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Reduction of street dust - overview of REDUST Life + demonstration project

- Best practices in winter maintenance to reduce respirable street dust

Outi Väkevä

Air Quality Expert

HSY Helsinki Region Environmental Services Authority

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Street dust – A significant air quality problem in Nordic cities

- Vehicle- and industrial particle emissions have declined dramatically since the 1980's
- Emission control regulation and technological development have improved the air quality in urban areas.
- Vehicle technology does not reduce street dust – the relative importance of street dust as environmental health problem has increased
- Use of studded tyres for road safety reasons (in Helsinki ca. 75 % of winter tyres) increases the formation of street dust

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REDUST Life + project 2011-2014

- Partners: Cities of Helsinki, Espoo and Vantaa, HSY, Nordic Envicon Oy and Metropolia University of Applied Science
- Ca. 1 million EUR budget with 50 % EU funding
- Objective to find best practices in winter maintenance to reduce respirable street dust (PM_{10}) to develop and implement a strategy to reduce PM_{10} with maintenance practices

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REDUST – AQ measurement equipment

Sniffer
Street dust measurements from street surface. Main tool for the REDUST research both in demonstrations and in street network measurements

-TEOM (1400A)
-DustTrak x2 (TSI 8530)
-Weather station
-GPS

Vectra
Street dust measurements from street surface. Winter tyre testing.

-TRAKER method
-DustTrak x2 (TSI 8530)

Mobile AQ measurement station (HSY)
Air quality and weather monitoring at main demonstration site Suurmetsäntie
-PM_{10}
-$PM_{2.5}$
-NO_2
-NO
-Weather station

Battery powered Osiris
3x2 Divided to opposite sides of Suurmetsäntie
-PM_{10}
-$PM_{2.5}$

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REDUST – studied maintenance methods and materials

Traction sanding:

- Crushed stone aggregates 1-5,6mm, 1-6mm, 2-5mm, 3-6mm
- Wet sieved, dry sieved, unsieved

Dust binding

- Whole lane and targeted dust binding (only the kerbside sprayed) were tested
- All tests with $CaCl_2$, targeted also with KCOOH

Street cleaning

- Traditional suction sweeping (left) / Street scrubber (mid) / Combination cleaning (right)

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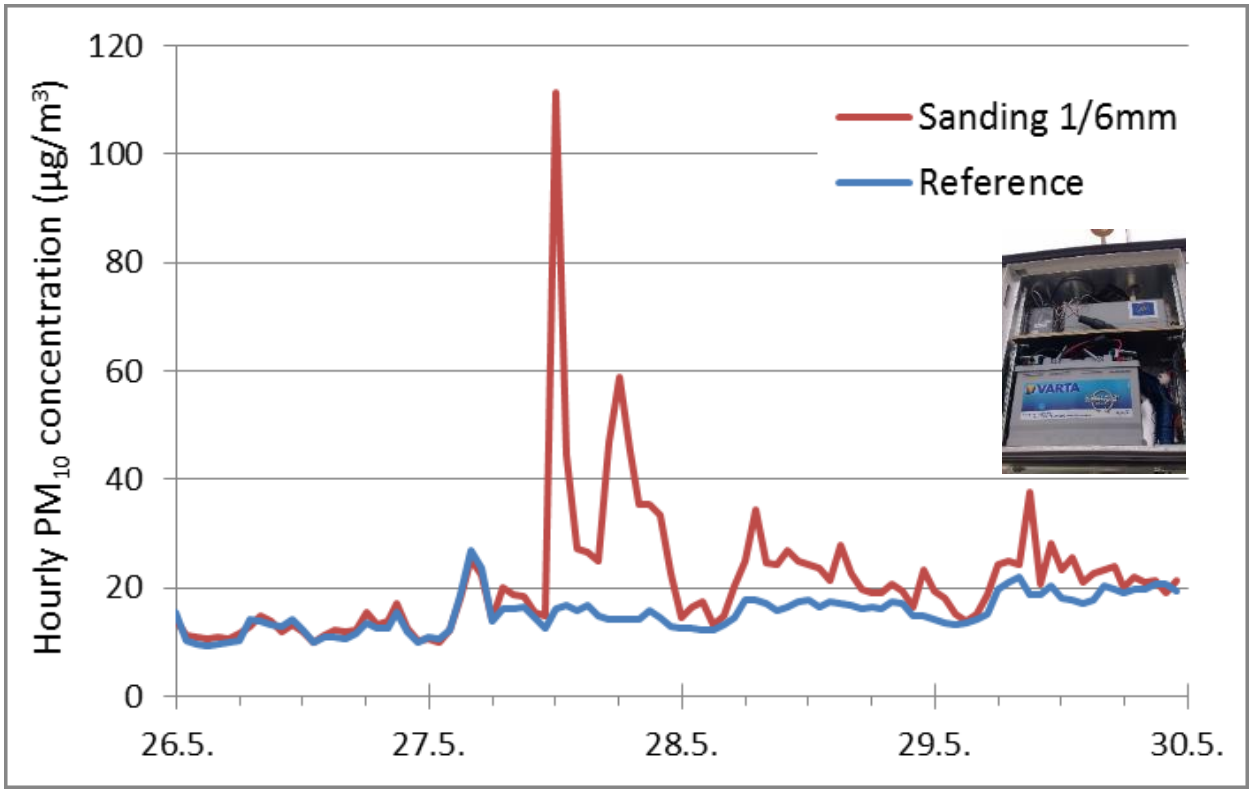
Results / Traction sanding



- 2013 tests: Traction sanding led to clear spike in PM measurements. Material was wet sieved
- Only the immediate impact of the traction sanding event was followed

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Results / Dust binding

- Targeted dust binding approx. 30 % reduction in street dust emissions for 2 days
- Whole lane dust binding approx. 60 % reduction in street dust emissions for 3 days
- Effectiveness of a single dust binding measure is always dependent on conditions such as weather, traffic and initial street dustiness

- Relative humidity impacts $CaCl_2$ effect: more humid conditions improve the effiveness
- Biodegradable potassium formiate (KCOOH) seems to work too (only 1 test in Redust, studied also in CMA Life+ project)

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Side effects of dust binding

- Dust binding with $CaCl_2$ has similar environmental impacts as traction control with NaCl, but the amounts of clorides used in traction control are much larger than those used in dust binding
- Possible side effects of $CaCl_2$
  - Loss of traction if the solution is too strong (risk of accidents)
  - Chlorides may deposit to ground water and soil
  - Harmful for vegetation next to the street
  - Corrosion of built environment and vehicles
- In Helsinki there are no major ground water reservoirs to protect and most of the clorides used on the streets end up in the storm drain system and eventually in the Baltic Sea
- If road salt is not used environmental reasons, dust binding with $CaCl_2$ is not recommended either. KCOOH and other biodegradable materials can still be used

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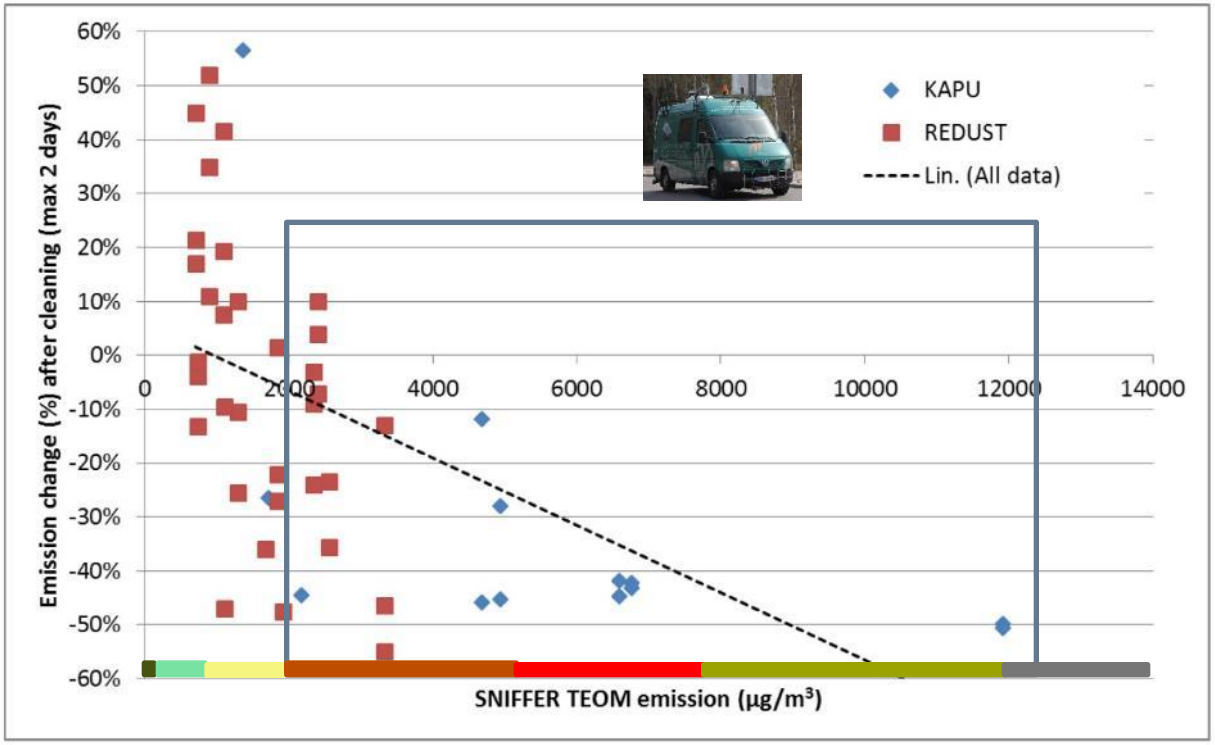
Results / Street cleaning



- Y-axis cleaning impact on street dust emissions
- X-axis initial street surface dustiness

- Street scrubber measurements from REDUST and earlier KAPU project
- The effectiveness of cleaning is strongly correlated with initial street dustiness (clean street results on the left side)

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REDUST recommendations, key points

Traction sanding:

- Wet sieved traction sanding materials produce less dust (finest material has been removed)
- Avoidance of ”unnecessary” traction sanding actions

Street cleaning:

- As fast spring cleaning as possible, beginning early in the spring
- Use of pressure washing methods reduces fine dust more efficiently than traditional suction sweeping

Dust binding:

- Dust binding with $CaCl_2$ works well and gives more time for street cleaning
- Whole lane spreading is more effective but targeted is quicker
- Chlorides harm vegetation and end up in ground water so they can not be used everywhere

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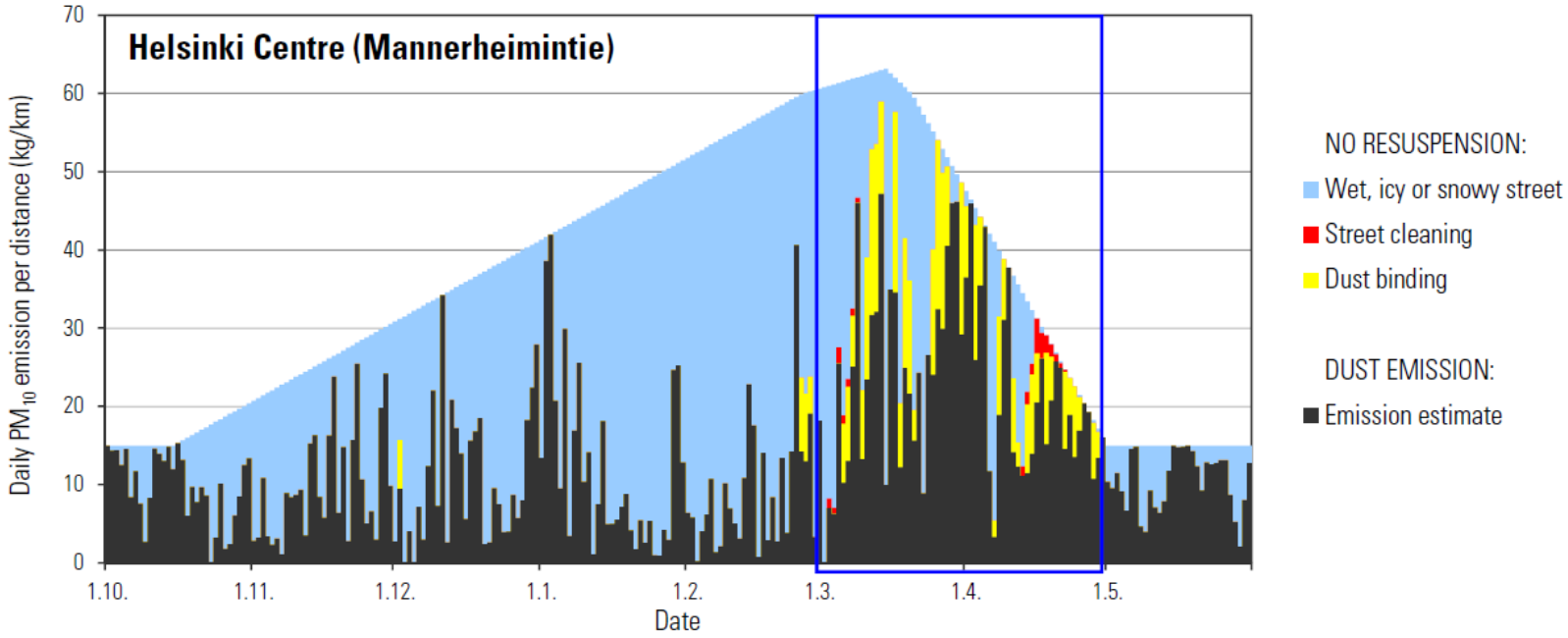
Improved maintenance actions impact on street dust emissions



- It was estimated that 25 % of street dust emissions can be cut in busy traffic locations with dust binding and improved street cleaning
- As an example estimate of street dust reduction at Mannerheimintie during spring 2014 (graph, spring dust season March-April in the blue box)

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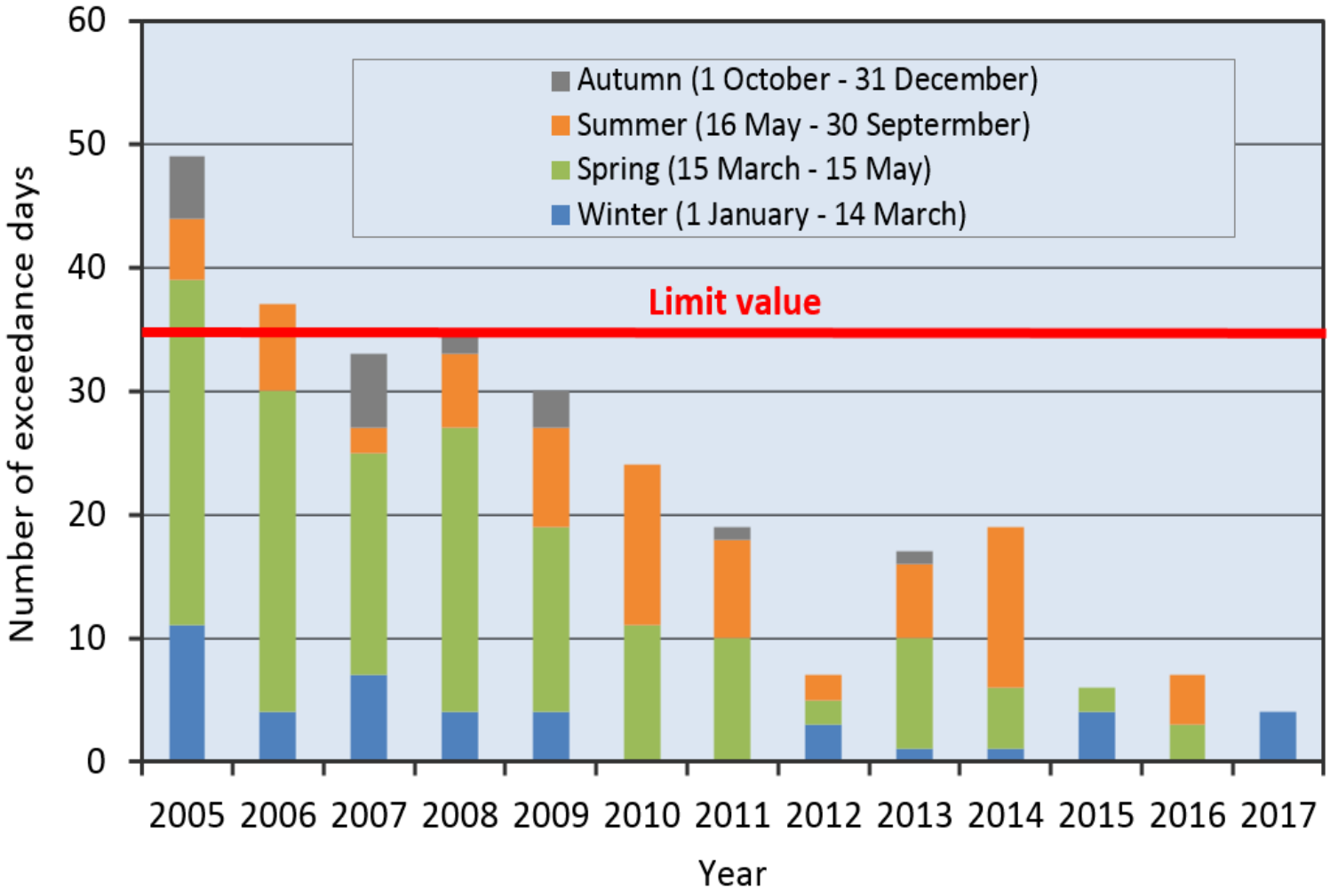
Decreasing trend in PM10 limit value exceedances in Helsinki City Centre



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Further information

Reports of the REDUST street dust project available online at http://www.ymk-projektit.fi/redust/en/

City of Helsinki Air Quality Action Plan 2017-2024 contains several measures to control street dust www.hel.fi/air-protection

Ongoing street dust research focuses on modelling the sources of street dust (NORTRIP model) and the effects of measures (e.g increasing the share of non-studded winter tyres)

More information: outi.vakeva@hsy.fi

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