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Measurement of  
emissions on W-JET  
with 3 different  
propellants

**Title:**

Measurement of emissions on W-jet with 3 different fuels

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## 1. Background and purpose

The company Winterskov Aps produces machines for weed burning and drying pavements, which i.a. is used before paving stripes on road surface. The machines use a microturbine, which blows hot air down on the weeds and road surface.

Winterskov Aps has contacted the Danish Technological Institute with the purpose of measuring emissions from these two types of machines with three different fuels. The aim is to examine whether the choice of fuel has a significant influence on the composition of the emissions from the machines.

## 2. Execution

The emissions are measured directly in the flue gas exhaust pipe with a probe. It is noted that the flue gas from the turbine consists of combustion gas from the combustion chamber mixed with ambient air, which in term results in diluted flue gas measurement.

The following flue gas components have been measured:

- CO<sub>2</sub>
- CO
- NO<sub>x</sub>
- HC (propane equivalents)
- Particulate number

The flue gas components are measured in ppm and the particulate number in particles/cm<sup>3</sup>.

All measurements are made over a period of 5 minutes (300 sec.) at three different load points. The fuel consumption during testing is measured by weighing scale.

The following fuels was tested:

- Fuel 1 - Multi clean ASW
- Fuel 2 - Petroleum - turbine oil
- Fuel 3 - Diesel, petrol, and oil

## 3. Equipment used

| Measurement      | Instrument      | ID        |
|------------------|-----------------|-----------|
| NO <sub>x</sub>  | Ecophysics CLD  | 149653    |
| HC               | Thermo FID      | 109825    |
| CO               | Sidor           | 8601      |
| CO <sub>2</sub>  | ABB EL3020      | 166234    |
| O <sub>2</sub>   | Sidor           | 8601      |
| PN               | AVL APC 489     | 148151    |
| Fuel consumption | Kern DS 100K0.5 | W19 02676 |
| Gas conditioning | MAK-10          | 8610      |
| Temperature      | TC Type K       | 8602      |

Table 1: Equipment used during test

## 4. Results

| Test   | Load point [RPM] | NO <sub>x</sub> [ppm] | HC [ppm] | CO <sub>2</sub> [%] | CO <sub>2</sub> [ppm] | CO [%] | CO [ppm] | O <sub>2</sub> [%] | Particles [p/cm <sup>3</sup> ] | Fuel consumption [g/hour] | Fuel consumption [l/hour] |
|--------|------------------|-----------------------|----------|---------------------|-----------------------|--------|----------|--------------------|--------------------------------|---------------------------|---------------------------|
| Fuel 1 | 41.000           | 8,4                   | 745      | 2,43                | 24.317                | 0,31   | 3.103    | 16,98              | 4.880.000                      | 13.377                    | 16,72                     |
|        | 55.000           | 6,7                   | 791      | 2,25                | 22.501                | 0,27   | 2.733    | 17,28              | 10.150                         | 17.653                    | 22,06                     |
|        | 72.000           | 6,7                   | 729      | 2,18                | 21.817                | 0,19   | 1.929    | 17,45              | 8.060                          | 24.469                    | 30,58                     |
| Fuel 2 | 41.000           | 13,1                  | 1.188    | 2,42                | 24.182                | 0,30   | 3.044    | 16,96              | 6.460.000                      | 13.567                    | 16,19                     |
|        | 55.000           | 14,1                  | 893      | 2,26                | 22.570                | 0,27   | 2.651    | 17,23              | 5.400.000                      | 18.442                    | 22,01                     |
|        | 72.000           | 12,9                  | 815      | 2,19                | 21.880                | 0,19   | 1.948    | 17,39              | 6.840.000                      | 24.508                    | 29,25                     |
| Fuel 3 | 41.000           | 15,6                  | 967      | 2,46                | 24.649                | 0,32   | 3.229    | 16,95              | 7.690.000                      | 14.065                    | 16,77                     |
|        | 55.000           | 15,5                  | 891      | 2,32                | 23.181                | 0,29   | 2.871    | 17,19              | 5.980.000                      | 18.854                    | 22,48                     |
|        | 72.000           | 15,5                  | 745      | 2,24                | 22.393                | 0,20   | 2.046    | 17,40              | 9.730.000                      | 24.810                    | 29,58                     |

Table 2: Measurement results of machine for drying and cleaning roads and pavement

| Test   | Load point [RPM] | NO <sub>x</sub> [ppm] | HC [ppm] | CO <sub>2</sub> [%] | CO <sub>2</sub> [ppm] | CO [%] | CO [ppm] | O <sub>2</sub> [%] | Particles [p/cm <sup>3</sup> ] | Fuel consumption [g/hour] | Fuel consumption [l/hour] |
|--------|------------------|-----------------------|----------|---------------------|-----------------------|--------|----------|--------------------|--------------------------------|---------------------------|---------------------------|
| Fuel 1 | 30.000           | 10,0                  | 327      | 2,58                | 25.825                | 0,21   | 2.115    | 16,91              | 1.133.000                      | 9.664                     | 12,08                     |
|        | 40.000           | 9,3                   | 429      | 2,55                | 25.545                | 0,25   | 2.477    | 16,92              | 1.772.000                      | 13.239                    | 16,54                     |
|        | 50.000           | 9,1                   | 541      | 2,50                | 24.992                | 0,26   | 2.558    | 16,99              | 504.000                        | 17.117                    | 21,39                     |
| Fuel 2 | 30.000           | 11,0                  | 348      | 2,66                | 26.557                | 0,22   | 2.181    | 16,79              | 12.876.000                     | 9.312                     | 11,11                     |
|        | 40.000           | 10,5                  | 444      | 2,60                | 25.977                | 0,24   | 2.441    | 16,84              | 12.122.000                     | 13.544                    | 16,16                     |
|        | 50.000           | 10,1                  | 546      | 2,55                | 25.496                | 0,25   | 2.483    | 16,90              | 5.519.000                      | 17.022                    | 20,32                     |
| Fuel 3 | 30.000           | 13,4                  | 260      | 2,70                | 26.971                | 0,22   | 2.220    | 16,80              | 6.085.000                      | 10.261                    | 12,23                     |
|        | 40.000           | 12,4                  | 368      | 2,66                | 26.560                | 0,27   | 2.735    | 16,80              | 3.369.000                      | 13.214                    | 15,75                     |
|        | 50.000           | 11,9                  | 412      | 2,58                | 25.770                | 0,27   | 2.682    | 16,92              | 2.148.000                      | 16.247                    | 19,37                     |

Table 3: Measurement results of machine for weed control and roofing