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## Introduction

Waste Incinerators are a known source of chemicals listed in Annex C of the Stockholm Convention (SC). In article 50.2 of the EU Directive on Industrial Emissions 2010/75/EU stands: 'Waste incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the incineration of waste is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850 °C for at least two seconds'. So, the occurrence of a '2 seconds column' – a homogeneous zone in the post-combustion chamber with a temperature of 'at least 850 °C for at least two seconds' – had to be verified.

## Methods and materials

Temperature and oxygen content are measured in two measurement planes (18 meter and 24 meter) in the post-combustion chamber of the incinerator by TÜV Rheinland Energy GmbH [1]. The waste had a calorific value of 10.3 MJ/kg (Full Load) and 10,1 MJ/kg (Part Load).

## Results

The SC have stringent rules to prevent exceeding dioxin emissions, like the 2 seconds rule of combustion above the 850 degrees, even under worst combustion situations. However, verification was never accomplished correctly, even not with the start of the installation.

Moreover, the management refuses to publish the temperatures that installed pyrometers continuously measure near the end of the post-combustion zone, and only reports temperatures that are calculated for this height using as input temperatures measured near the roof of the combustion chamber. According to Directive 2010/75/EU such a procedure only is permitted after a previous, comprehensive, measurement campaign in the combustion chamber has shown that a homogeneous '2 seconds column' exists, even under the most unfavourable conditions.

In April 2017 TÜV found a difference of 70 degrees in the published calculated temperatures. A number of critical comments can be made on the verification of the post-combustion zone.

- Caloric value waste:** In the test waste wasn't burn at the most unfavourable conditions, but tested, in conflict with the directive of the SC, only under most favourable conditions.
- Begin of post-combustion zone:** The constructor of the incinerator states the beginning of the post-combustion zone at 18 meter. The incinerator, however, calculates from 14,2 meter – the level of the 'last injection of combustion air' – as the beginning of the '2 seconds column', ignoring auxiliary burners at 16,8 meter (see figure 1).
- Inhomogeneous results:** measurements show inhomogeneous temperature and oxygen levels (see Figure 1 for optimal results and Figure 2 for measured results )
- Data gap:** Results of the O<sub>2</sub>-measurements at 24 meter have not been published.

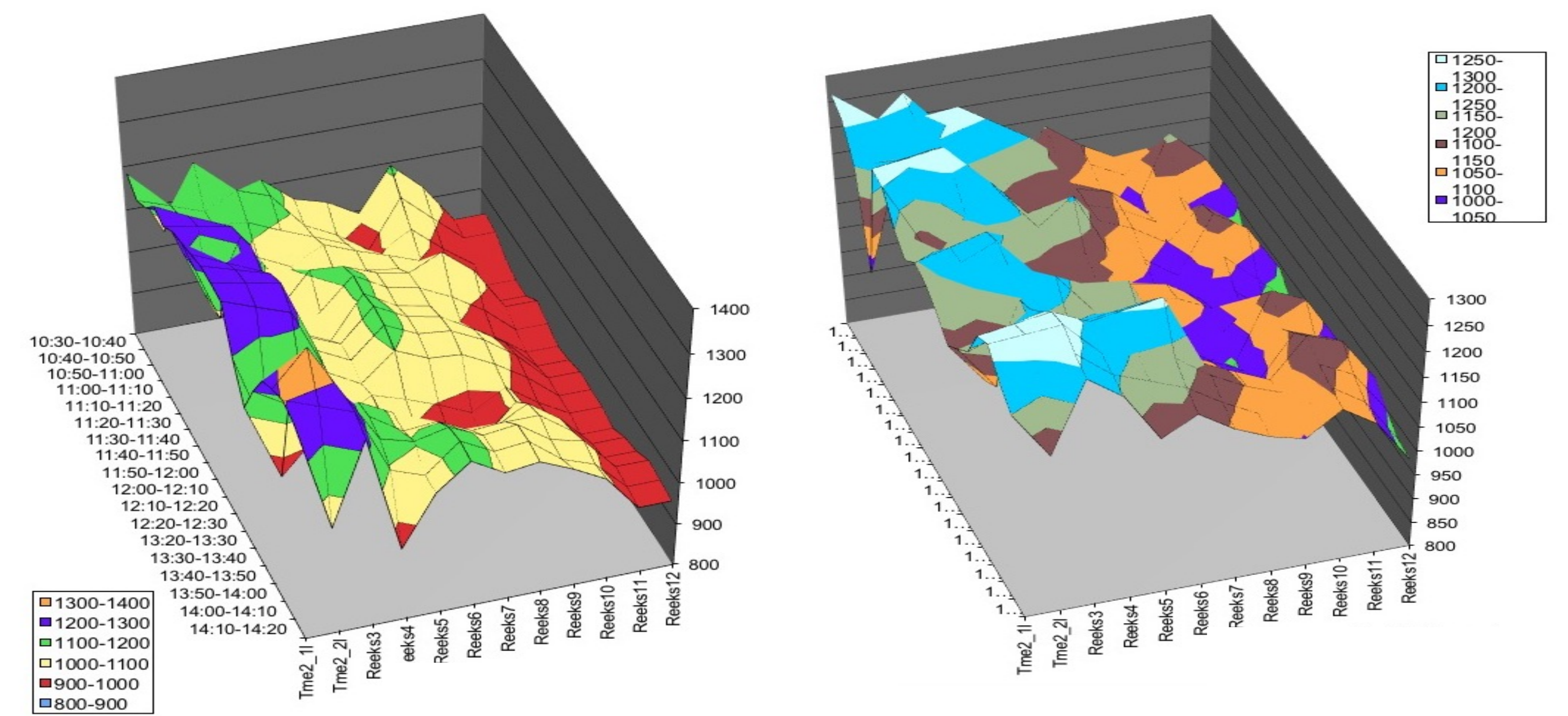
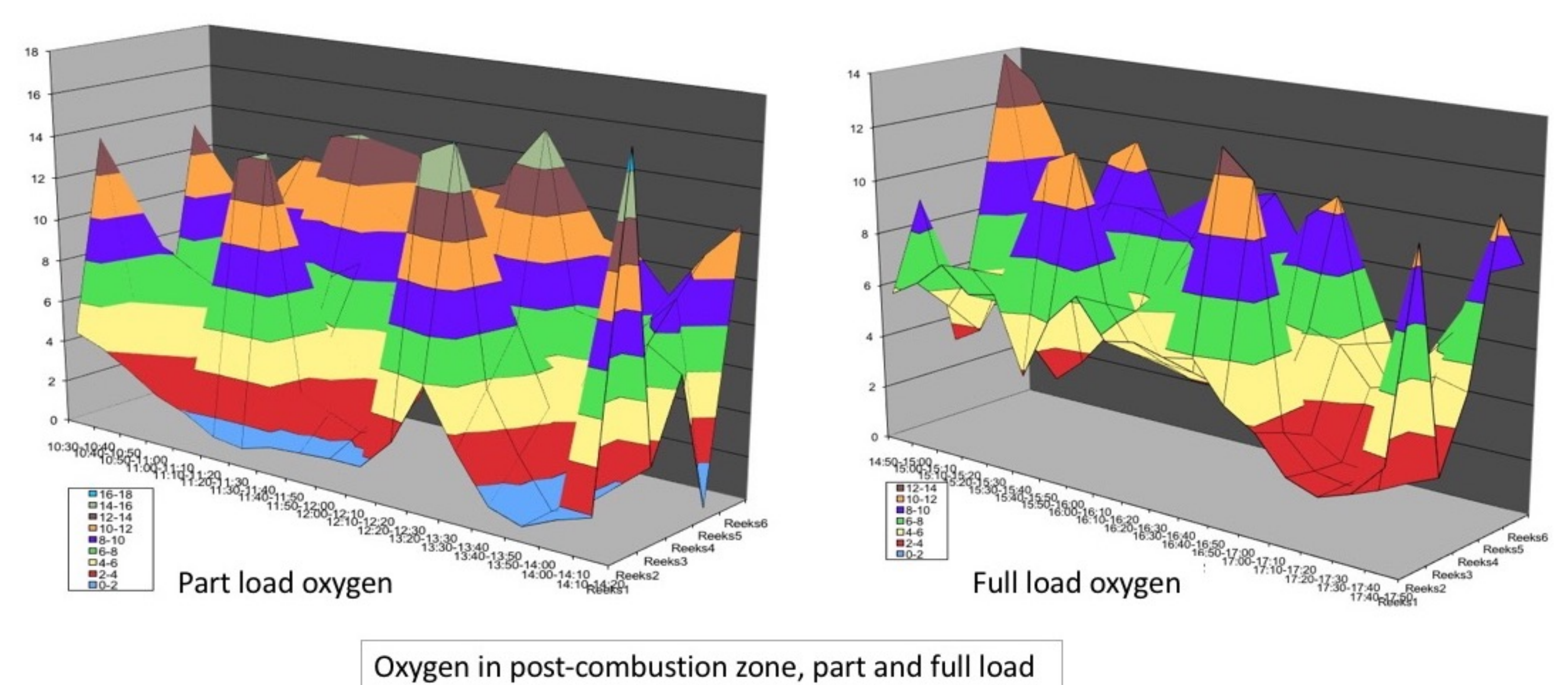


Figure 2: Part and full load temperature in PostCombustion Zone (18 m)



Oxygen in post-combustion zone, part and full load

Figure 3: Part and full load oxygen in PostCombustion Zone (18 m)

At the 18 meter measurement plane rather inhomogeneous oxygen-content percentages – that violate Directive 2010/75/EU which does not allow individual percentages that deviate more than 50% from the grid average – have been established [1].

## Conclusions

Directive 2010/75/EU requires that the flue gases of a Waste Incinerator have a residence time of 2 seconds at 850 °C in a homogeneous environment. Measurements indicate that the incinerator in Harlingen may be unable to comply with this. The enforcement of this requirement needs to be stricter in order to reduce Persistent Organic Pollutants such as dioxins, and to ensure that Waste Incinerators use the Best Available Techniques (BAT) / Best Environmental Practices (BEP) [2]. The management of the incinerator violates the guidelines in Annex C, article 5 of the Stockholm Convention, that prescribe open communication and transparency.

Unintentional production of Persistent Organic Pollutants (UPOPs) have been established by long-term sampling, not only PCDD/F, but also dl-PCB, PBB, PFOA, PBDE, PAH and PBDD/F. In order to reduce UPOPs to the environment a more stringent application of the Stockholm Convention is highly recommended.

## Acknowledgements

NGO ToxicoWatch is supported by citizens which are concerned about industrial pollution in their environment.

## References

- Measurement report REC, Harlingen, Netherlands, 21.08.2017, TÜV Report No.: 936/21239402/A Cologne
- Guidelines on Best Available Techniques and provisional guidance on Best Environmental Practices, relevant to article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants, 2007, United Nations Environment Programme
- Klasen et al; Optimierung des MHW Bremen (2006)

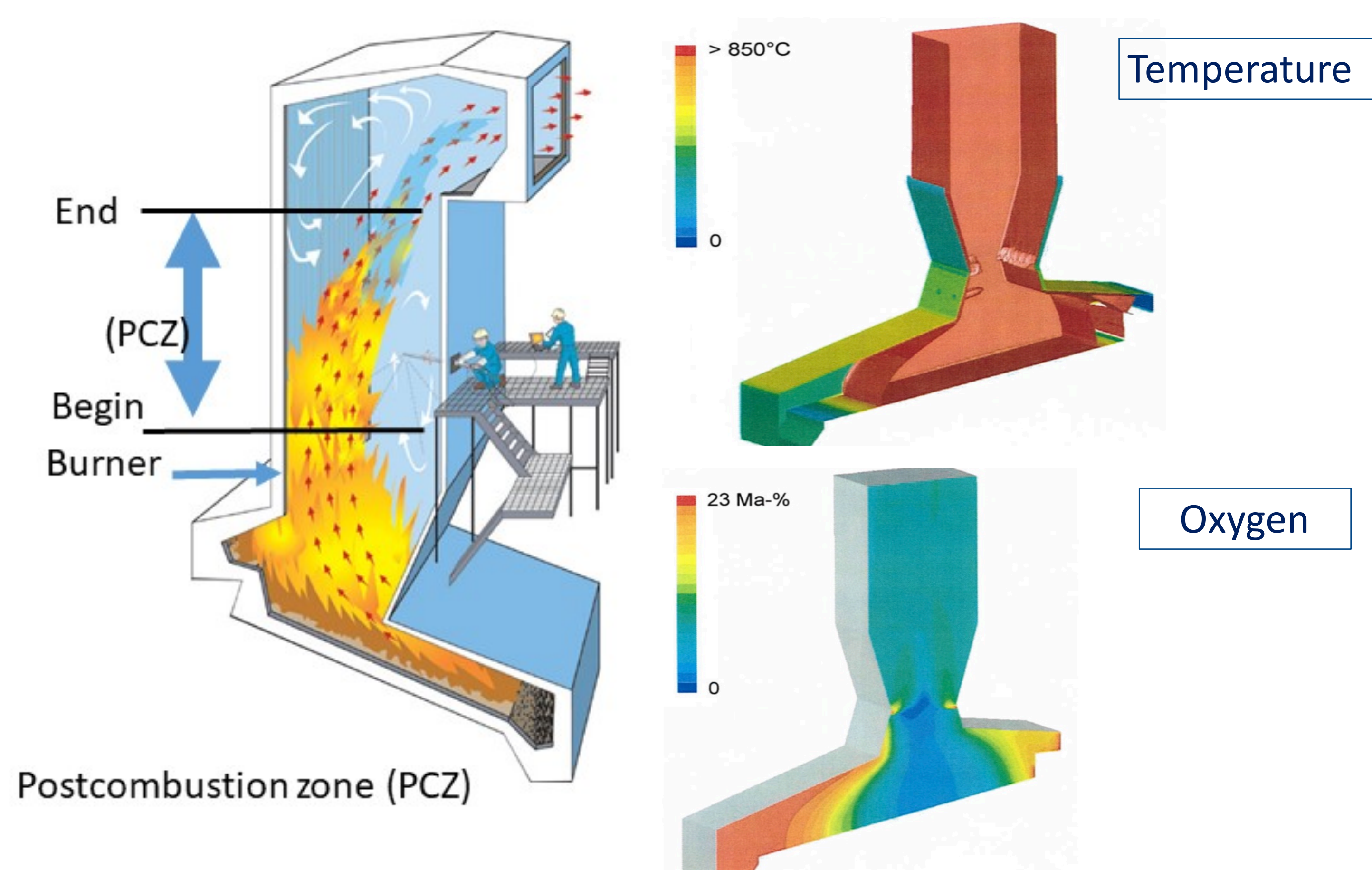


Figure 1: Distribution of temperature and oxygen in the PostCombustion Zone (Klasen et al.)