Handheld- and Small Machines Network HaSMaNet

- contribution to the occupational health protection

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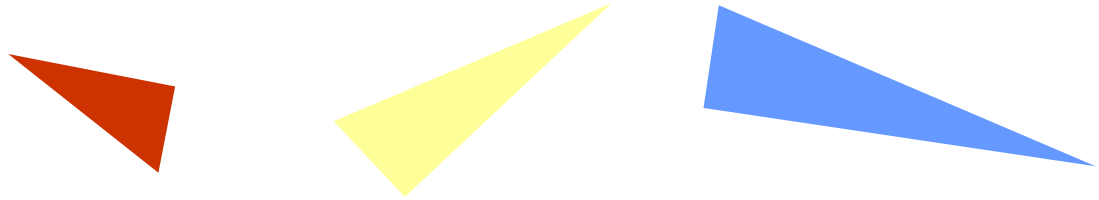

General Situation

NRMM Directive is unsufficient for NRS

→Meeting VERT with EU-Commission 13.June 2017

Limit Values for handheld Petrol NRSh

Emissionsstufe	Motorenunterklasse	Leistungsbereich	Art der Motorzündung	CO	HC + NO_x
		kW		g/kWh	g/kWh
Stufe V	NRSh-v-1a	0<P<19	FZ	805	50
Stufe V	NRSh-v-1b			603	72

PM/PN and PAH not even mentioned

*Meanwhile we are used to milligramms/kWh but here we are in the order of magnitude of (**Kilo)gramms***

NRMM-Limits – NRE → PN introduced !?

Emissionsstufe	Motorenunterklasse	Leistungsbereich	Art der Motorzündung	CO	HC	NO_x	Partikelmasse	PZ	A
		kW		g/kWh	g/kWh	g/kWh	g/kWh	#/kWh	
Stufe V	NRE-v-1 NRE-c-1	0<P<8	SZ	8,00	(HC+NO_x≤7,50)		0,40[1)]		1,10
Stufe V	NRE-v-2 NRE-c-2	8≤P<19	SZ	6,60	(HC+NO_x≤7,50)		0,40		1,10
Stufe V	NRE-v-3 NRE-c-3	19≤P<37	SZ	5,00	(HC+NO_x≤4,70)		0,015	$1x10^{12}$	1,10
Stufe V	NRE-v-4 NRE-c-4	37≤P<56	SZ	5,00	(HC+NO_x≤4,70)		0,015	$1x10^{12}$	1,10
Stufe V	NRE-v-5 NRE-c-5	56≤P<130	alle	5,00	0,19	0,40	0,015	$1x10^{12}$	1,10
Stufe V	NRE-v-6 NRE-c-6	130≤P≤560	alle	3,50	0,19	0,40	0,015	$1x10^{12}$	1,10
Stufe V	NRE-v-7 NRE-c-7	P>560	alle	3,50	0,19	3,50	0.045	-	6,00

Bern University of Applied Sciences
Biel-Bienne Switzerland
AFHB | IC-Engines and Exhaust Gas Control

Handheld Machines (HaMa) – 2-S Engines

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HaMaNet

Organized by AFHB Oct. 2011 until May 2018, 9 Meetings

Hanheld
Machines
Network

NRSh

JRC/VELA; FOEN; UBA; Swiss Lubes; AECC;
MOTOREX; Aspen; Emak; STIHL; MOT;
Dolmar, Husquarna, KIT/MOT, Lubrizol, DUH, ENI,
Heraeus, VSS, VSI, TTM, AFHB

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Research and screening test programs inspired by HaMaNet

JRC

MAY 2016 TO FEBRUARY 2018

22 MACHINES

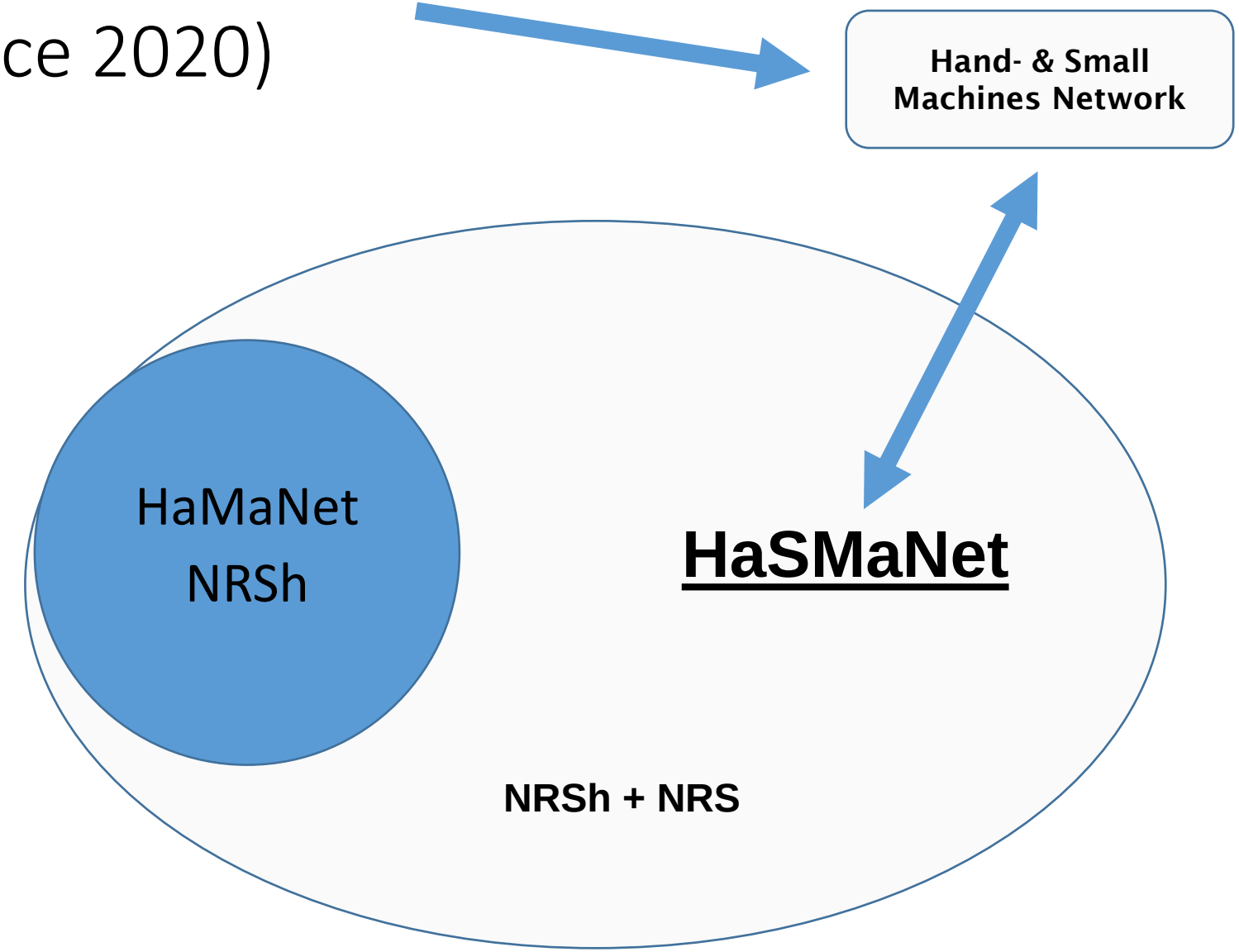
ISM AND COP

- STIHL
- KIT / MOT
- SWRI / Lubrizol
- JRC
- FOEN / AFHB
- Motorex

Technical conclusions (2-S)

- small 2-S aerosol (PN)→ lube oil
- condensation effects, HC-matrix → important for PN
- influence of lube oil ash-content → moderate
- ox. cat. → significant reduction of PM & PN
- BAT → lube oil + Alkylate fuel + ox. cat.

Consider NRS
(since 2020)



HaSMaNet Web-Meeting, Dec.’20

Most important statements

- STIHL: powertrain electrification progress approx. 25%/a, in hobby-sector almost exclusively, partly also in the professional sector (with the requirements of higher power density and longer operation time the ICE-propulsion is needed)
- DUH: performed three big market screenings of handheld machines 2013, 2015 and 2017. High rate (mostly above 50%) of exeedances of legal limit values were registered. A consequent, coordinated and centralized market surveillance with well established legal procedures and penalties is necessary.
- AFHB: shows potentials of lowering CO and HC of a small 4-S engine with oxidation catalyst and puls-air-valve.
- All: further legal steps for improving the occupational protection are necessary – lowering of limit values, provisions for CoP, ISC, PTI.

Small Machines (SMa) – 4-S Engines

Some examples

vibration pounder

small dumper

plate compactor

Simple SI 4S-engines

Yoke-mower

Simple SI 4S-engine

Lawn-mower

Technical conclusions (4-S)

- Excursion on internet: there are small engines both SI and Diesel; no information about exhaust aftertreatment (EAT)

- For the manufacturers no necessities for BAT because of not sufficient legal stimulation (most of the manufacturers have the actual EAT-technology for bigger engines in house)

- With the actual EAT considerable reduction of emissions similarly, like in the on-road sector, are possible. For SI – Ox.Cat.+sec.air, 3WC, or 4WC; for Diesel – Ox.Cat, Ox.Cat.+DPF, or Ox.Cat.+DPF+deNOx

Conclusions for VERT

VERT extends the work for emission reduction to all engines < 56 kW

→ introduce Alkylate Fuel worldwide to eliminate cancer and accident risks
→ introduce Oxidation Catalyst with Sec.Air, as the first step to oxidize CO and HC
→ demonstrate feasibility of EAC for < 56 kW
→ Standardization for Alkylat Fuels and Lube Oils
→ increase awareness of lube oil toxicity
→ increase awareness for PTI for small engines
→ Inspection and Maintenance (I&M) rules

With common efforts: legislation, testing, market control & occupational protection – significant improvements are possible.

Thank you for your attention!