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Dioxin Emission Continuous Sampling

Tecora introduces Dioxins continuous sampling

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Dioxin Emission Continuous Sampling

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Company Introduction



- TECORA was founded in 1974 near Milan, Italy;
- Since then Tecora developed technology to monitor air quality;
- Core Competencies:
 - Emissions;
 - Sampling;
 - Innovation;
 - Service.

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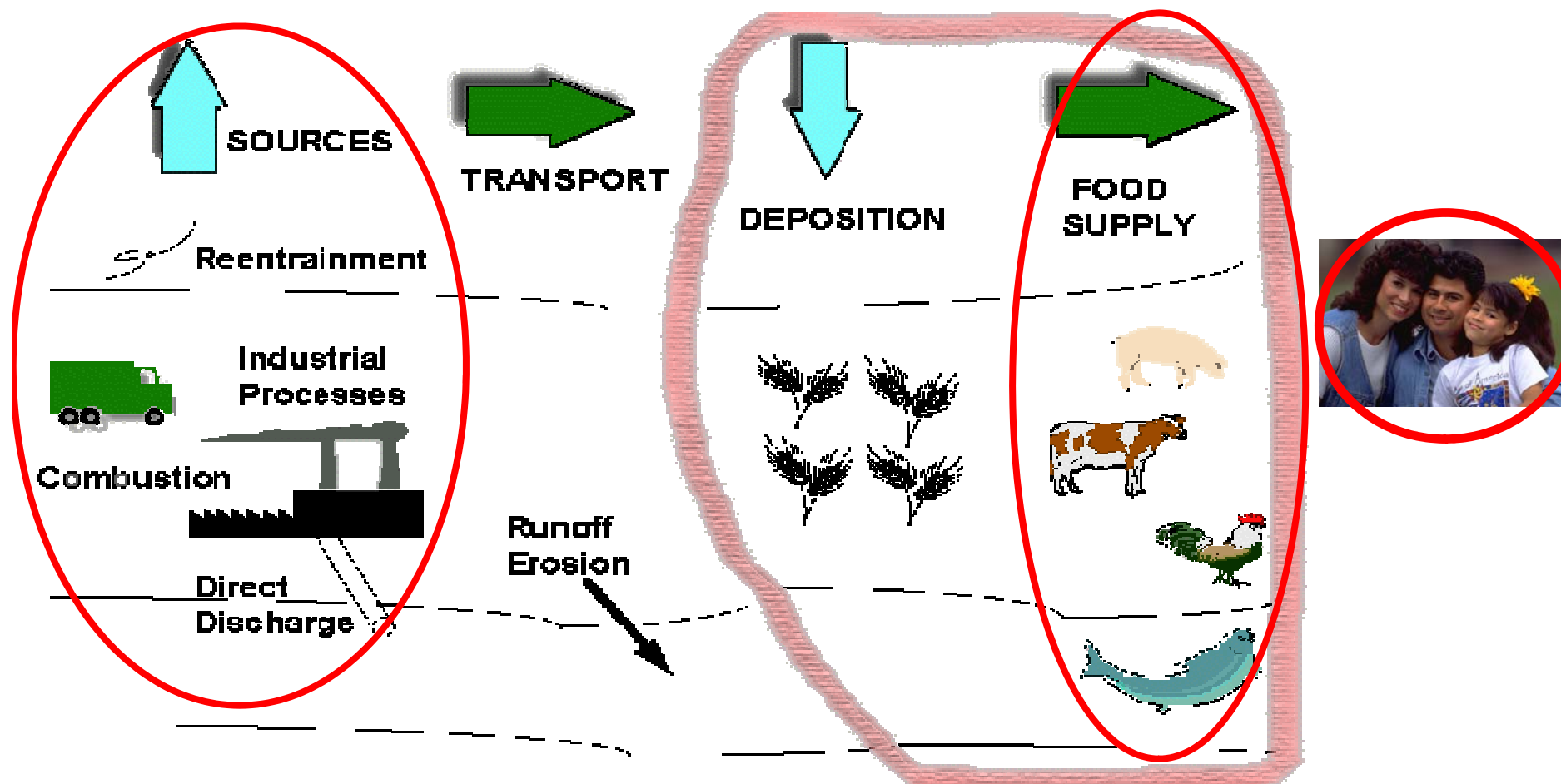
1. Why do we need to monitor Dioxins;
2. Why continuous sampling was developed;
3. Introducing DECS;
4. DECS certification & field test;



Why do we need to monitor Dioxins

- Combustion process of large plants transforming urban and industrial wastes into energy are potential source of dioxins emissions;
 - Urban waste incinerators,
 - steel mills,
 - cements plants.

How POP's and dioxins reach the human life





Dioxin effect to human life

- **The Dioxin (2,3,7,8-TCDD) is a cancer agent, while other dioxins and furans may be a cancer trigger.**
- **Some of the undesirable effect of dioxins:**
 - Reduced neuro ability, depression;
 - Immunodeficiency;
 - Central neuro system alteration;
 - Skin alteration
 - Metabolic alteration;
 - Alteration of sexual function;
 - Hormone alteration;
 - Newborn baby alteration;



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Why continuous sampling was developed

- Plants environmental risk permit;
- Industry image and social impact;
- Avoidance of costly plant shut-down;
- Automatic dioxins sampling system for on-site continuous operation obtains reliable detection of PAH and other dangerous micropollutants;
- The objective is to get a realistic picture of risk industries emissions.



Standards for dioxin control as is today

Directives for the incinerators in Europe and in many other countries follow common guide lines :

- **LIMIT VALUE** for Dioxins and Furans: 0.1 ng/m³ TE
- **MEASURE FREQUENCY** from 1 to 4 times per year
- **SAMPLING DURATION** from 3 to 10 hours

With traditional periodical sampling we have just a “snap-shot” of the real situation compared to the entire duration of the emission. Peaks and anomalies of the plant cannot be tracked and evaluated.

That is why continuous sampling is needed!



1) Standards for the dioxins control as is today

EN1948 – 1 with 3 methods :

- 1) Filter/Condenser**
- 2) Dilution**
- 3) Cooled Probe**

US EPA Method 23 :

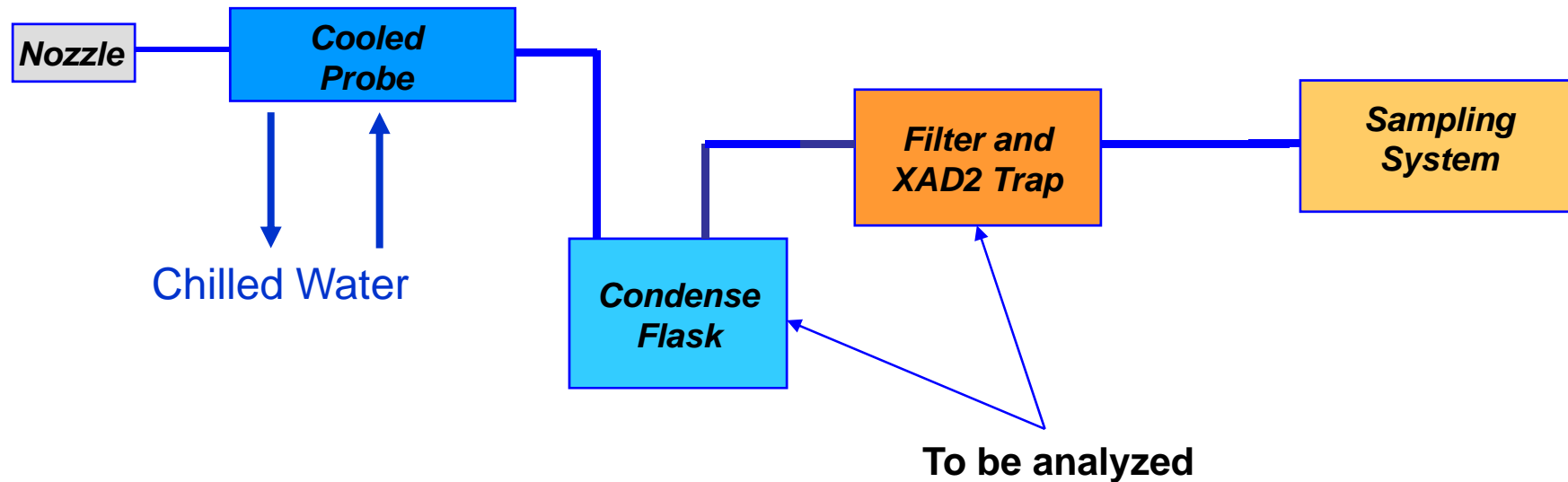
Filter/Condenser

The methods are designed for periodical sampling



Standards for the dioxins control

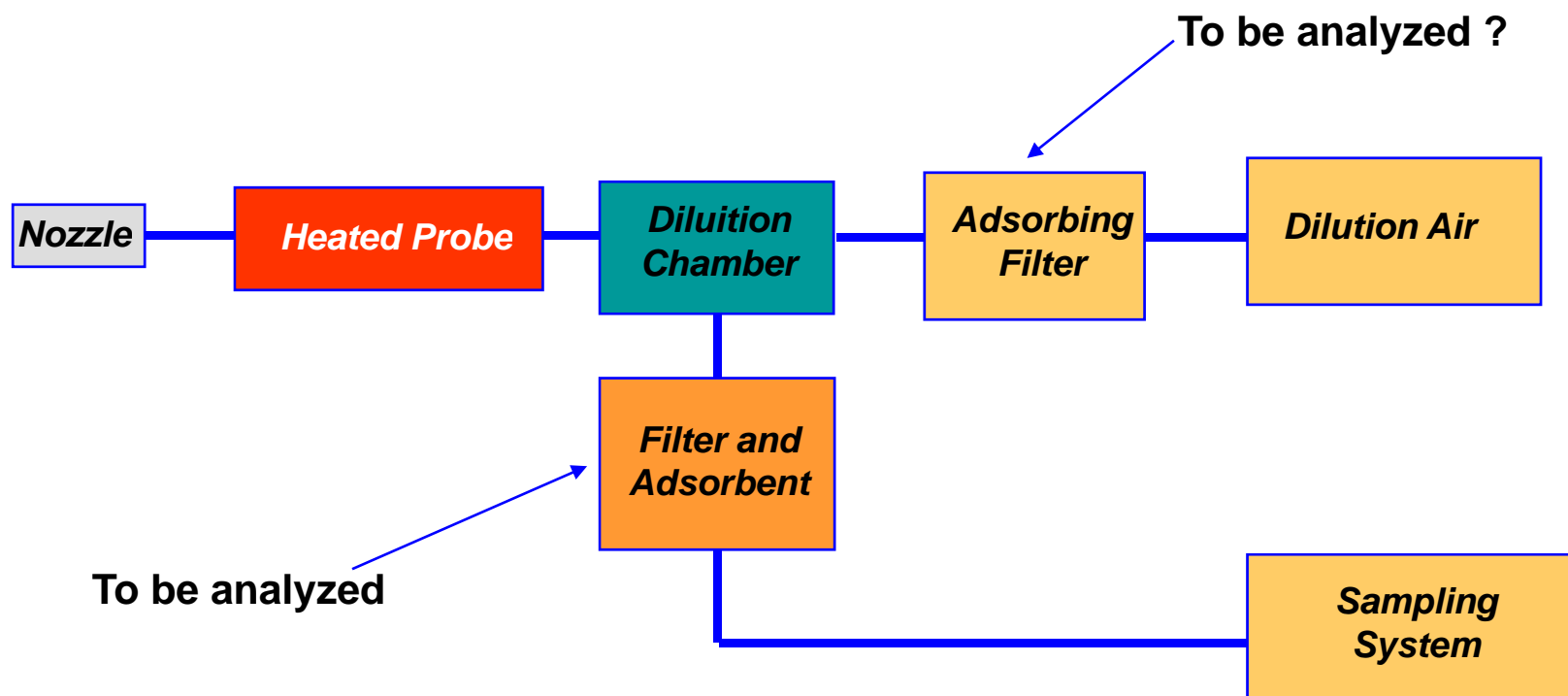
Cooled Probe Method





Standards for the dioxins control

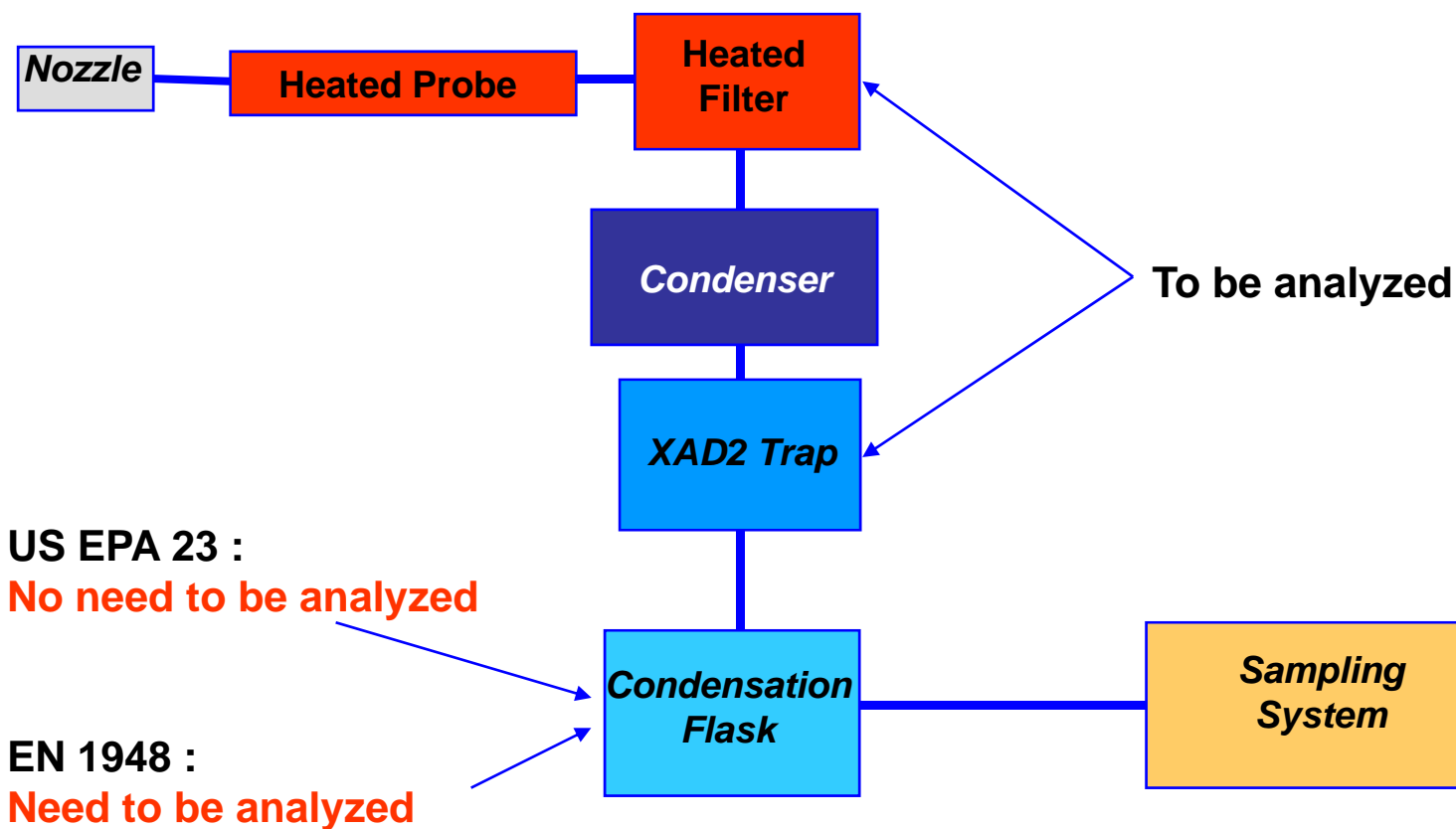
Dilution Method





Standards for the dioxins control

Filter/Condenser Method





Design of a continuous sampling

Which Method to choose?

Filter/Condenser

Dilution

Cooled Probe



Which Method to choose?

- Each method has pro's and con's;
- Let us analyse each method looking at the need of a long duration sampling:
 - To design in compliance with a standard method;
 - Reliability;
 - Accuracy;



Application of sampling methodology

About Dioxin

Dioxins

Particulate

Gas phase

Dioxins % Distribution

+

Particulate

-

Gas Phase

+

Fine

-

Coarse

In the fine particulate there is the greatest percentage of dioxins



Application of sampling methodology

In the emission sampling there are three phases

	Particulate ↓ Filter	Liquid ↓ Condensate	Gas ↓ XAD 2
Per m3	1 – 10 mg e.g.: 5 mg	100 – 200cc 150	0.1 ng TE
8 hours	40	1200	0.8
24 hours	120	3600	2.4
1 week	840	25200	16.8
1 month	3.36 gr	100.8 liters ↑	67.2 ng

Possible

Critical to handle

Possible



Application of sampling methodology

To be Compliant to accredited standard

Conclusion:

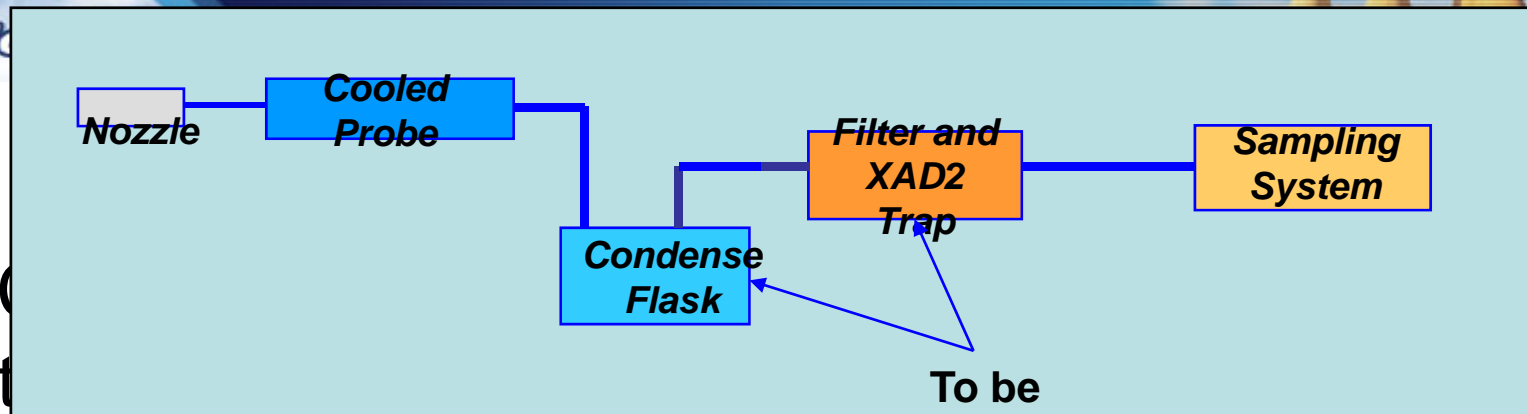
- We strongly wish to design according to standard, but for technical reasons, in the case of a continuous sampling system, to simplify design and operation, it is recommended that we avoid a method requiring condensate analysis.



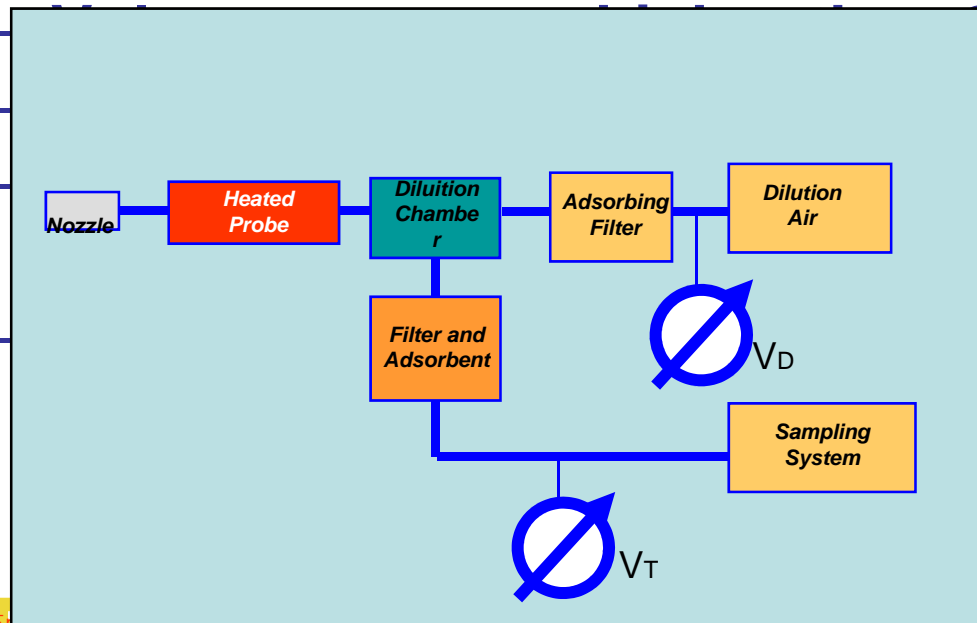
Which Method to choose?

- Cooled probe requires condensate collection, therefore is out;
- Dilution probe is complex and redundant:
 - **Double line = double instrumentation, higher cost;**
 - **Volume accuracy higher than 2%;**
 - **Critical temperature control of the adsorbing trap;**
 - **EN1948 requires the storage and eventual analysis of the dilution air filter cartridge;**
 - **heavy metals, mercury, etc. in accordance to other official methods, not available.**

Emission



- Dilution probe is complex and redundant:
 - Double line = double instrumentation, higher cost;



%;
the adsorbing trap;
eventual analysis
e;
accordance to
table.

Dioxin E

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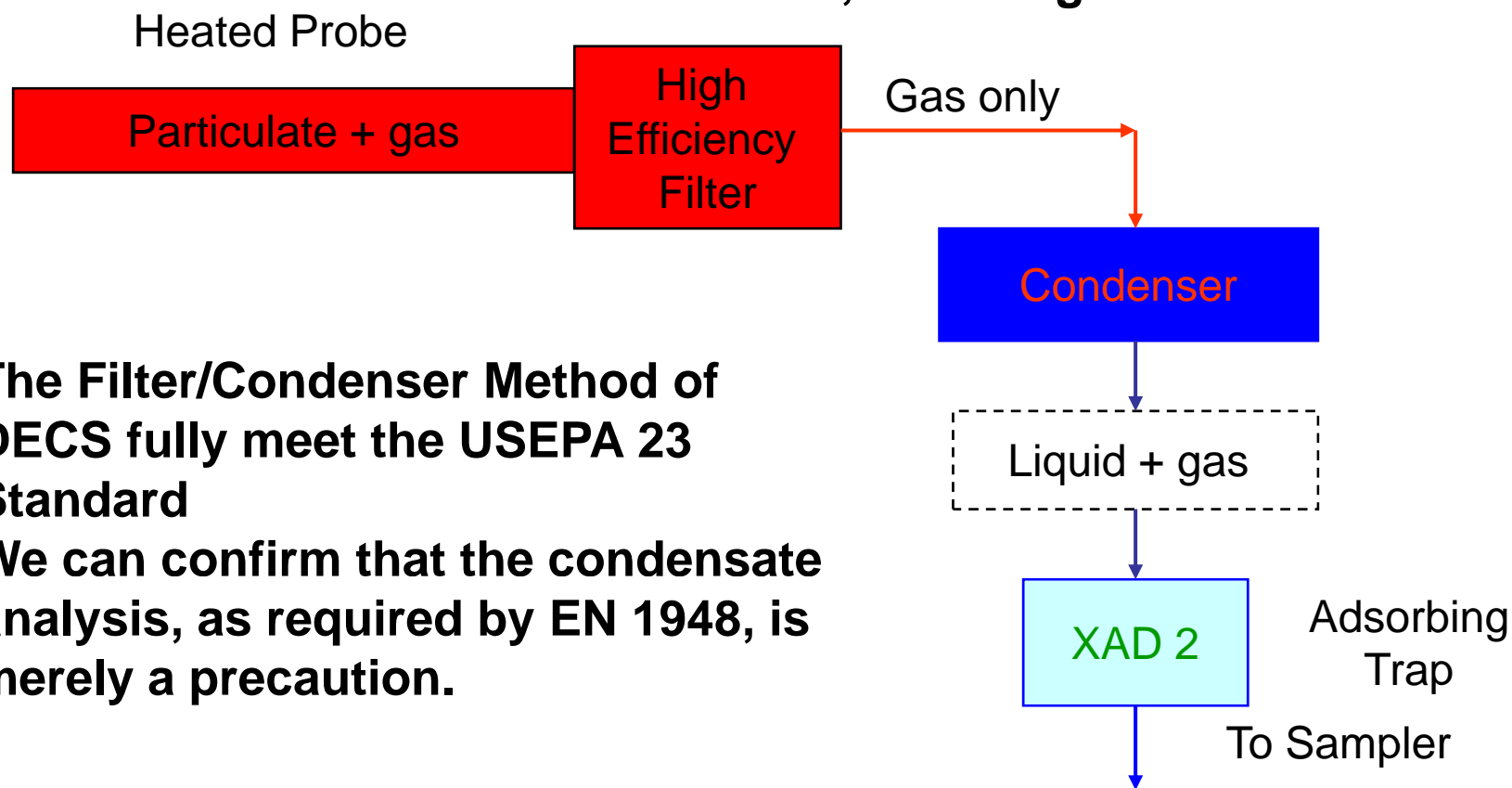
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The Tecora Solution

Filter/Condenser Method

Condensate must be analyzed? $\begin{cases} \text{Yes, following EN 1948 Method} \\ \text{No, following USEPA 23 Method} \end{cases}$



The Filter/Condenser Method of DECS fully meet the USEPA 23 Standard

We can confirm that the condensate analysis, as required by EN 1948, is merely a precaution.



The Tecora Solution

- **Why choose filter condenser?**
- **Compliant to an accredited sampling method;**
- **The condensate collection is avoided;**
- **It's possible to use the side stream sampling technique;**
- **Therefore : heavy metals, mercury, HCl, etc.**
- **The cooling system allows the adsorbing cartridge to work at operating temperature lower than 20°C;**
- **High efficiency membranes with a reasonable pore size.**



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The continuous sampling system for dioxins and furans consists of:

- Sampling Unit – Fixed in the stack sampling point
- Control Unit – Placed in a protected, easy to access area
- Distance up to 100m

Control Unit



Sampling Unit



Process Specifications :

The instrument is designed to meet industrial applications

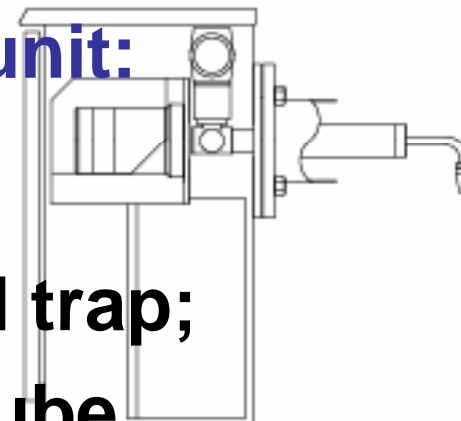
Process Specifications :

Temperature of flue gas	: up to 350°C
Velocity in the stack	: 2 to 40 m/s
Humidity of flue gas	: 0 to 40 % volume 320 g/m ³ absolute
PM Concentration	: 0 to 100 mg/m ³
Installation	: outdoor or indoor



Technical functionality of Sampling unit:

- Ready to use anytime
- Heated Probe Filter-condenser and trap;
- Interchangeable Nozzle and Pitot tube
- Materials in contact with sample : Titanium and glass;
- Suitable for outdoor installation, IP55 protection;
- Small size and low weight:
 - 600 x 700 x 350 mm, 37 Kg including cabinet





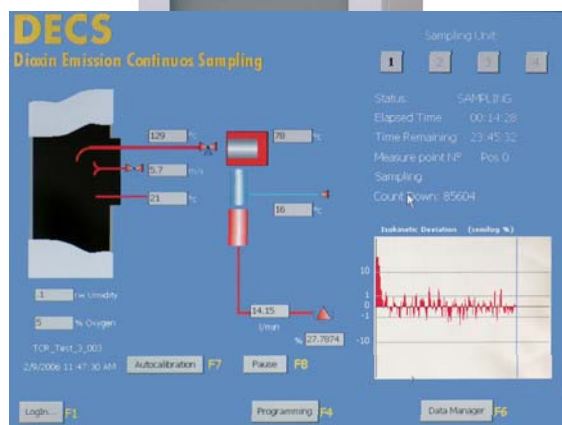
Sample management

- High efficient filters
47mm Membrane and
thimbles for short and
long term sampling;
- Easy to use and to
substitute without
contamination risks.
- Other methods
available for heavy
metals, mercury and
HCl;





Technical functionality of the control unit:



- Microprocessor based system;
- Full automatic start up & shut-down;
- Fully automatic sampling;
- Automatic isokinetic process;
- Remote control via intranet or internet;
- Accurate volume measurement;
- Automatic leak test;
- Anti-corrosion function;
- Automatic Purging;
- Datalogging;
- Industrial cabinet with keylock
- Dimensions : 600x1800x600 mm, 93 Kg



Summary

- **Compliance with USEPA and EN standards;**
- **Condensate collection and analysis not required;**
- **Ready to work at anytime**
- **Easy to use, easy to handle the sample;
Suitable also for heavy metals, Hg, HCl and others;**
- **Automatic start and operation procedure**
- **Remote Control**

Emission

DECS in action



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DECS in action



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DECS Certification

- DECS is certified mCERTs;
- The evaluation test was completed in November 2006 and certification was issued on December 12, 2006 By Cesi in Milan (Italy);



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DECS Certification

- The certificate is issued according to standards and procedures issued from Environment Agency (UK) “Performance Standards and Test Procedures for Automatic Isokinetic Samplers” Version 2 September 2005.



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What is *m*CERTs



End users



Regulators

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Validation



Manufacturers

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CESI

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Telefono +39 02 52611
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Capitale sociale € 550.000.000
Integrità verificata
Codice Fiscale e numero
tributario CEDAA 0270581026

Registro Imprese di Milano
Tribunale Distrettuale
di S.G.A. 63822
P.I. 070700502102

Certification
scheme
MCERTS



MCERTS
THE ENVIRONMENT AGENCY
MANAGING CERTIFICATION SCHEME

MCERTS is operated by
CESI on behalf of the
Environment Agency



ENVIRONMENT AGENCY
800 House, Waterside Drive
Aztec West, Northampton
NN6 8JZ 4UK (UK)

CERTIFICATE

Product Conformity Certificate A6032632

Applicant **TCR TECORA S.r.l.**
Via A. Volta, 22 - Corsico (Milan) - Italy

Certified product **Automatic Isokinetics Sampler**

Designation **Dioxin Emission Continuous Sampling**

Manufacturer **TCR TECORA S.r.l.**
Via A. Volta, 22 - Corsico (Milan) - Italy

Certification Ranges

- Velocity range: 2-20 m/s
- Accuracy of isokinetic sampling rate response to changes in flue gas velocity: $\pm 5\%$
- Accuracy of determination of volume of gas sampled: $\pm 2\%$
- Linearity of isokinetic sampling rate: $\pm 5\%$
- Response Time, $T_{90} < 100$ s
- Flow repeatability under laboratory conditions: $\pm 5\%$
- Minimum operational velocity: 2 m/s
- Drift (short term): $\pm 2\%$

Normative reference documents **Environment Agency "Performance Standards and Test Procedures for Automatic Isokinetic samplers" Version 2, September 2005**

This document attests that the certified product, subjected to all the tests and verifications prescribed by the normative reference documents, was found in conformity with them.

This Certificate is composed of this page and the **Evaluation Report CESI A6032630**.
Only integral reproduction of this Certificate including the Evaluation Report is allowed without written permission from CESI.

Initial Certification
12 December 2006

This Certificate Issued
12 December 2006

Renewal date
11 December 2011

Prepared
Franco Zagliani


Approved
Virginia Scaroni
CESI
Centro Elettrotecnico Sperimentale Italiano
Giacinto Ruffa SpA
Business Unit Technical Calibration-Verification
The Hague



Field Tests

- Tecora has independently run tests with a qualified national Laboratory Sinal accredited, to check the effectiveness of DECS to capture of Furans and Dioxins according to EN1948-1 standard.
- Three tests were run with our continuous automatic isokinetic sampler DECS over a period of six months. The test were executed on two urban waste incinerators in Lombardia during their normal operation.



The incinerators used for the test



Plant “A”

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Plant “B”

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Analysis summary

Sampling 1

Dioxins TEQ concentration

Sampling spike recovery

Analysis filter + XAD2

9.2 pg/Nm³

106.46% - 110.92% - 92.08%

Sampling 2

Dioxins TEQ concentration

Sampling spike recovery

Analysis filter + XAD2

3.9 pg/Nm³

105.37% - 130.06% - 130.65%

Sampling 3

Dioxins TEQ concentration

Sampling spike recovery

Analysis filter + XAD2

3.8 pg/Nm³

63.27% - 50.72% - 57.95%

Sampling 3

Dioxins TEQ concentration

Sampling spike recovery

Condensate analysis

<0.0003 pg/Nm³

0.75% - 1.58% - 0.65%

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Conclusions about the tests

- The design of DECS perfectly suits the requirement for the collection of dioxins for stack emission control;
- The collection of the sample with filter/condenser with adsorbing trap on the gas phase proved to be effective;
- The system proved to be reliable.



Conclusions about the tests

- The results of the test proved that dioxin content in the condensate are negligible when sampled with the filter condenser and adsorbing trap;
- The condensate collection and treatment for analysis is rather difficult and complex.
- For this reason Tecora adopted the filter condenser method with the adsorbing trap on the wet gas.



Thank you