

ESSEVA

Etude du SVDU Sur les Emissions de Vif Argent (Mercure) *SVDU's Study on Quick Silver Emissions (Mercury)*

Etude sur le mesurage, le comportement et le traitement
du mercure dans les centres de valorisation énergétique
de déchets municipaux et assimilés

*Study on measurement, behaviour and abatement of
mercury in municipal and similar waste-to-energy plants*

EXECUTIVE SUMMARY (English)

Mars
2021



SVDU



SVDU, SYNDICAT NATIONAL DU TRAITEMENT ET DE LA VALORISATION DES DECHETS URBAINS ET ASSIMILES, is the association of the operators of French Waste-to-Energy (incineration with energy recovery) plants, and brings together about around 60 entities active in the field of the recovery of energy from waste. Representing around 110 plants and 90% of the capacity of the country, SVDU members treat and recover the energy of around 13 Mtpa of Municipal Solid and similar residual Waste and generate about 4 TWh of electricity, half of which is renewable, as well as 8 TWh of ENR&R (Renewable and Recovered Energy), so contributing to the greening of District Heating networks. SVDU, is a member of FEDENE (Fédération des Services Energie Environnement) and FNADE (Fédération Nationale des Activités de la Dépollution et de l'Environnement) as well as a member of CEWEP (Confederation of European Waste-to-Energy Plants). The purpose of SVDU is to promote the activity and the interest of the industry.

Therefore SVDU aims at:

- Raising awareness and supporting the current and future challenges related to the recovery of energy from waste in connection with its French and European partners ;
- Putting forward proposals to the French and European authorities, through active participation in the preparation of the French, European and International legislation and regulations relevant to the sector ;
- Providing expertise and make recommendations and proposals on all economic, social, administrative, technical, financial, legal, tax or standards related issues relevant for the profession.

As an industrial solution ensuring an environmental-friendly treatment of waste, Waste-to-Energy is fully integrated into an advanced multiple treatment process in line with the European Waste Treatment Hierarchy and the circular economy framework. In particular, Waste-to-Energy helps to meet the national objectives for 2023 for several related topics: generate renewable energy, substitute the energy from fossil fuels with heat and electrical energy recovered from the combustion of waste, contribute to Greenhouse Gas emissions reduction and optimise the cost of the treatment of waste.

EXECUTIVE SUMMARY

SVDU, the French association of W-t-E (Waste-to-Energy) plants operators ensures that its facilities operate in compliance with the most advanced Environment and Health rules.

Even before the publication of the conclusions on Best Available Techniques of the new Waste Incineration BREF - which strengthens obligations on mercury emissions - SVDU decided to launch the ESSEVA study, with the support of ADEME, in order to improve its knowledge on:

- Continuous, semi-continuous and periodic mercury measurements;
- Origin and behaviour of mercury in W-t-E plants;
- Abatement of mercury by Flue Gas Cleaning (FGC) systems.

The study includes tests carried out for a few months from 2018 to 2020 in 4 SVDU plants picked up as representative of the French W-t-E installations. These tests allowed to complement the theoretical information collected within the professional and scientific network of SVDU by:

- Comparative monitoring from:
 - Most of the continuous mercury analysers available on the market (supplied by Durag, Envea, Gaset, Opsi, PS Analytical, Thermo Fisher, Sick),
 - A short or long term semi-continuous sampler (Ameva-M),
 - The reference method implemented by two field laboratories (Leces and CME) and four analytical laboratories (Carso, Ianesco, MPT, SGS);
- Analysis of mercury transformation and transfer phenomena within the installations with dry, $\frac{3}{4}$ dry and wet FGC systems;
- Analysis of the effectiveness of devices for mercury abatement currently installed in W-t-E plants and the possible improvements and testing of reagents active on mercury abatement: lignite coke, minerals doped with activated carbon, Dioxorb, Minsorb (Sorbacal), brominated adsorbant on dry FGC, TMT 15, polysulfide on wet FGC.

This study has proven to be of the utmost usefulness in understanding the behaviour of a metal, which could be qualified as "temperamental" due to its occurrence in peaks of concentration in W-t-E plants as well as its sensitivity to many process parameters. The comprehensive analysis undertaken clearly shows that great care should be taken for mercury abatement and monitoring.

In addition to an exhaustive review of the regulations and standards applicable today in France for mercury measurements, the report makes numerous practical recommendations to operators as well as suggestions for future work.

Thus, the report provides detailed experience feedback on the implementation of mercury measurement devices, for example on:

- The continuous measuring devices (AMS), the choice of the technique for converting ionic mercury into elemental mercury in relation to the measurement interfering substances and poisons of the (possible) catalyst, the material of the sampling line (PFA rather than PTFE), self-calibration at zero and at the span check, backblowing and backflushing as well as their effects on the measured concentration averages, the impact of the speciation function on the accuracy of the measurements average, the special provisions for measurement in raw gas and the possibility of in situ measurement.
- The reference method (SRM) by control laboratories, which requires special precautions sometimes beyond the recommendations of the standards in force and which can be adapted to measure elemental mercury and ionized mercury separately (speciation).



- *The semi-continuous sampler using sorbent traps, which could, if validated for this purpose, constitute a better alternative to SRM thanks to the benefits from an extended sampling period. According to the Waste incineration BREF conclusions, it can replace the continuous measurement where the mercury input is low and stable (e.g. in some sewage sludge or solid recovered fuels facilities) but obviously, if it is not the case, does not allow to react in case of significant mercury peak.*

The report presents various comparisons between mercury measurements and discusses the possible sources of the observed discrepancies between the measurements of different measuring devices. This database can also serve as a reference, for example, for the proportions of elemental and ionized or gaseous and particulate mercury.

Special support was provided by INERIS, the French national institute for industrial environment and risks, throughout the report and its annexes for metrological aspects focussing on the performance of AMSs and laboratories (SRM). It provides information in particular on:

- *the Limits of Quantification (LOQ), the corresponding measurement uncertainties and the lowest limit values that can be associated to them;*
- *the technical reasons to refute the practice of replacing the 95% confidence interval for the control of compliance with the ELVs (Emission Limit Values) with the standard deviation of the pairs of measurements obtained during the QAL2 calibration tests;*
- *the upcoming arrival of a new French standard which recommends to use absolute uncertainties below certain concentration thresholds for mercury and other substances.*

The behaviour of mercury in each element of the different types of FGC system studied is described and, more particularly, the reasons that can explain the mechanisms of accumulation and reemission of mercury in the de-NO_x SCR at the tail end of the FGC system.

The report also shows the performance of the different reagents that were suitable for testing, given the ATEX constraints that complicate the use of certain reagents in test periods. It includes elements on emission control method and on the influence of temperature, suggests using additional adsorbent with additive for coping with significant peaks, discusses the usefulness of monitoring mercury in raw gas. A section is also devoted to how to deal with an exceptionally high peak in mercury concentration.

Thanks to the results of the study, the ESSEVA task force is confident in that the owners and operators will be able to comply as from December 2023 with the future daily ELV of 20 µg/Nm³ during normal operating conditions, notwithstanding the critical metrology aspects outlined in the report.

However, the task force recommends to use the time until the deadline to get equipped as quickly as possible and to become familiar with both measuring devices as well as the behaviour of mercury and its capture, which may require several months and to train staff. Indeed, one of the conclusions of the study is that the behaviour of mercury differs from one W-t-E plant to another and from one line to another within the same plant.

The report also suggests ways to improve the situation: better knowledge of waste containing mercury and of the behaviour of mercury, validation of a new alternative technique to the standard reference method, parallel measurement of continuous analysers, testing reagents, optimizing regulation, etc.

ABOUT ADEME

Here at ADEME - The French Agency for Ecological Transition - we are firmly committed to fighting global warming and the depletion of our natural resources.

On all fronts, we mobilise citizens, economic stakeholders and local actors towards a fairer, more harmonious, low carbon and resource-efficient society.

Whatever the field - energy, circular economy, food, mobility, air quality, adaptation to climate change, soils, etc. - we advise, facilitate and help to finance many projects, from research to solutions sharing.

At every level, our expertise and forecasting capacities serve to guide and inform public policies.

ADEME is a public agency under the joint authority of the Ministry for an Ecological Transition and the Ministry for Higher Education, Research and Innovation.

ADEME VOCATIONS

Developing knowledge



ADEME organises and contributes to the financing of research and innovation and to establishing and coordinating observation systems to understand better how industries are changing.

Convincing and mobilising:



Because public information and awareness are essential to the success of environmental policies, ADEME implements communication campaigns to change mindsets, behaviours and purchasing and investment practices.

Advising



ADEME acts in an advisory capacity to direct the actors' decisions in society and the economy, establishing tools and methods that suit their needs. Direct dissemination via expert advisers is a major way in which it provides its expertise;.

Assisting with implementation



ADEME provides graduated financial support and promotes the implementation of regional and national reference



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However, the task force recommends using the time until the deadline to get equipped as quickly as possible and become familiar with both measuring devices and the behaviour of mercury. Indeed one of the study's conclusions is that the behaviour of mercury differs from one W-t-E plant to another and from one line to another within the same plant.

ESSEVA provides valuable practical information to all of whom are interested in mercury in W-t-E.

In addition to an exhaustive review of the regulations and standards applicable today in France for mercury measurements, the report provides lists of waste containing mercury. It describes, analyses and comments on the measurement instruments and methods; and presents the various assumptions to explain the behaviour of mercury in W-t-E. It also reviews the abatement techniques as well as the appropriate reagents and makes recommendations for a good approach of the subject.

At last, the report provides detailed feedback on the experience gained during ESSEVA tests as well as in the European professional network of SVDU, which would be valuable for implementing these pieces of equipment.