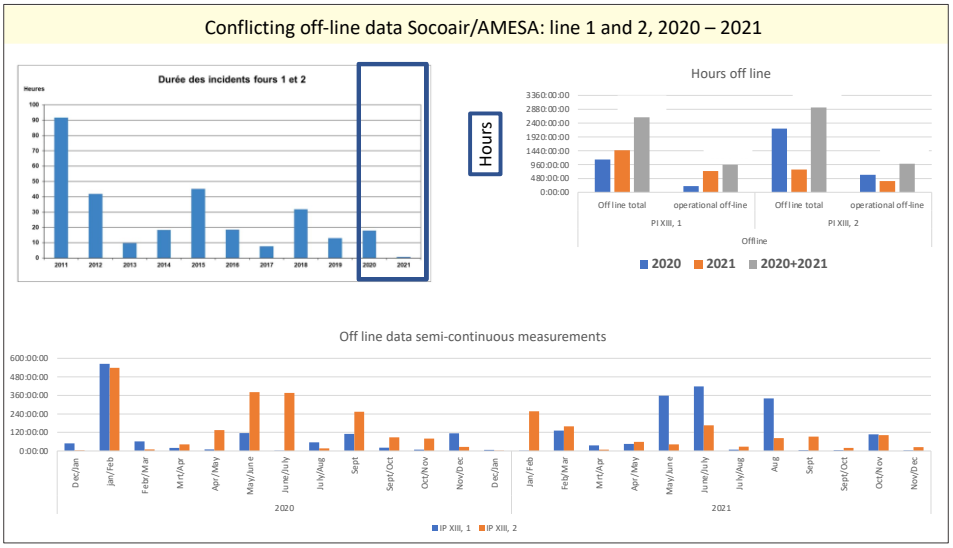


Figure 22: Conflicting off-line data SOCOR Air/AMESA, Line 1,2, 2020-2021

2.7. Comparison AMESA dioxin emissions IVRY-PARIS XIII and REC (NL)

The *Dossier d'information du public* shows the dioxin results complying with the EU limit of 0.1 ng TEQ/Nm^3. One should note, however, that this emission limit has been unchanged for 33 years, see Figure 6 on page 11. Considered that the European Food and Safety Authority (EFSA) proves with comprehensive scientific studies the toxicity of dioxins is 35 times more than first assumed in 1997. Anno 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/ Nm^3 for dioxin (PCDD/F/dl-PCB) emissions. Based on this stricter limit of 0.01 ng TEQ/ Nm^3, 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/ Nm^3 has met an extended public exposure. In special technical commissions, these exceeding emissions are thoroughly discussed and analysed. It is remarkable that waste incinerator IVRY-PARIS XIII in a world capital like Paris can have such an 'old' permit for allowing high emissions of dioxins. Taken the fact that semi-continuous measurements, like AMESA, do not cover full measurements, because sampling equipment is hampered at OTNOC events. If the waste incinerator IVRY-PARIS XIII should have to comply with this limit of 0.01 ng TEQ/ Nm^3, 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/ Nm^3 and orange between 0.01 – 0.05 ng TEQ/ Nm^3.
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 furnace 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

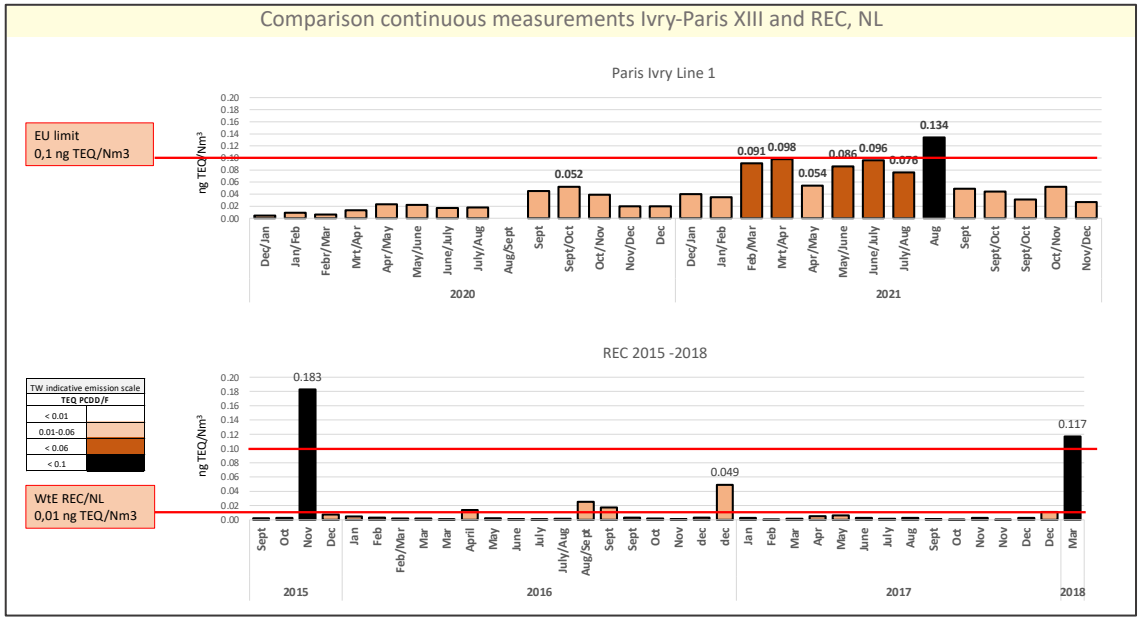


Figure 23: Comparison continuous measurements IVRY-PARIS XIII with REC (NL)

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 under article 28 b-1 of the decree of 20 September 2002, a one-off measurement of dioxins and furans was carried out on 7 October and a second measurement on 15 December. 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 Events of interruptions

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.

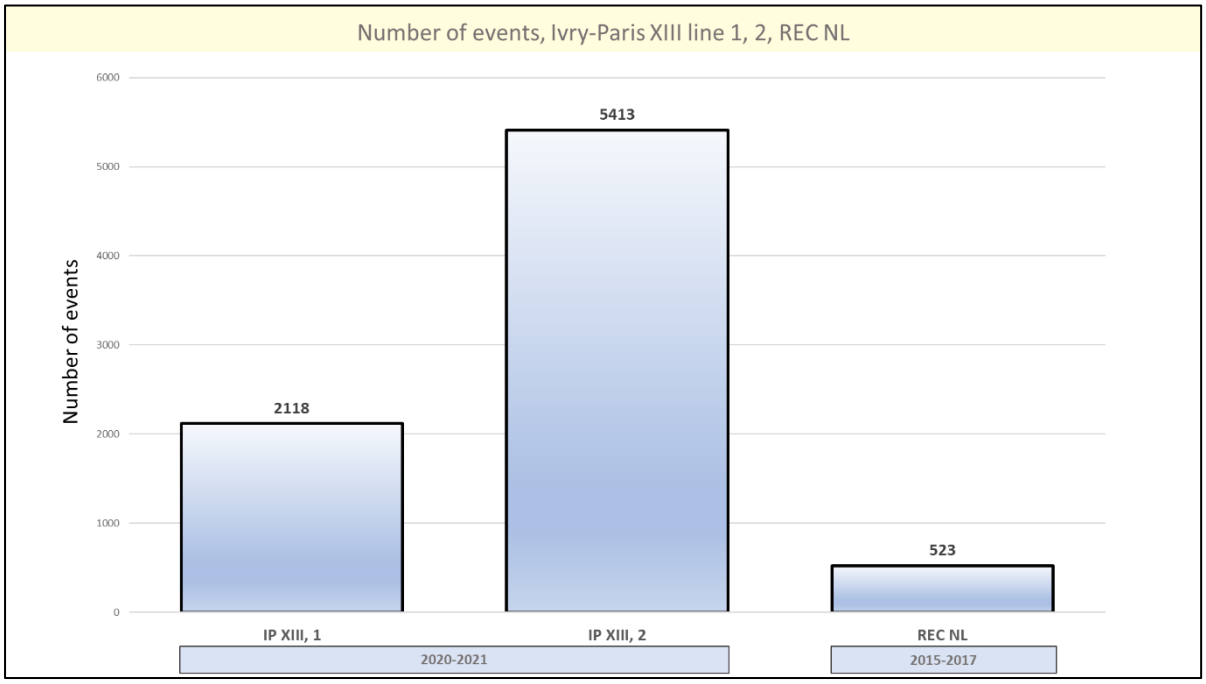


Figure 24: Comparison events IVRY-PARIS XIII line 1, 2 (2019-2021) and REC, NL (2015- 2017)

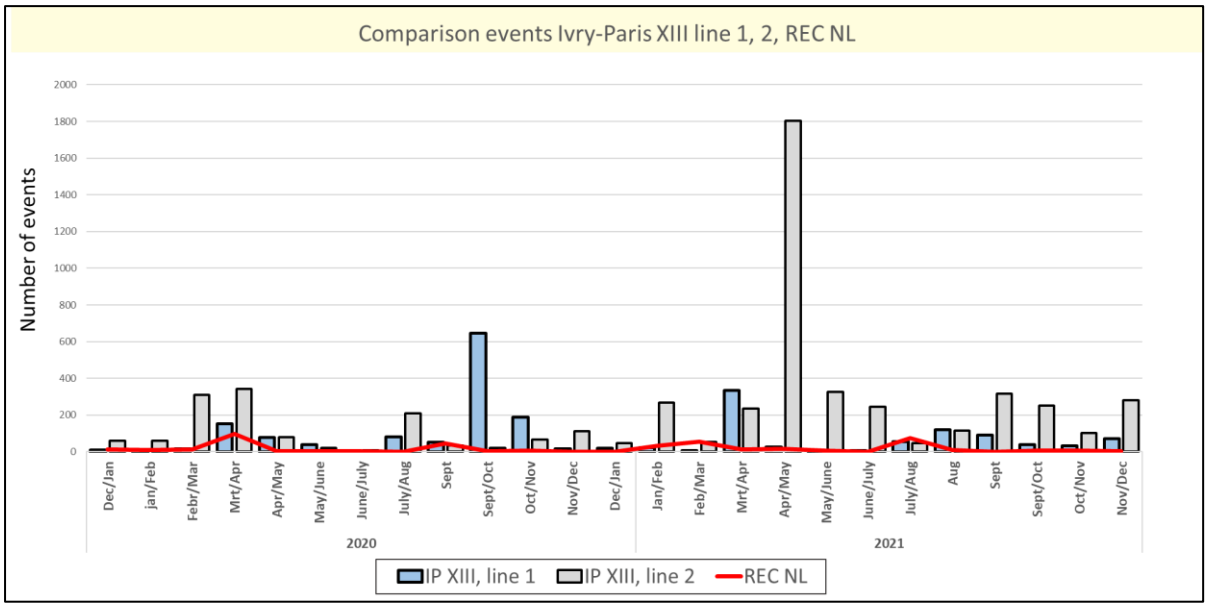


Figure 25: Number of events IVRY-PARIS XIII, line 1, 2 (2019-2021) and REC, NL (2015-2017)

3.2 Offline time data

In Figure 26 below is given a graph with times the semi-continuous sampling is blocked, so given the data, no sampling and no measurements could have taken place. See Chapter 2 for various reasons.

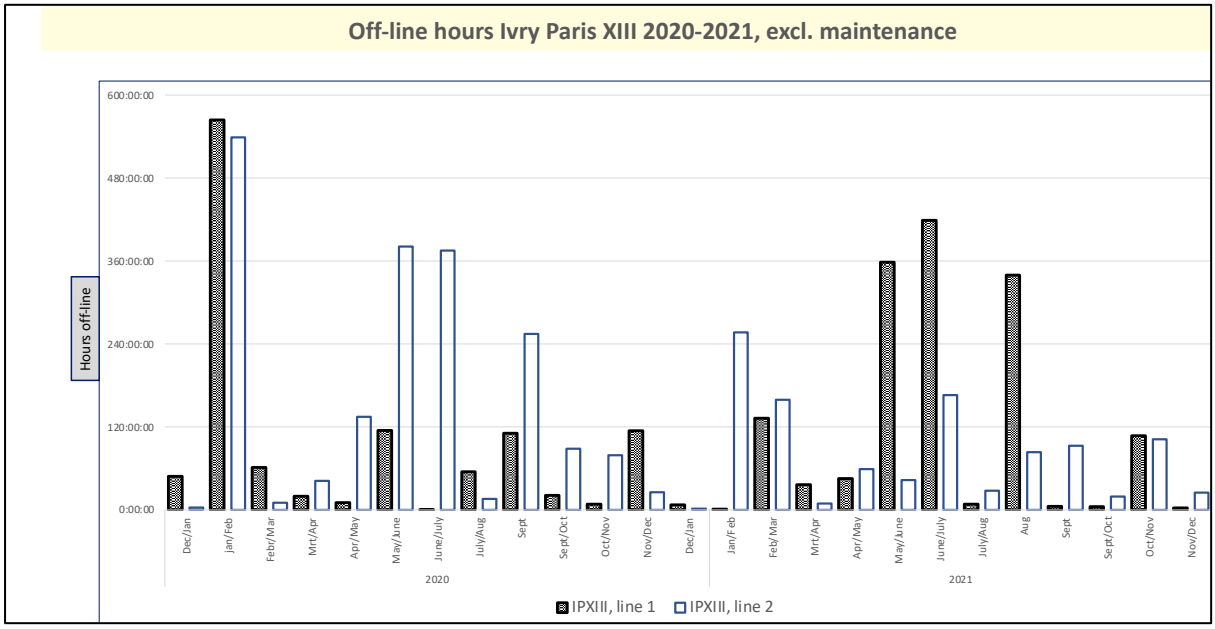


Figure 26:Off-line hours IVRY-PARIS XIII 2020-2021, exclusive maintenance

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 offline of **5 hours and 45 minutes** in the Netherlands triggered an extensive investigation by both the government and the incinerator to find the causes of the problem and the associated high dioxin emissions. Compared with the results from the Dutch waste incinerator, the results from IVRY-PARIS XIII are extremely worse. It shows the incinerator of Paris has a greater influence on dioxin pollution than previously thought.

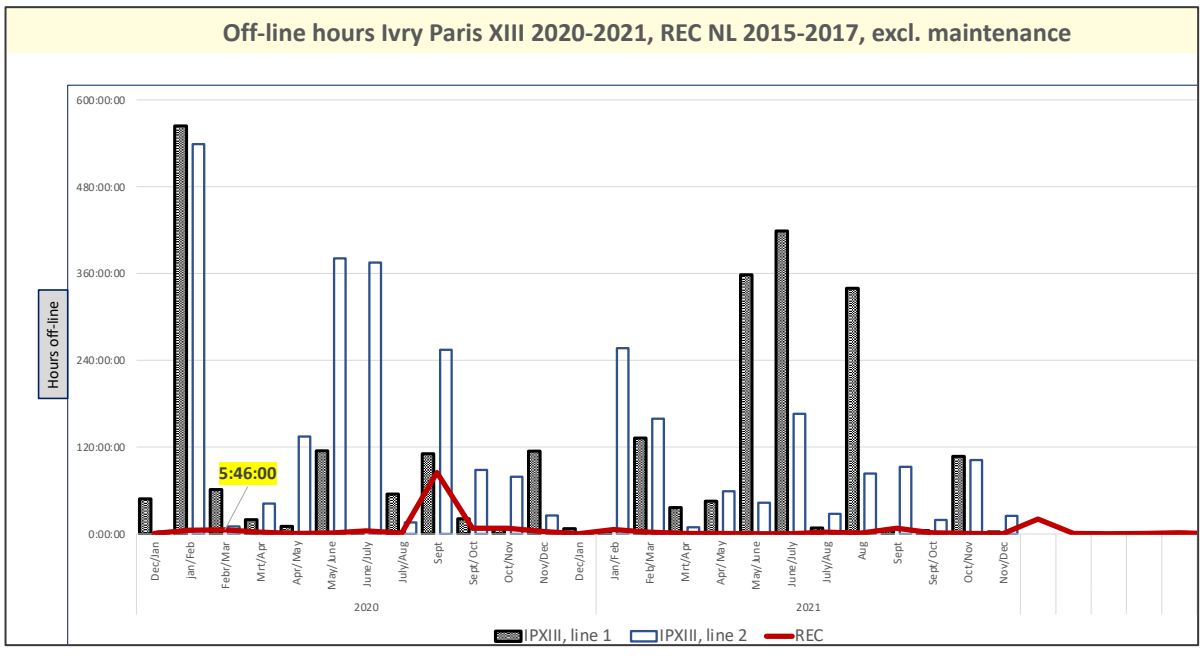


Figure 27: Off-line hours IVRY-PARIS XIII in 2020-2021 vs REC (NL) 2015-2017, exclusive maintenance hours

3.3 Time clusters of high dioxin emissions

The graph below in Figure 28 presents time clusters of high dioxin emissions measured. The high emission of dioxins in August 2021 of 0.134 ng TEQ (above the EU limit) is measured with a sampling time of the flue gas for 330 hours. In this period 130 events took place and probably a restart of the automatic AMESA monitoring (no mention of the actual use of two (2) cartridges for this period). AMESA was 330 hours offline, meaning 49% efficiency. Implicating the level of dioxin could be more because of the seriously interrupted sampling system.
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.

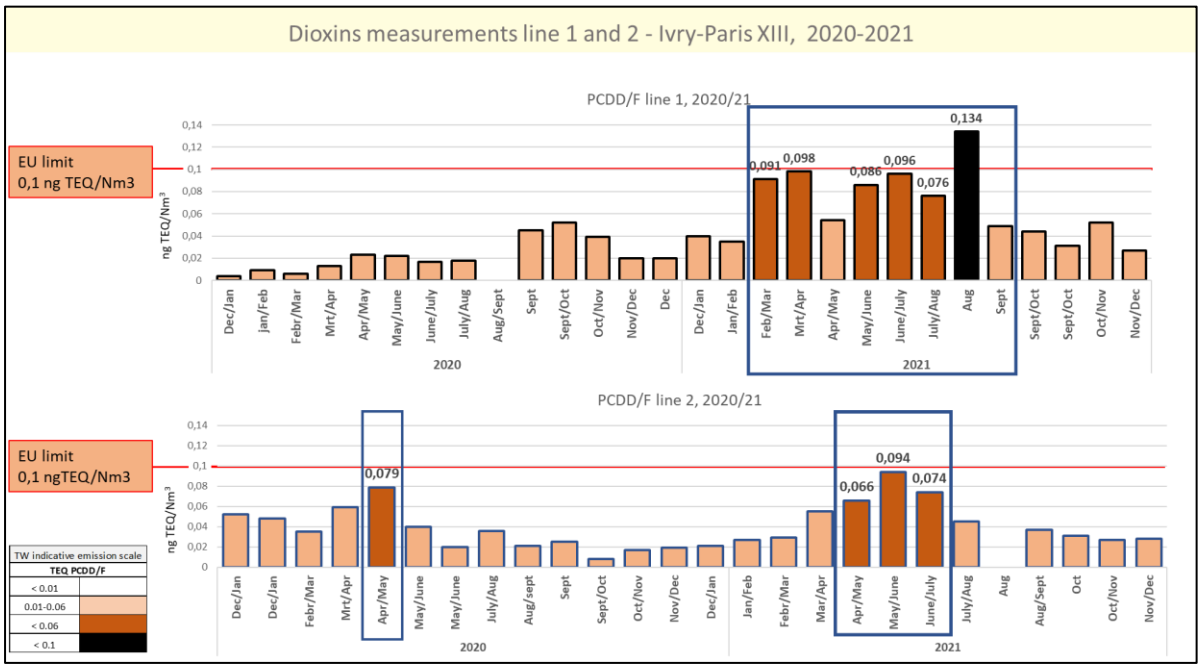


Figure 28: Results dioxin emissions by data of semi-continuous measurements IVRY-PARIS XIII, Line 1 and 2, 2020-2021

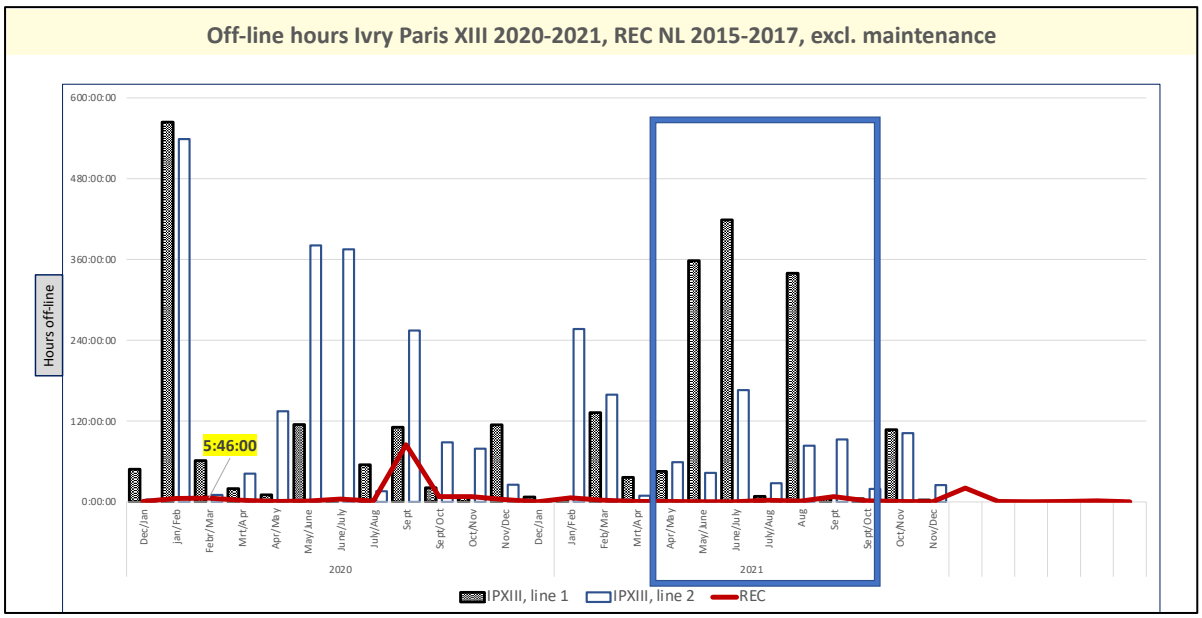
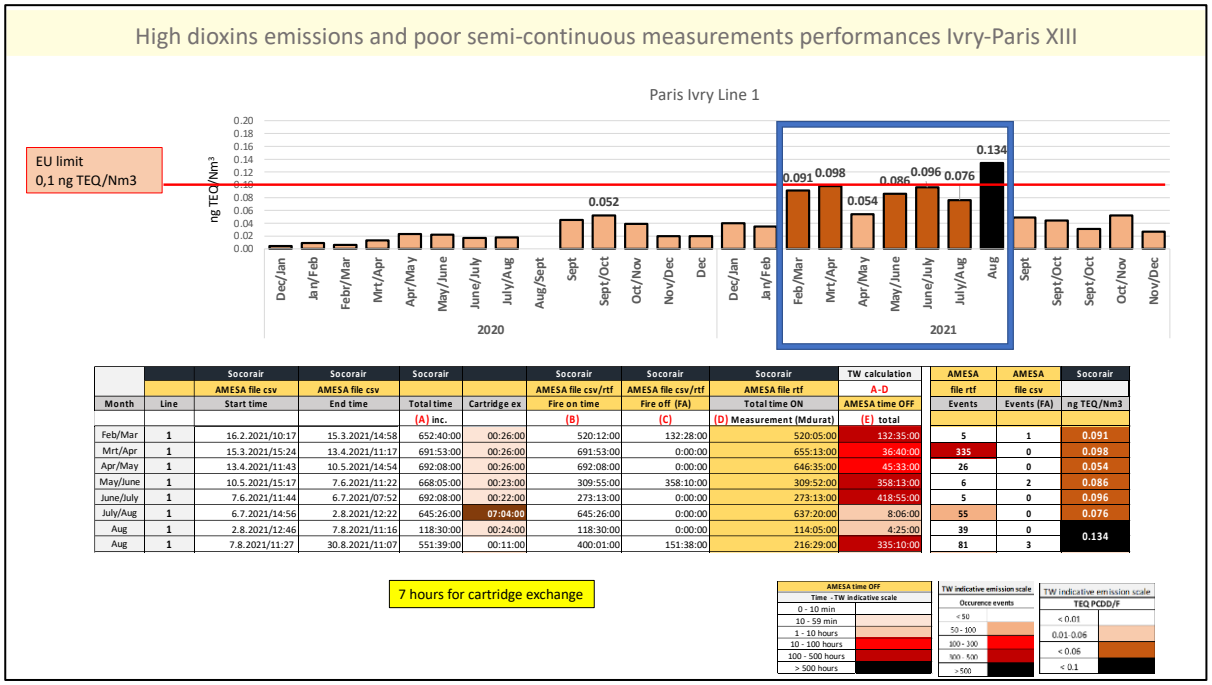


Figure 29: Off-line hours IVRY-PARIS XIII 2020-2021 vs REC (NL) 2015-2017, excl. maintenance

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 the AMESA 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, is needed to interpret the real impact of the emissions of dioxins.



		Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation	AMESA	AMESA	Socorair
		AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	file rtf	file csv	
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			
Feb/Mar	1	16.2.2021/10:17	15.3.2021/14:58	652:40:00	00:26:00	520:12:00	132:28:00	520:05:00	132:35:00	5	1	0.091
Mrt/Apr	1	15.3.2021/15:24	13.4.2021/11:17	691:53:00	00:26:00	691:53:00	0:00:00	655:13:00	36:40:00	335	0	0.098
Apr/May	1	13.4.2021/11:43	10.5.2021/14:54	692:08:00	00:26:00	692:08:00	0:00:00	646:35:00	45:33:00	26	0	0.054
May/June	1	10.5.2021/15:17	7.6.2021/11:22	668:05:00	00:23:00	309:55:00	358:10:00	309:52:00	358:13:00	6	2	0.086
June/July	1	7.6.2021/11:44	6.7.2021/07:52	692:08:00	00:22:00	273:13:00	0:00:00	273:13:00	418:55:00	5	0	0.096
July/Aug	1	6.7.2021/14:56	2.8.2021/12:22	645:26:00	07:04:00	645:26:00	0:00:00	637:20:00	8:06:00	55	0	0.076
Aug	1	2.8.2021/12:46	7.8.2021/11:16	118:30:00	00:24:00	118:30:00	0:00:00	114:05:00	4:25:00	39	0	0.134
Aug	1	7.8.2021/11:27	30.8.2021/11:07	551:39:00	00:11:00	400:01:00	151:38:00	216:29:00	335:10:00	81	3	

7 hours for cartridge exchange

AMESA time OFF	
Time - TW indicative scale	
0 - 10 min	
10 - 59 min	
1 - 10 hours	
10 - 100 hours	
100 - 500 hours	
> 500 hours	

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

TW indicative emission scale	
TEQ PCDD/F	
< 0.01	
0.01-0.06	
< 0.06	
< 0.1	

Figure 30: Data February- Augustus 2021, High dioxin emissions and poor semi-continuous measurements performances

In August 2022, Collectif 3R requested such data for 6 periods with dioxin (PCDD/F) levels above 0,08 ng/ Nm^3 measured by AMESA (raw minute-by-minute data of combustion parameters from the control room: dust (PM10, PM 2.5 and if possible PM 1); CO; CxHy; Sox; NOx; HCl; HF; temperatures in furnaces, in post-combustion-zones (PCZ), in filtration equipment, and in chimneys). SYCTOM did not respond to give these dates.
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.

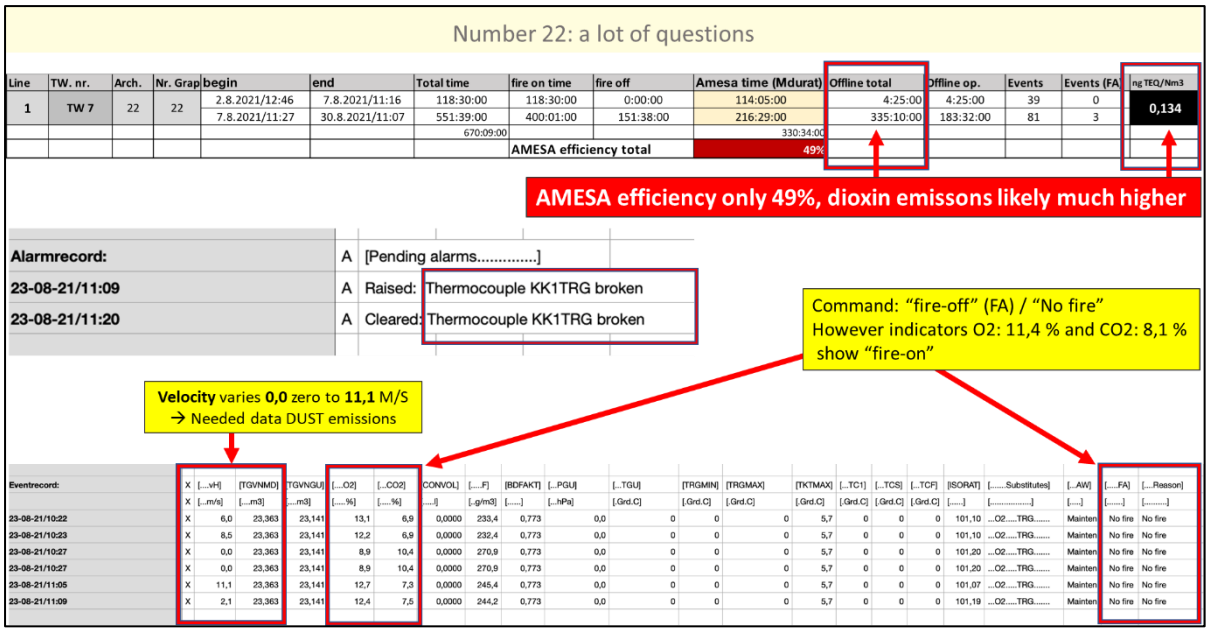
The CADA issued a favourable opinion on the Collectif 3R request.

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."*

An exceedance of the EU limit value of 0.134 ng TEQ/ Nm^3 was observed during the measurement period from August 2nd, 2021, till August 30th, 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<TRGMIN" (Low temperature in the chimney) and four (4) 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.



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]	[.....%]	[.....%]	[.....]	[..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 of August 2nd, 2021, till August 30th, 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[21] 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 happened two times when the cartridges were damaged by 'explosions' in the furnace, according to management REC/NL. If different cartridges were used, a problem arose: 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.

Use of multiple cartridges for one measurement period of 4 weeks , IP XIII 2020-2021

5 multipele cartridges														
			Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation	AMESA	AMESA	Socorair
			AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	file rtf	file csv	Dioxins
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	Total	"Fire OFF"	PCDD/F/
2020	Nov/Dec	1	23.11.2020/14:50	9.12.2020/00:59	370:09:00	00:26:00	370:09:00	0:00:00	256:30:00	113:39:00	17	0	0.200
	Dec		9.12.2020/09:27	22.12.2020/11:15	313:47:00	8:28:00	313:46:00	0:01:00	313:10:00	0:37:00	10	1	
2021	Aug	1	2.8.2021/12:46	7.8.2021/11:16	118:30:00	00:24:00	118:30:00	0:00:00	114:05:00	4:25:00	39	0	0.134
			7.8.2021/11:27	30.8.2021/11:07	551:39:00	00:11:00	400:01:00	151:38:00	216:29:00	335:10:00	81	3	
2021	June	2	7.6.2021/12:10	10.6.2021/18:37	78:26:41	00:15:00	5:45:00	72:41:41	64:30:00	13:56:41	24	14	0.074
	June/July		10.6.2021/18:52	6.7.2021/08:51	613:59:00	00:17:00	613:59:00	0:00:00	600:09:00	13:50:00	15	0	
2021	Sept/Oct	2	27.9.2021/12:38	23.10.2021//16:18	627:39:35	00:19:00	88:48:00	538:51:35	608:22:00	19:17:35	249	244	0.031
	Oct		23.10.2021/17:51	25.10.2021/15:21	45:30:00	01:33:00	45:30:00	0:00:00	45:26:00	0:04:00	2	0	
2021	Oct	2	25.10.2021/15:47	27.10.2021/10:42	42:55:00	00:26:00	42:55:00	0:00:00	41:01:00	1:54:00	5	0	0.027
	Oct		27.10.2021/10:57	27.10.2021/17:00	6:03:00	00:15:00	6:03:00	0:00:00	6:00:00	0:03:00	2	0	
	Oct/Nov		27.10.2021/18:46	23.11.2021/11:34	640:47:00	01:46:00	543:48:00	96:59:00	540:32:00	100:15:00	96	1	

AMESA time OFF
Time - TW indicative scale
0 - 10 min
10 - 59 min
1 - 10 hours
10 - 100 hours
100 - 500 hours
> 500 hours

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

TW indicative emission scale
TEQ PCDD/F
< 0.01
0.01-0.06
< 0.06
< 0.1

Table 6: Use of multiple cartridges for one measurement period of 4 weeks.

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.

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

3.5 Discrepancies in 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 72:41:00 hours conflicts with data of SOCOR Air with an efficiency of 99,8% for the “fire-on”.

Figure 32 The discrepancy between data SOCOR Air and AMESA, 7-6-2021

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	
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

Amesa time: 64:30 + 600:09 = 664:39
Total incineration time: 692:25
AMESA efficiency: 96.0%
27 hours and 46 minutes not measured

Availability of fire:
72 hours and 41 minutes no fire
Efficiency is 89,5% (=619:44/692:25)

Fire-off: 72:41
Fire-on: 613:49 + 5:45= 619:44
Total: 692:25

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

Figure 32 shows the actual operating time of the incinerator of 691:34 hours. The line in the Table is marked with an asterisk to indicate data is provided by SYCTOM. However, the AMESA data show another figure of operating time: 619.44 (613:59 + 5.45) and explicitly a “fire-off” time of 72:41:00 hours. In this “Fire-off time”, a total of 14 stops in the AMESA sampling were made by the "FA" 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.[22]

[22] *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)*

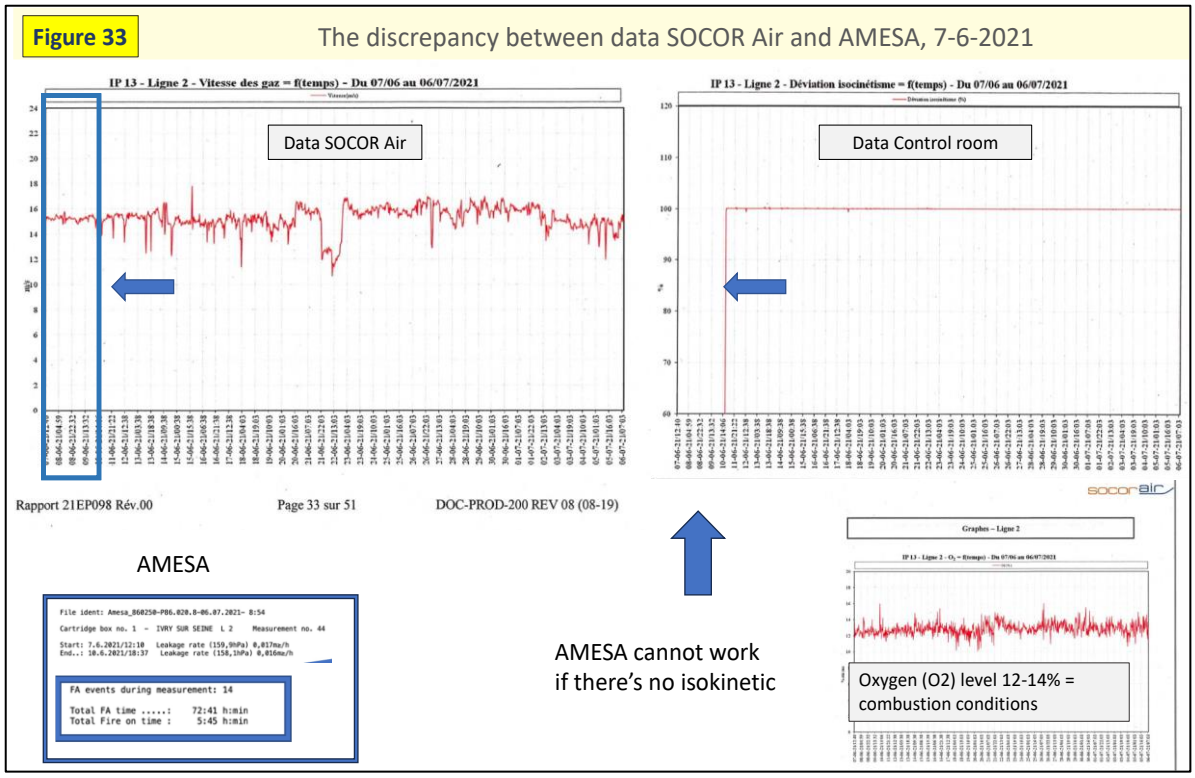


Figure 33: Discrepancy between data SOCOR Air and AMESA 7-6-2021

Example August 2021

In the data of SOCOR Air and AMESA of August 2021 a difference is to be noticed in the time that the "fire on" is mentioned. SOCOR Air gives 0:00, while the AMESA gives a total of sample duration for "fire on" time of 386:09 (hours: minutes), although the AMESA has a measurement duration of 0:00. Also line 1 was 329:05 hours: minutes "offline", which is a typical phenomenon if there are problems on one line the other show problems as well. This underlines the need for the continuous functioning of AMESA, Figure 34.

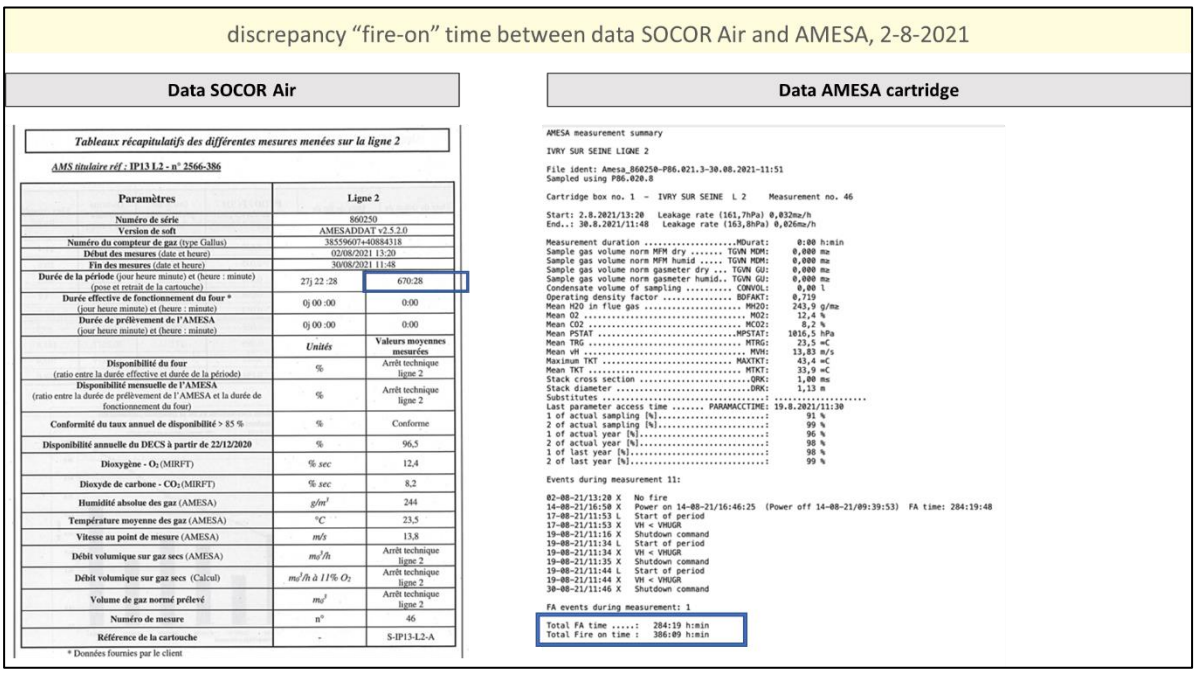


Figure 34: Discrepancy "fire-on" time between data SOCOR Air and AMESA 2-8-2021

Example September 2021

SOCOR Air shows in Figure 35 the fire was on 673:57:00 hours. However, the AMESA data, divided in two separate log files, No. 48, and No. 7, mention 88:48 in the first run and 45:30 in the second run, together 134:18 hours of total "fire on" time, due to 244 events of "fire off" (FA) commands (244+0). The AMESA sampled 653:48 hours of the total of 673:43 hours, with 19,95 hours not measured.

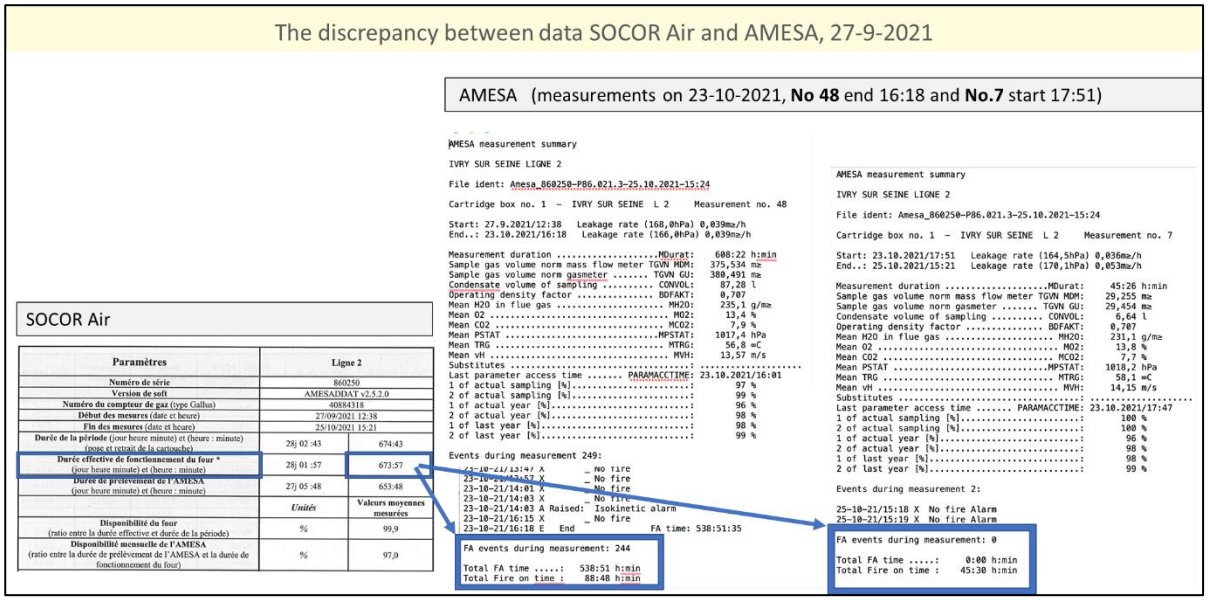


Figure 35: Discrepancy between data SOCOR Air and AMESA, 27-09-2021

Example October 2021

In October/November 2021, sampling is blocked for 107:09 hours (Table 8), with 34 events (Figure 36, left) and 4 times "FA" command of 75:55 hours (Figure 36 right, FA = Feuer aus/"*No fire*"). The efficiency of the semi-continuous measurements (Table 7: E.Time) decreased to a calculated value of 83.9%, not complying with the 85% of the minimal limit (set for the performance of the AMESA equipment according to guidance GA X 43-139).[23] However, SOCOR Air in Table 7 calculates the efficiency of the semi-continuous measurement (AMESA) at 93,9%. The result of the analyses of dioxins is 0.052 ng TEQ/ Nm^3.

Fire on time	Fire off (FA)	Total time ON	AMESA time OFF		Events	Events (FA)		ng TEQ/Nm3	E. Fire	E. Time
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: Event data of four (4) times "fire-off" stops.

[23] *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: AMESA-data SOCOR Air, Rapport d'essais du suivi en semi-continu des PCDD/F-21EP103-Revision00, Prélèvements effectués du 25 octobre au 23 novembre 2021, support AMESA, SUEZ IP13, Site d'Ivry sur Seine (94)

3.6 Isokinetic sampling

The command "VH<VHUGR" occurs very frequently in semi-continuous data files of IVRY-PARIS XIII. One of the causes of this command is the blocking of dust particles in the probe of the AMESA equipment, see Figure 14, page 17. The sampling tube may have become clogged by a dust particle, causing the velocity (VH) to fall below a set velocity limit ("VHUGR"). A program is then started to clean the tube with a blow to flush 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. In the Netherlands, this value was set at 1.5 m/s to prevent unnecessary stops during sampling. They are blocking AMESA sampling results in an underreporting of emitted dioxins.

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 of the sampling. 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.

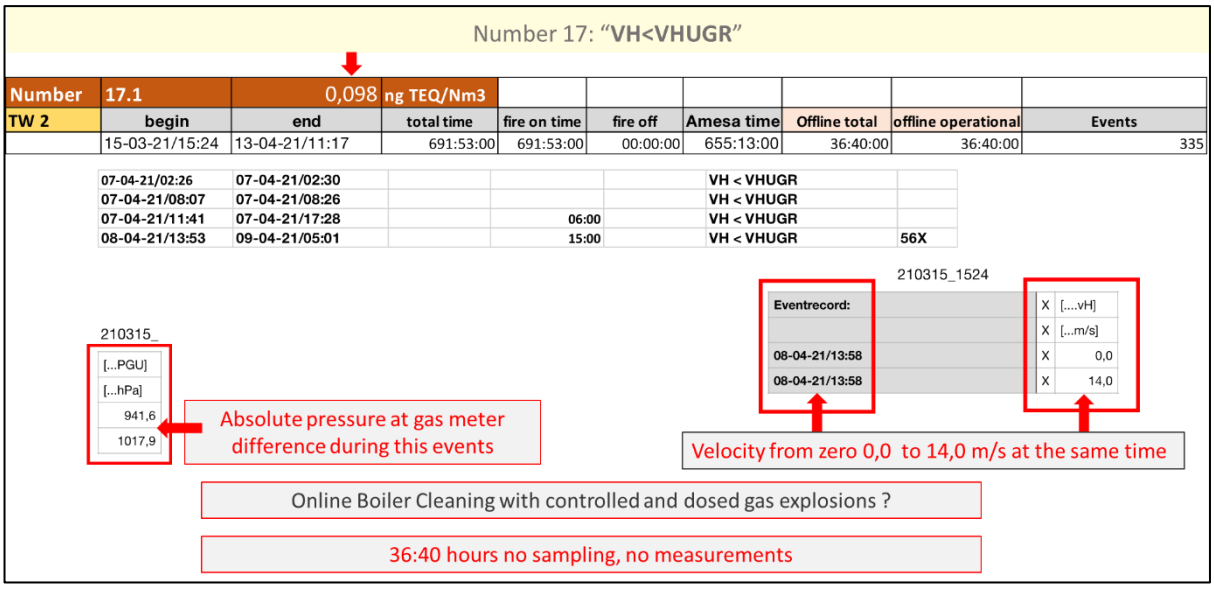


Figure 37: Measurement 15/03/2021 to 13/04/2021 with nearly an exceeding of the dioxin limit

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.[24] A graph of the total number of shutdowns/start-ups observed in IVRY-PARIS XIII and the REC (NL) is presented in Figure 38.

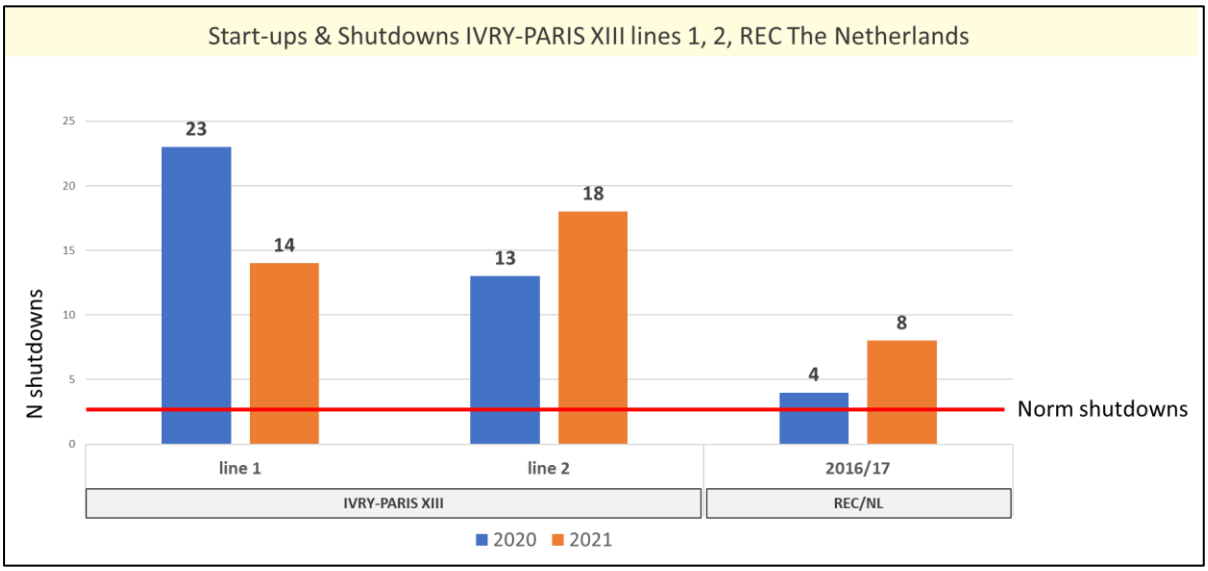


Figure 38: Shutdown IVRY-PARIS XIII, Lines 1,2, vs REC (NL)

The start-up of the incinerator IVRY-PARIS XIII is initiated with untreated **wood from short oak offcuts.**[25] 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 being used in the 2 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)[26] mentions 24 and 21 start-ups and shutdown frequency in resp. 2020 and 2021. The difference could be explained by 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)[27] the need to reduce the frequency of OTNOC to reduce emissions to the air is underlined in BAT 18.[28] A frequency of 3 start-ups per year is considered a norm for normal operating incinerators, [29,30] which is significantly less than the many start-ups observed at IVRY-PARIS XIII.

3.8 Measurements of start-ups IVRY-PARIS XIII

[24] *Hung et al. Continuous sampling of MSWI dioxins, Chemosphere, Volume 145, 2016, Pages 119-124,*
[25] *Dossier d'information du public 2021, page 15*
[26] *Dossier d'information du public 2021, page 25*
[27] *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010L0075*
[28] *Neuwahl F. et al (2019. Best Available Techniques (BAT) Reference Document for Waste Incineration; EUR 29971 EN*
[29] *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.*
[30] *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*

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 guidelines of EN-13824-1. Therefore, the measurement results are not accredited and are expressed in units such as "pièce, 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.

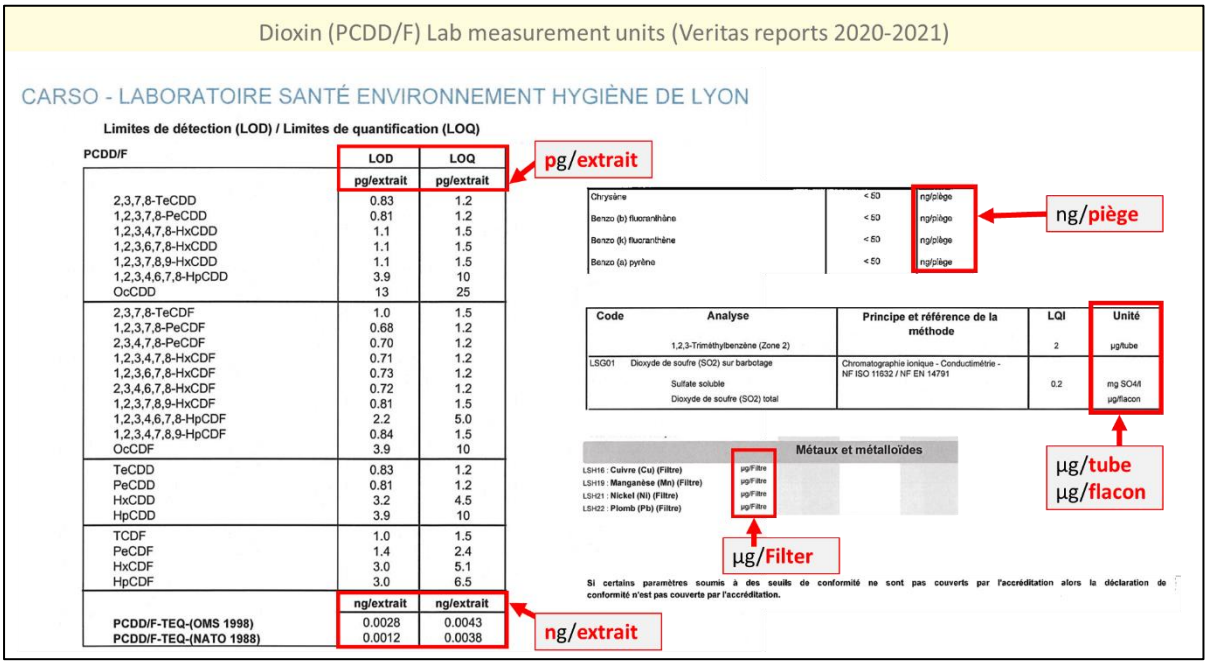


Figure 39: Dioxin (PCDD/F) lab measurement units (Veritas report 2020-2021)

Measurement of dioxin emissions (PCDD/F) during the start-up is performed in 125 minutes, while the procedure of the start-up 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.[31]

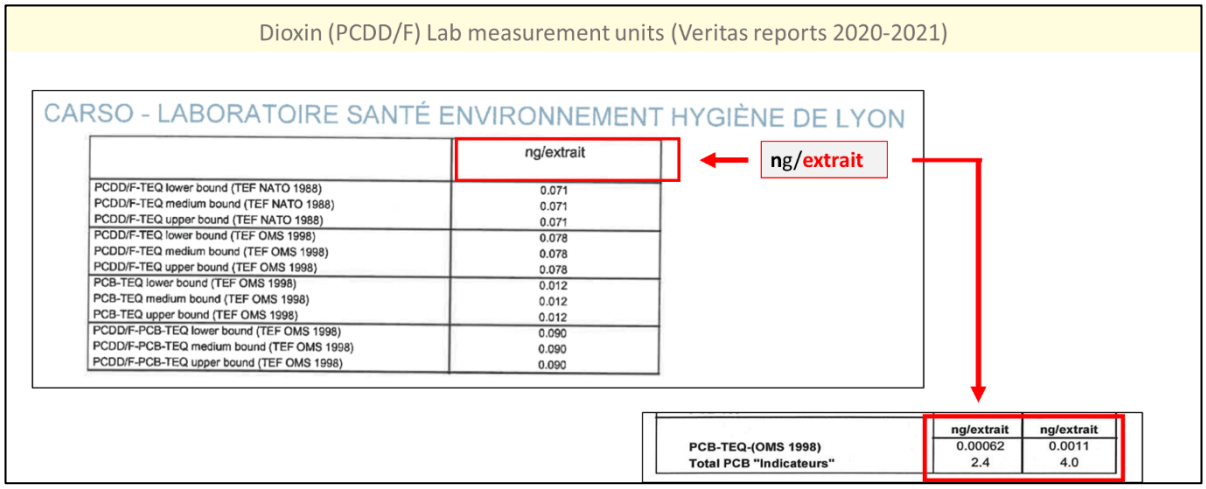


Figure 40: Dioxin (PCDD/F) TEQ values, Ivry-Paris XIII start-up on 3-9-2021, of line 2

[31] *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 Measurements of start-ups REC, The Netherlands

In the Netherlands, the measurements of the start-up can be divided into four phases: Flushing, (the time when the interior of the incinerator is intensively cleaned), Pre-heating, Waste feeding, and Regular combustion, Figure 41.

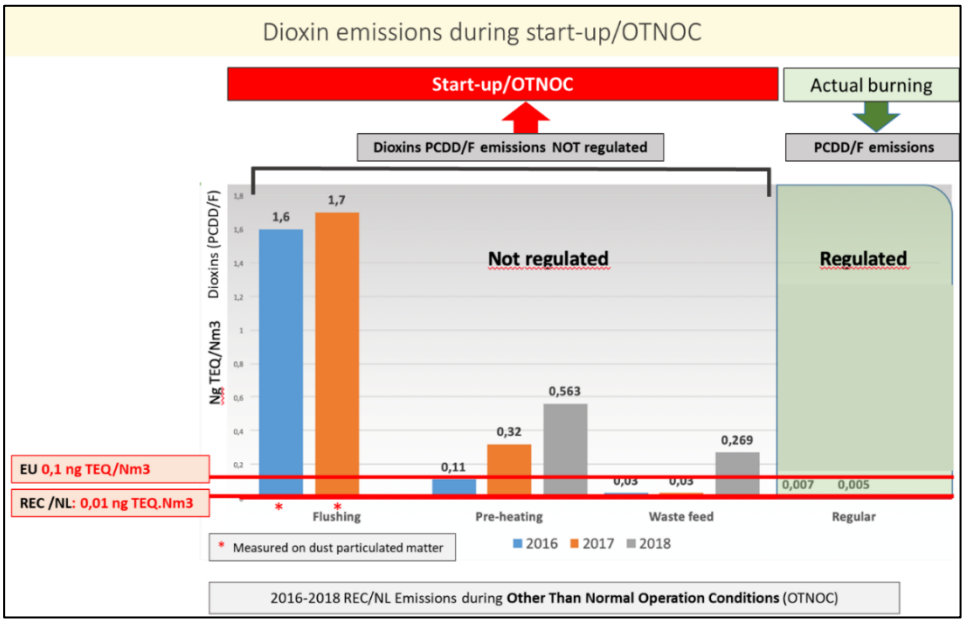


Figure 41: Start-up stages of a waste incinerator

The figure above makes it clear, that it is important when the measurements are taken place. Phase 1 when the waste incinerator is cleaned turns out to be extremely sensitive to high dioxin emissions, especially if unfiltered dust is blown out of the chimney. Because there is no waste to be incinerated, filters can be set off, EU Directive 2010/75/EU.[32] However, blowing unfiltered dust into the environment is in principle forbidden.[33]
TW research has revealed that cleaning dust occur by emitting dump stacks while the AMESA was set out of order and the bag filters were bypassed in a repeated 3-minute frequency, Figure 42.

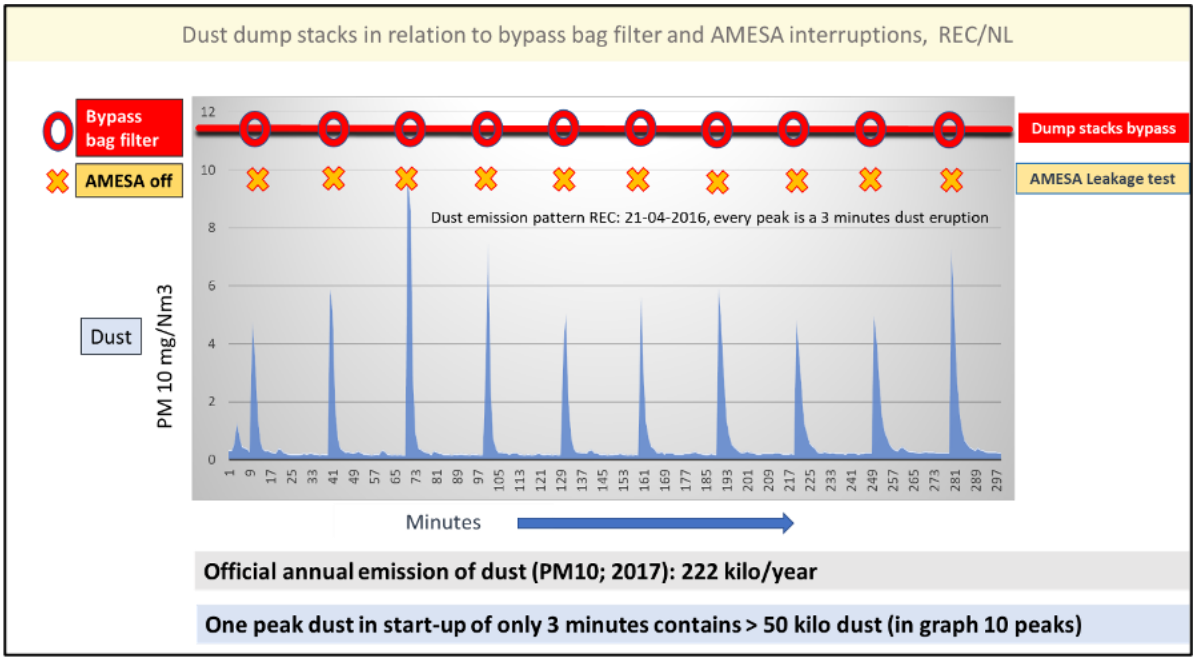


Figure 42: Dust dump stacks in relation to bypass bag filter and AMESA interruptions, REC/NL

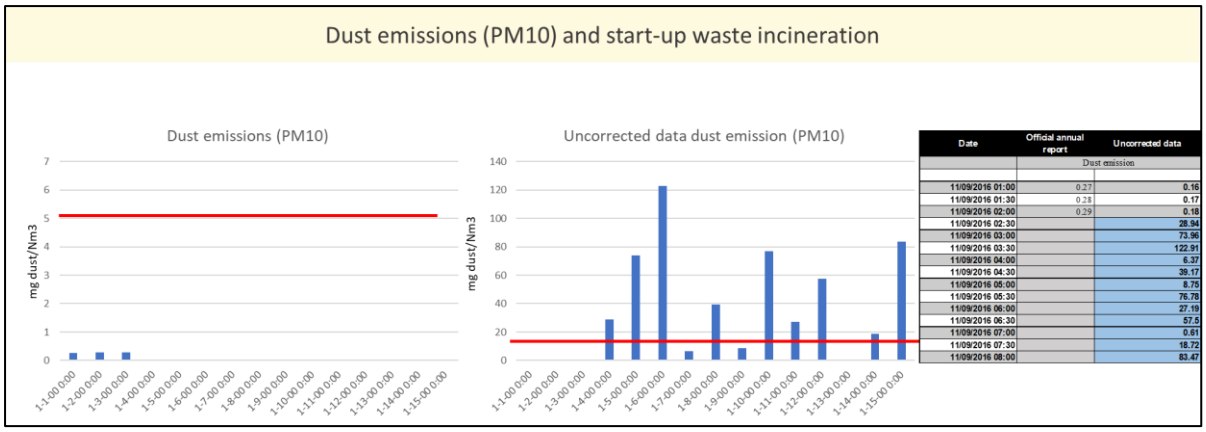
[32] *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010L0075*
[33] *Neuwahl F. et al (2019. Best Available Techniques (BAT) Reference Document for Waste Incineration; EUR 29971 EN*

3.10 Corrected and uncorrected dust data

It is important to study uncorrected data from emissions. In Figure 43 below an example of dust emissions during a start-up of corrected and uncorrected data from the incinerator REC in The Netherlands, all conform to the legal rules.

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 at the right 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.



Date	Offical annual report	Uncorrected data
	Dust emission	
11/09/2016 01:00	0.27	0.16
11/09/2016 01:30	0.28	0.17
11/09/2016 02:00	0.29	0.18
11/09/2016 02:30		28.94
11/09/2016 03:00		73.96
11/09/2016 03:30		122.91
11/09/2016 04:00		6.37
11/09/2016 04:30		39.17
11/09/2016 05:00		8.75
11/09/2016 05:30		76.78
11/09/2016 06:00		27.19
11/09/2016 06:30		57.5
11/09/2016 07:00		0.61
11/09/2016 07:30		18.72
11/09/2016 08:00		83.47

Figure 43: Dust emissions (PM10) and start-up waste incineration

4. Conclusion

This report is about semi-continuous measurements (AMESA) of dioxin emissions of IVRY-PARIS XIII (IP-XIII) in 2020-2021. The research is based on reports and documents of AMESA, COFRAC, SOCOR Air, Veritas, and the *Dossier d'information du public* (DIP), all provided by the organisation of C3R.

Semi-continuous measurements are made in 4-week periods and are a good step forward in monitoring emissions of substances of very high concern (SVHC) such as dioxins (PCDD/F/dl-PCB) released from waste incineration. The former EU requirement was and still is in many countries based on only 6-12 hours of dioxin emissions measurements in the chimney during optimal incineration conditions and is performed during pre-announced visits. However, long-term measurements, like the AMESA, are not continuous measurements, as sampling is stopped during OTNOC. Nor are continuous measurements made during maintenance periods. Even if no waste is incinerated, dioxins are likely to be emitted during such maintenance operations, especially when the waste incinerator is restarted with a start-up.

In summary the AMESA measurements IP-XIII concerning operation hours:

- Total waste incineration time in 2020-2021 was 34,937 hours.
- Total semi-continuous measurements by AMESA in 2020-2021 were 28,001 hours.
- A total of 6,936 hours were not sampled meaning 20% of the AMESA measurement was off-line.
- A total of 7,864 events were registered to block the AMESA measuring system.

Other findings in this study are:

- Considerable differences are found between AMESA and SOCOR Air data regarding combustion. Minute data from the incinerator control room are needed to determine the actual dioxin emissions.

- The provided documents about OTNOC as well as start-up and shutdown cannot be subject to interpretation due to the use of non-convertible measurement units such as µg/flacon, ng/pièce, µg/tube, or pg/extrait.

- The nozzles, part of the AMESA equipment, used in IVRY-PARIS XIII are for both lines below the mandatory diameter of 6 mm, only 5 mm is applied.

- High frequency of 45 start-ups in the two lines in two years.

- Commands of “fire-off” (FA) are mentioned 320 times in the provided data.

- Missing emission data for 6,936 hours of measurements during OTNOC.

The provided data of semi-continuous measurements in this report are compared with those of the incinerator REC in the Netherlands, which has an emission permit of 0.01 ng TEQ/Nm^3, a factor 10 lower than IP XIII.

a. IP XIII exceeded the Dutch limit by 94 %.
b. A factor of 15 more interruption times of IP XIII (2,597 and 2,994 vs 173 hours for the REC).
c. A factor of 4-10 more interruptions/events of IP XIII (2,120 and 5,424 vs 523 events for the REC).

In the urban environment of the national capital city Paris, almost 7,000 hours of disturbed combustion conditions (OTNOC, shutdowns, start-ups) have occurred without measurements of dioxin emissions in 2020-2021. The AMESA equipment was out of operation during these OTNOCs. To fill this data gap, transparent data is needed from the control room of the waste incinerator IP-XIII of uncorrected minute data of temperatures, dust, NOx, CO, and velocity, among other parameters, to research the performance and unmonitored dioxin emissions. The BREV-2019 mentioned all efforts and best available techniques (BAT) should be implemented for sound management, according to performing the utmost to reduce emissions of hazardous substances such as dioxins into the environment for the protection of human health. A proper working continuous measurement system is essential to monitor even during other than normal operating conditions (OTNOC).

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List of Figures

Annex

Hidden emissions waste incinerator IVRY-PARIS XIII

AMESA semi-continuous measurements 2020 - 2021

Annex 1: AMESA data, August 2021

Paramètres	Ligne 1
Numéro de série	860263
Version de soft	AMESADDAT v2.5.2.0
Numéro du compteur de gaz (type Gallus)	38322344+40884324
Début des mesures (date et heure)	02/08/2021 12:46
Fin des mesures (date et heure)	30/08/2021 11:07

Number	22.1A		0.134 ng TEQ/Nm3				two runs		
TW 7.1	begin	end	total time	fire on time	fire off	Amesa time	Offline total	offline operational	Events
Total	**02-08-21/12:46**	**07-08-21/11:16**	**118:30:00**	**118:30:00**	00:00:00	114:05:00	**4:25:00**	**4:25:00**	**36**
				100%	**0%**	**96%**	**4%**	4%	
Specific	06-08-21/04:34	06-08-21/07:14						02:40:40	TRG < TRGMIN
	06-08-21/09:39	06-08-21/10:59						01:20:00	TRG < TRGMIN
	07-08-21/09:04	07-08-21/10:44					2	01:40:40	TRG < TRGMIN
	07-08-21/10:54	07-08-21/11:14						00:20:00	
									no shutdown command
								06:01:20	

Number	22.2B		0.134 ng TEQ/Nm3						
TW 7.2	begin	end	total time	fire on time	fire off	Amesa time	Offline total	offline operational	Events
Total	07-08-21/11:27	30-08-21/11:07	551:39:00	240:44:00	310:55:00	216:29:00	335:10:00	0:30:30	81
				44%	56%	39%	61%	0%	
Specific	07-08-21/18:21	07-08-21/18:58						00:30:30	TRG < TRGMIN
	08-08-21/07:58	21-08-21/19:13						323:00:00	Maintenance/No fire
	21-08-21/20:50	22-08-21/03:55						07:05:00	Maintenance/No fire
	22-08-21/06:14	22-08-21/06:50						00:36:00	Maintenance/No fire
	21-08-21/20:50	23-08-21/18:24						45:34:00	Maintenance/No fire
			total time					376:45:30	
stop		30-08-21/11:07	665:44:00						

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
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	

Annex 2: Multiple uses of cartridges, 25-10-2021, line 2

Three (3) different sheets are rolling out for this measurement. Probably just the same cartridge, only push the button. If different cartridges were used, the question arises of how the results are calculated.

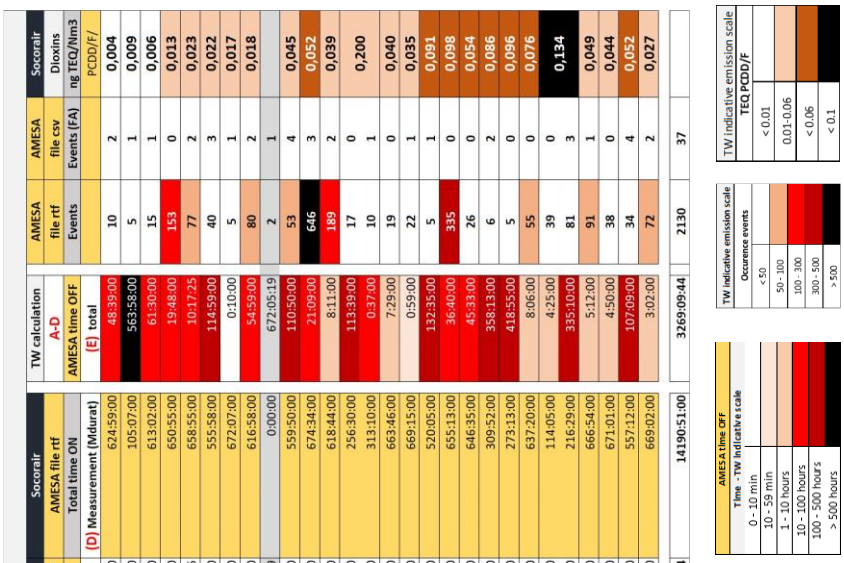
```
AMESA measurement summary

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



IVRY-PARIS XIII 2019-2021 LINE 1

Year	Month	Line	Socrair AMESA file csv Start time	Socrair AMESA file csv End time	Socrair Total time (A) inc.	Cartridge ex	Socrair AMESA file csv/rtf Fire on time (B)	Socrair AMESA file csv/rtf Fire off (FA) (C)	Socrair AMESA file rtf Total time ON (D) Measurement (Mdurat)	TW calculation A-D AMESA time OFF (E) total	AMESA file rtf Events	AMESA file csv Events (FA)	Socrair Dioxins ng.TEQ/Nm3 PCDD/F/
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	10	2	0,004
	Jan/Feb	1	21.1.2020/13:06	18.2.2020/10:11	669:05:00	00:31:00	105:13:00	563:52:00	105:07:00	563:58:00	5	1	0,009
	Febr/Mar	1	18.2.2020/10:22	17.3.2020/12:55	674:32:00	00:11:00	613:50:00	60:42:00	613:02:00	61:30:00	15	1	0,006
	Mrt/Apr	1	17.3.2020/13:13	14.4.2020/11:56	670:43:00	00:18:00	670:43:00	0:00:00	650:55:00	19:48:00	153	0	0,013
	Apr/May	1	14.4.2020/12:21	12.5.2020/10:58	669:12:25	00:25:00	669:11:00	0:01:25	658:55:00	10:17:25	77	2	0,023
	May/June	1	12.5.2020/11:15	9.6.2020/10:13	670:57:00	00:17:00	558:43:00	112:14:00	555:58:00	114:59:00	40	3	0,022
	June/July	1	09.06.20/10:34	7.7.20/10:51	672:17:00	00:21:00	672:12:00	0:05:00	672:07:00	0:10:00	5	1	0,017
	July/Aug	1	7.7.2020/11:21	4.8.2020/11:18	671:57:00	00:30:00	625:41:00	46:16:00	616:58:00	54:59:00	80	2	0,018
	Aug	1	4.8.2020/11:47	1.9.2020/11:47	672:05:19	00:29:00	0:00:00	672:05:19	0:00:00	672:05:19	2	1	
	Sept	1	1.9.2020/12:13	29.9.2020/10:53	670:40:00	00:30:00	582:28:00	88:12:00	559:50:00	110:50:00	53	4	0,045
	Sept/Oct	1	29.9.2020/11:23	28.10.2020/11:06	695:43:00	00:30:00	695:40:00	0:03:00	674:34:00	21:09:00	646	3	0,052
	Oct/Nov	1	28.10.2020/11:28	23.11.2020/14:24	626:55:00	00:23:00	626:52:00	0:03:00	618:44:00	8:11:00	189	2	0,039
	Nov/Dec	1	23.11.2020/14:50	9.12.2020/00:59	370:09:00	00:26:00	370:09:00	0:00:00	256:30:00	113:39:00	17	0	0,200
	Dec		9.12.2020/09:27	22.12.2020/11:15	313:47:00	8:28:00	313:46:00	0:01:00	313:10:00	0:37:00	10	1	
2021	Dec/Jan	1	22.12.2020/11:56	19.1.2021/11:11	671:15:00	00:41:00	671:15:00	0:00:00	663:46:00	7:29:00	19	0	0,040
	Jan/Feb	1	19.1.2021/11:36	16.2.2021/09:51	670:14:00	00:25:00	670:13:00	0:01:00	669:15:00	0:59:00	22	1	0,035
	Feb/Mar	1	16.2.2021/10:17	15.3.2021/14:58	652:40:00	00:26:00	520:12:00	132:28:00	520:05:00	132:35:00	5	1	0,091
	Mrt/Apr	1	15.3.2021/15:24	13.4.2021/11:17	691:53:00	00:26:00	691:53:00	0:00:00	655:13:00	36:40:00	335	0	0,098
	Apr/May	1	13.4.2021/11:43	10.5.2021/14:54	692:08:00	00:26:00	692:08:00	0:00:00	646:35:00	45:33:00	26	0	0,054
	May/June	1	10.5.2021/15:17	7.6.2021/11:22	668:05:00	00:23:00	309:55:00	358:10:00	309:52:00	358:13:00	6	2	0,086
	June/July	1	7.6.2021/11:44	6.7.2021/07:52	692:08:00	00:22:00	273:13:00	0:00:00	273:13:00	418:55:00	5	0	0,096
	July/Aug	1	6.7.2021/14:56	2.8.2021/12:22	645:26:00	07:04:00	645:26:00	0:00:00	637:20:00	8:06:00	55	0	0,076
	Aug	1	2.8.2021/12:46	7.8.2021/11:16	118:30:00	00:24:00	118:30:00	0:00:00	114:05:00	4:25:00	39	0	0,134
			7.8.2021/11:27	30.8.2021/11:07	551:39:00	00:11:00	400:01:00	151:38:00	216:29:00	335:10:00	81	3	
	Sept	1	30.8.2021/11:38	27.9.2021/11:44	672:06:00	00:31:00	672:03:00	0:03:00	666:54:00	5:12:00	91	1	0,049
	Sept/Oct	1	27.9.2021/12:07	25.10.2021/15:58	675:51:00	00:23:00	675:51:00	0:00:00	671:01:00	4:50:00	38	0	0,044
	Oct/Nov	1	25.10.2021/16:21	23.11.2021/10:50	664:21:00	00:23:00	588:26:00	75:55:00	557:12:00	107:09:00	34	4	0,052
	Nov/Dec	1	23.11.2021/11:21	21.12.2021/11:26	672:04:00	00:31:00	671:59:00	0:05:00	669:02:00	3:02:00	72	2	0,027
	Total		24.12.2019/10:57	21.12.2021/11:26	17460:00:44	25:55:00	14730:57:00	2310:08:44	14190:51:00	3269:09:44	2130	37	

AMESA time OFF Time - TW indicative scale
0 - 10 min
10 - 59 min
1 - 10 hours
10 - 100 hours
100 - 500 hours
> 500 hours

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

TW indicative emission scale TEQ PCDD/F
< 0.01
0.01-0.06
< 0.06
< 0.1

Annex 4: Line 2 Semi-continuous measurements XP XIII

IVRY-PARIS XIII 2019-2021 LINE 2													
			Socorair	Socorair	Socorair		Socorair	Socorair	Socorair	TW calculation	AMESA	AMESA	Socorair
			AMESA file csv	AMESA file csv			AMESA file csv/rtf	AMESA file csv/rtf	AMESA file rtf	A-D	file rtf	file csv	Dioxins
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	Total	"Fire OFF"	PCDD/F/
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	61	0	0,052
	Dec/Jan	2	21.01.2020/12.22	18.2.2020/10:36	670:13:00	00:43:00	131:30:00	538:43:00	131:24:00	538:49:00	61	0	0,048
	Febr/Mar	2	18.2.2020/10:51	17.3.2020/12:26	673:34:00	00:15:00	673:34:00	0:00:00	663:16:00	10:18:00	309	0	0,035
	Mrt/Apr	2	17.3.2020/12:45	14.4.2020/11:22	670:37:00	00:19:00	670:37:00	0:00:00	628:33:00	42:04:00	343	0	0,059
	Apr/May	2	14.4.2020/11:48	12.5.2020/10:18	670:30:00	00:26:00	542:26:00	128:04:00	535:50:00	134:40:00	81	4	0,079
	May/June	2	12.5.2020/10:42	9.6.2020/10:46	670:30:00	00:24:00	289:56:00	382:07:00	289:33:00	380:57:00	20	1	0,040
	May/June	2	9.06.2020/11:06	7.7.2020/10:13	671:07:00	00:22:00	670:33:00	0:34:00	295:58:00	375:09:00	8	1	0,020
	July/Aug	2	7.7.2020/10:39	4.8.2020/10:47	672:07:00	00:26:00	672:07:00	0:00:00	656:15:00	15:52:00	208	0	0,036
	Aug/sept	2	4.8.2020/11:10	1.9.2020/12:23	673:12:00	00:23:00	420:49:00	252:23:00	418:35:00	254:37:00	34	2	0,021
	Sept	2	1.9.2020/12:47	29.9.2020/10:07	669:19:00	00:24:00	622:35:00	46:44:00	580:52:00	88:27:00	21	3	0,025
	Sept/Oct	2	29.9.2020/10:43	28.10.2020/11:44	697:01:00	00:36:00	695:58:00	1:03:00	617:53:00	79:08:00	65	1	0,008
	Oct/Nov	2	28.10.2020/12:09	23.11.2020/15:11	627:01:00	00:25:00	626:46:00	0:15:00	601:31:00	25:30:00	112	1	0,017
	Nov/Dec	2	23.11.2020/15:37	22.12.2020/12:05	692:28:00	00:26:00	692:28:00	0:00:00	690:41:00	1:47:00	46	0	0,019
	Dec/Jan	2	22.12.2020/12:23	19.1.2021/10:39	670:16:00	00:18:00	418:58:00	251:18:00	413:30:00	256:46:00	269	2	0,021
2021	Jan/Feb	2	19.1.2021/11:01	16.2.2021/09:08	670:07:00	00:22:00	587:43:00	82:24:00	510:47:00	159:20:00	55	2	0,027
	Febr/Mar	2	16.2.2021/09:39	15.3.2021/14:21	652:42:00	00:31:00	652:42:00	0:00:00	643:31:00	9:11:00	234	0	0,029
	Mar/Apr	2	15.3.2021/14:47	13.4.2021/10:45	691:58:00	00:26:00	691:58:00	0:00:00	632:57:00	59:01:00	1802	1	0,055
	Apr/May	2	13.4.2021/11:07	10.5.2021/14:02	670:30:00	00:22:00	643:26:00	7:28:00	627:23:00	43:07:00	325	1	0,066
	May/June	2	10.5.2021/14:44	7.6.2021/11:53	669:09:00	00:42:00	514:36:00	154:33:00	503:07:00	166:02:00	244	2	0,094
	June	2	7.6.2021/12:10	10.6.2021/18:37	78:26:41	00:15:00	5:45:00	72:41:41	64:30:00	13:56:41	24	14	0,074
	June/July		10.6.2021/18:52	6.7.2021/08:51	613:59:00	00:17:00	613:59:00	0:00:00	600:09:00	13:50:00	15	0	
	July/Aug	2	6.7.2021/09:18	2.8.2021/12:58	651:40:00	00:27:00	625:39:00	26:01:00	568:12:00	83:28:00	115	1	0,045
	Aug	2	2.8.2021/13:20	30.8.2021/11:48	670:28:00	00:22:00	284:19:00	386:09:00	0:00:00	670:28:00	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	317	1	0,037
	Sept/Oct	2	27.9.2021/12:38	23.10.2021//16:18	627:39:35	00:19:00	88:48:00	538:51:35	608:22:00	19:17:35	249	244	0,031
	Oct		23.10.2021/17:51	25.10.2021/15:21	45:30:00	01:33:00	45:30:00	0:00:00	45:26:00	0:04:00	2	0	
	Oct	2	25.10.2021/15:47	27.10.2021/10:42	42:55:00	00:26:00	42:55:00	0:00:00	41:01:00	1:54:00	5	0	0,027
	Oct		27.10.2021/10:57	27.10.2021/17:00	6:03:00	00:15:00	6:03:00	0:00:00	6:00:00	0:03:00	2	0	
	Oct/Nov		27.10.2021/18:46	23.11.2021/11:34	640:47:00	01:46:00	543:48:00	96:59:00	540:32:00	100:15:00	96	1	
	Nov/Dec	2	23.11.2021/12:08	21.12.2021/10:51	670:43:00	00:34:00	669:29:00	0:00:00	645:26:00	25:17:00	281	0	0,028
	Total	2	24.12.2019/10:04	21.12.2021/10:51	17476:14:16	14:04:00	14489:37:00	2967:20:16	13810:46:00	3665:28:16	5415	283	

Annex 5: Post-Combustion Zone (PCZ)

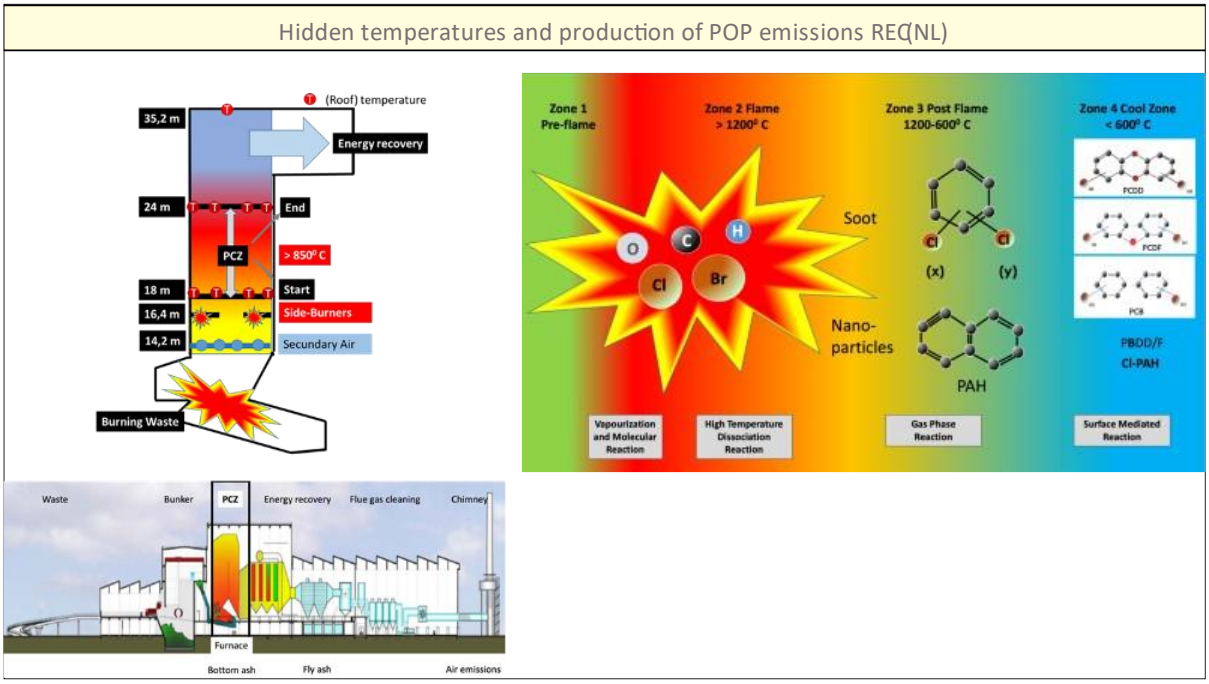


Figure 44: Post-Combustion Zone (PCZ), REC (NL) de-novo syntheses of dioxins in relation to temperatures.

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.

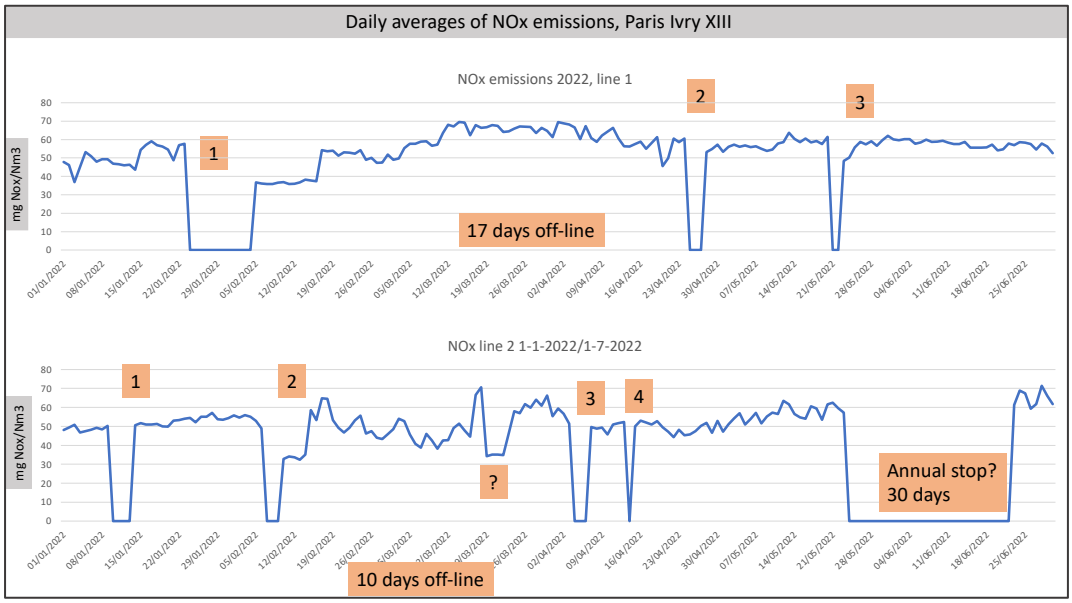


Figure 45: Daily averages of NOx emissions Ivry-Paris XIII, Line 1 and 2, 2022

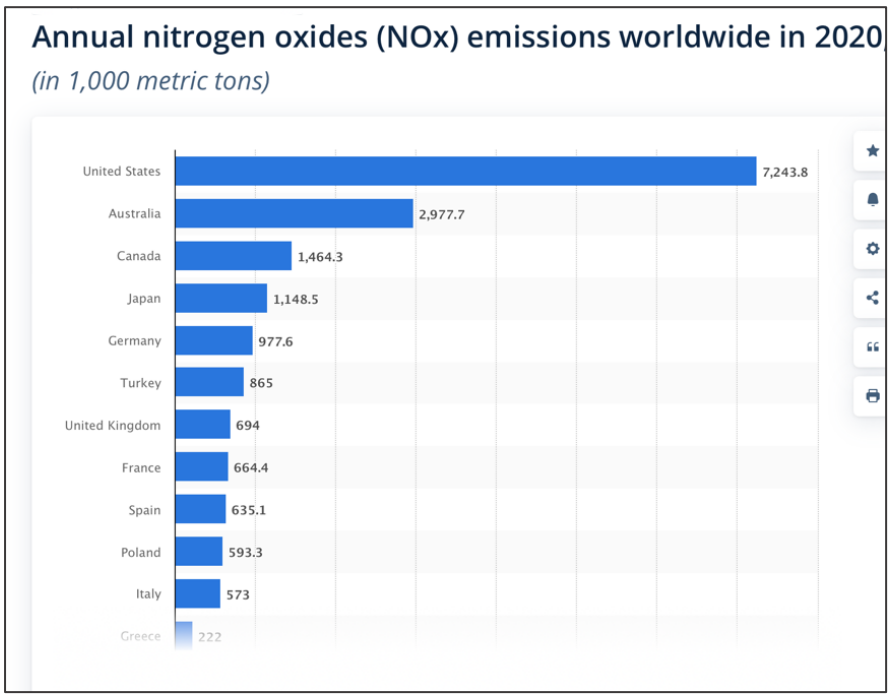


Figure 46: Annual nitrogen oxides (NOx) emissions worldwide in 2020, source: https://www.statista.com/statistics/478831/leading-countries-based-on-nitrogen-oxide-emissions/

Annexe 7: Emissions Benzene and Carbon Monoxide

Several volatile organic compounds were also measured in the start-up and shutdown monitoring reports of Veritas[34]. 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 shows 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 are not allowed. In the air quality directive (2008/EC/50), the EU 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). [35]

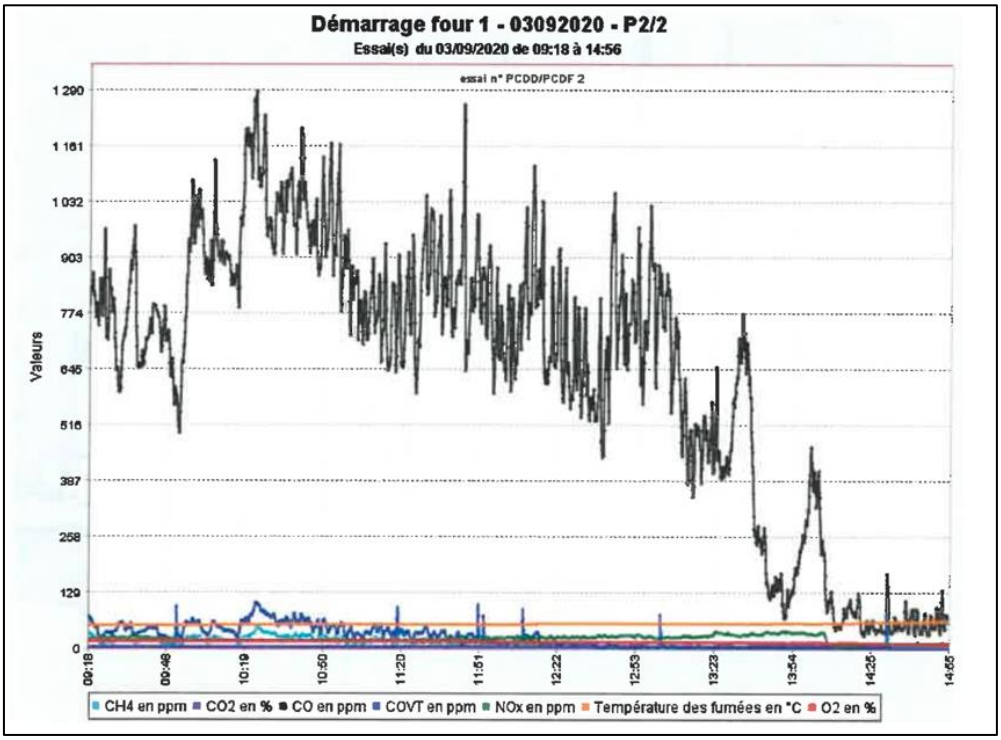


Figure 47: Carbon monoxide, Ivry-Paris XIII, September 3rd, 2020

[34] *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*

[35] *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