# Development and characterization of candles with reduced particle emissions

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## Introduction

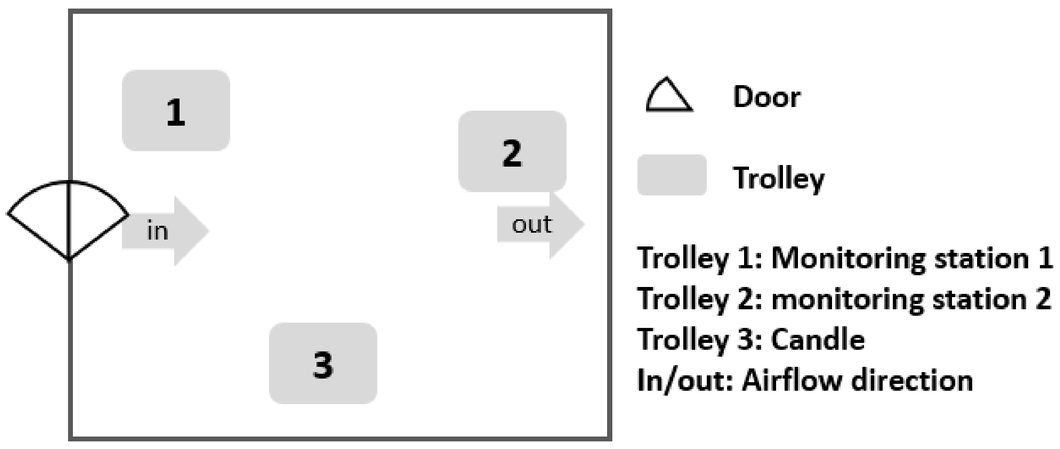
The awareness of particle emissions from candles is increasing and in Denmark candles are responsible for approximately 60% of the particle pollution in the candle-using homes. New types of candles are constantly being developed such as candles made of beeswax, mixes of traditional candles waxes and paraffin, vegetable waxes, animal fat based waxes etc. In order to develop new and better candles with reduced particle emissions, additional knowledge about candle emissions is needed.

The purpose of the present project is to develop new candles with reduced particle and VOC emissions by utilizing new types of waxes and wicks. The development has been carried out as a part of an international joint venture co-financed by the Danish EPA.

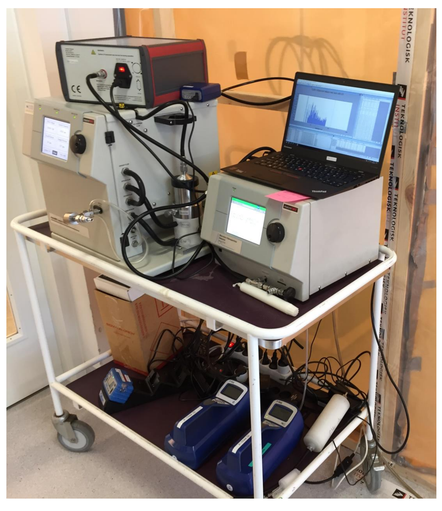
Danes have the highest consumption of candles in the EU, averaging 5.8 kg per person per year. This results in an increased concentration of particles in the indoor environment and potential health hazardous effects.

## Methods

Particle measurements were carried out in a custom-built climate room with air change control. The room concentration of particle and VOC emissions have been characterized while maintaining an air change rate of 0,5 per hour. Two monitoring stations placed in diagonally opposite corners of the climate room were utilized for the measurements. The candle under test was placed at a distance of approx. 150 cm from each monitoring station, in a wire screen cylinder (230 mm in diameter, 300 mm in height, air permeability 60 ± 5 %) according to the well-established standard EN15426.




Particle measurements were performed using a TSI scanning mobility particle sizer spectrometer using a size range from 4.3 nm to 167 nm. Additionally, sampling on filters and analytical thermal desorption (ATD) tubes was performed for subsequent chemical analysis of content of selected metals and salts as well as volatile organic compounds (VOC).



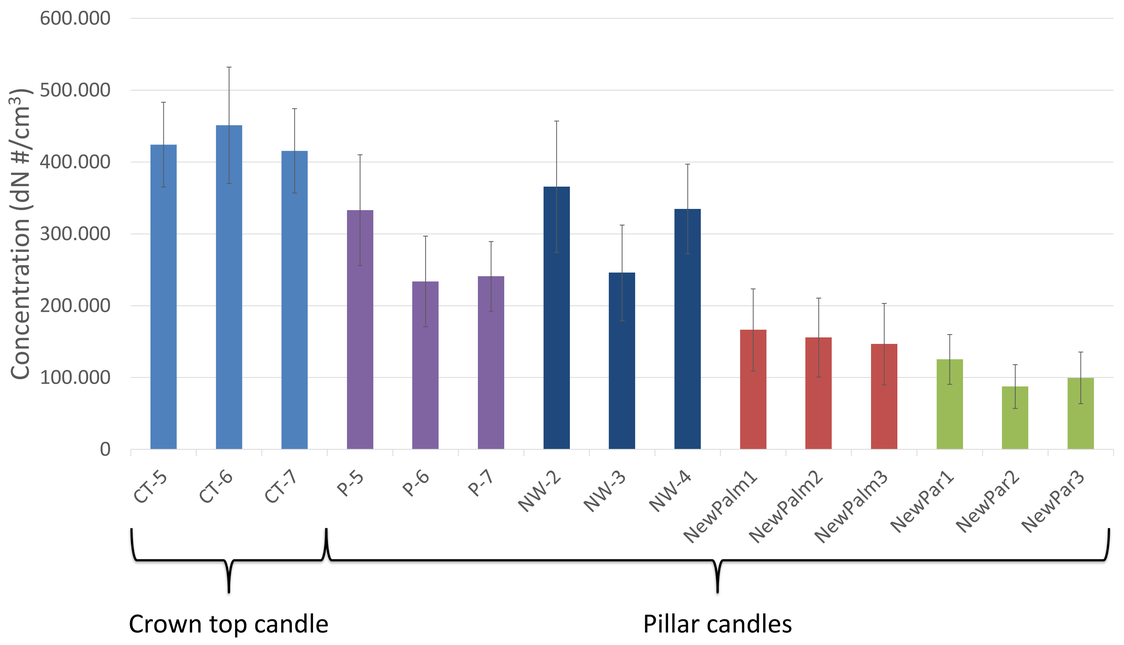
## The analyzed candles

One type of crown top candle (23 mm x 200 mm) and one type of pillar candle (58 mm x 120 mm), both made of animal stearin, were chosen as reference candles, *CT* and *P*. In one pillar candle an alternative wick was used, *NW*. Finally, two new pillar candles were developed made of palm stearin and fully-refined paraffin wax, respectively, *NewPalm* and *NewPar.*

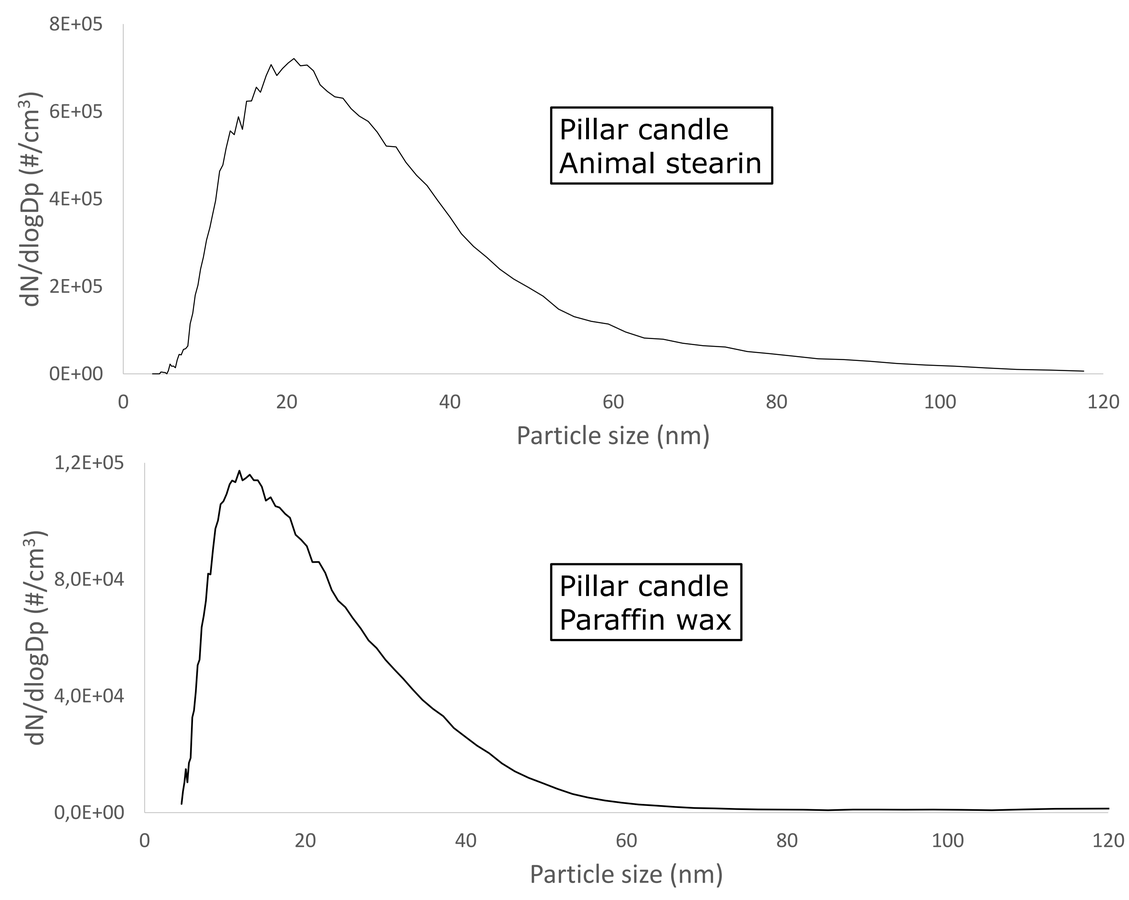


## Ultrafine particle (UFP) emission

A significantly lower UFP emission was seen for the newly developed pillar candles and especially for the new paraffin candle.




## Size distribution





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Environmental Protection Agency

eca european candle association

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