



NRMM, an International Perspective

Urs Halter

- Managed bus company & BL dealership in Switzerland
- Introduced modern DPF technology into Switzerland
- First independent long-term tests with mobile DPFs
- First Bus with combined DPF & SCR
- Chaired international environmental bus group
- Independent consultant on emission control



Similarities between London and Switzerland:



Similarities between London and Switzerland:

HSBC



UBS

Population

8,5 Mio

8,4 Mio

None local background

~37%

~37%

Similarities between London and Switzerland:

Legislation

Guidance / By-Law

GLA

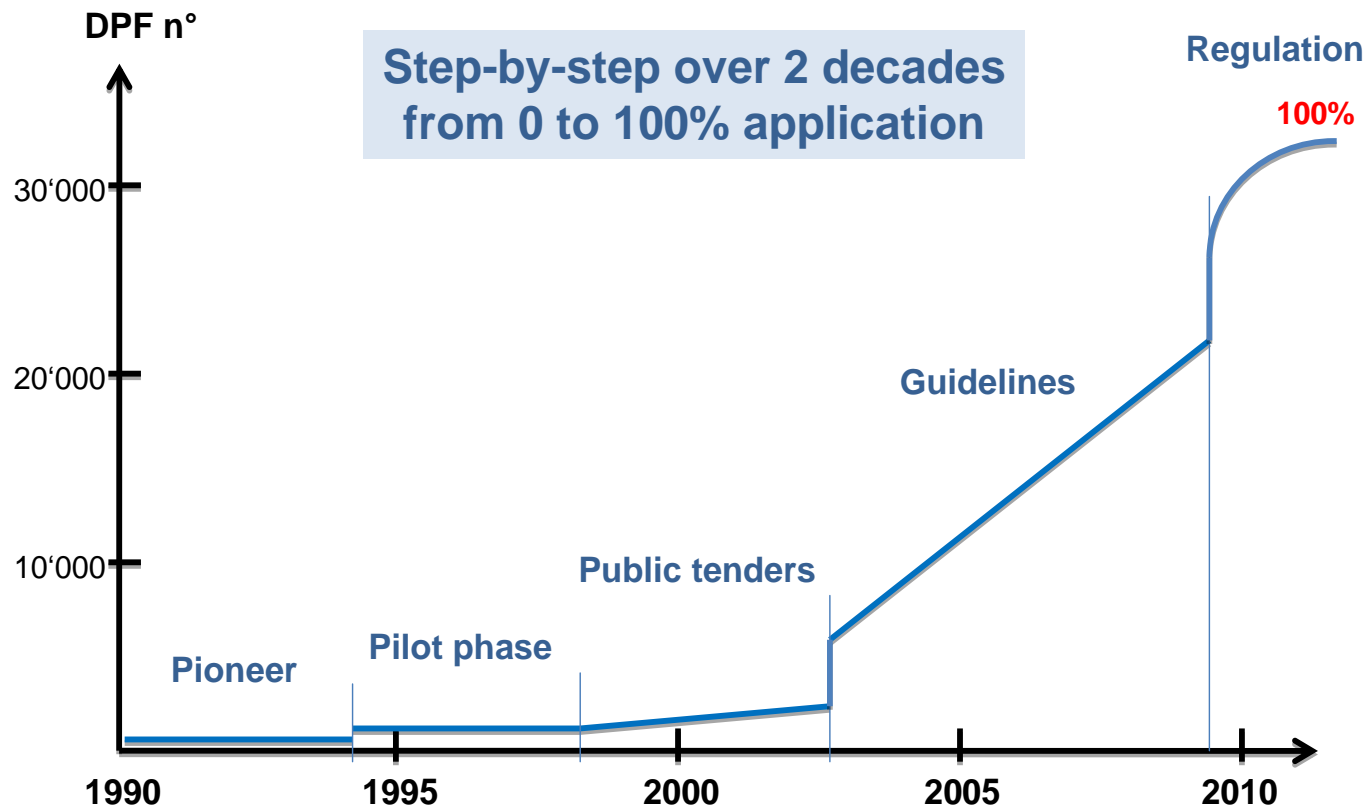
Federal Government

Execution

Boroughs (36)

Cantons (26)

DPF Retrofit of Construction Machines Switzerland



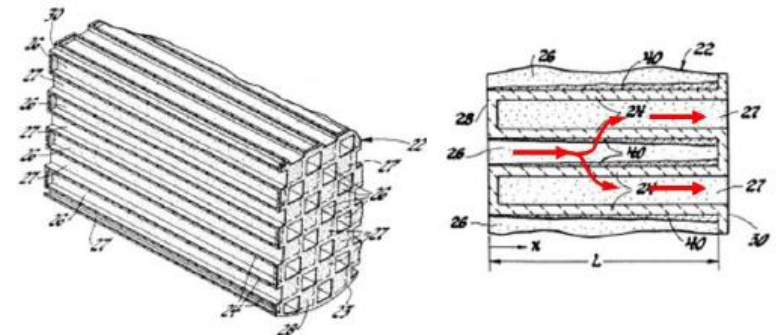
Pioneer Phase (1990 – 1995)

- 1987 WHO classifies PM as probably being carcinogenic
- First Diesel Particulate Filters developed
- Swiss Government allowed use of DPFs provided no secondary emissions

1979

Historical Perspective (Ceramic Wall-Flow Monolith 1979)

- Inventors: **Outland; Robert J.** (Grosse Pointe Woods, MI) Assignee: **General Motors Corporation** (Detroit, MI) Appl. No.: 099935 Filed: December 3, 1979. Issued: June 30, 1981, 4,276,071.



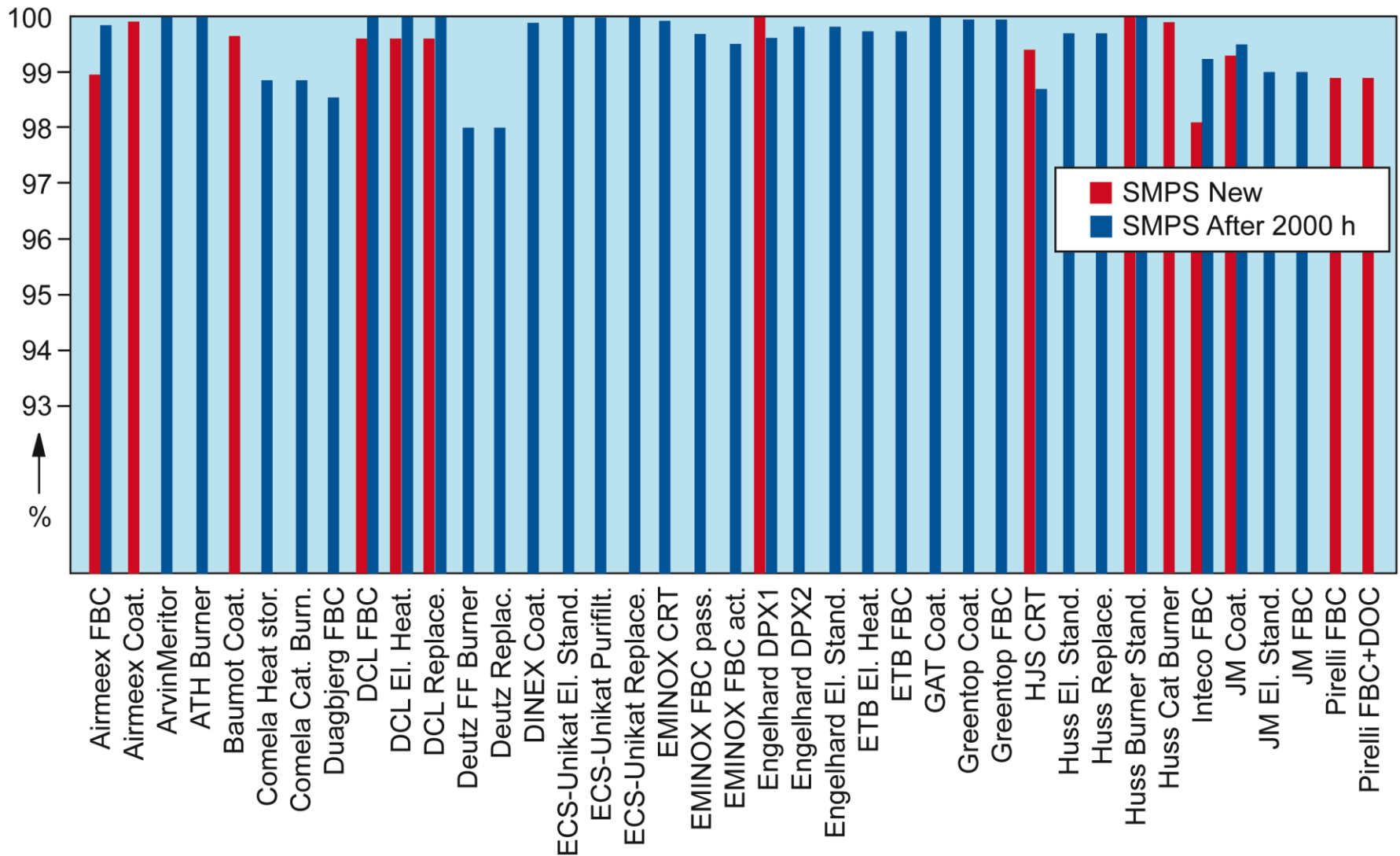
Deep-Bed and Surface (cake) Filtration

Pilot Phase (1994 – 2002)

- 1991 Busses in Zurich & Geneva retrofitted
- 1994 first fork lifts (indoor)
- 1994-1998 CH, G, AU joint occupational research
 - > **VERT** (Verification of Emission Reduction Technology)



VERT: average reduction 98.6%, 25% > 99.8%



Public Tender (2002 – 2008)

- 2000 tunnel construction (planning started 1993)
- Large construction sites (Zurich Airport, pipeline etc)
- In January 2002 all underground construction sites DPFs become mandatory



Regulation

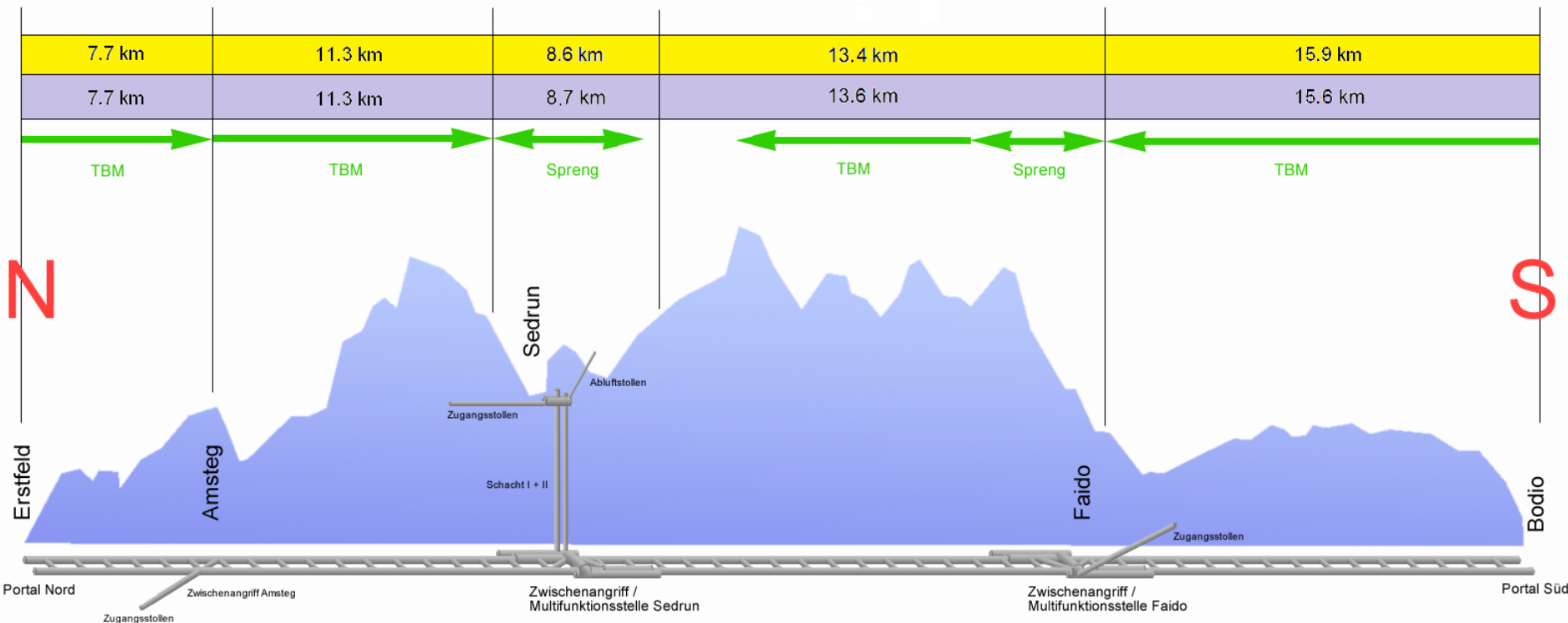
Neue Eisenbahn Alpentransversale NEAT Gotthard-Basistunnel

zwischen Erstfeld UR und Bodio TI, Schweiz
Länge: 57 km - Bauzeit: 1993 - 2017

Stand: 13. Dezember 2009

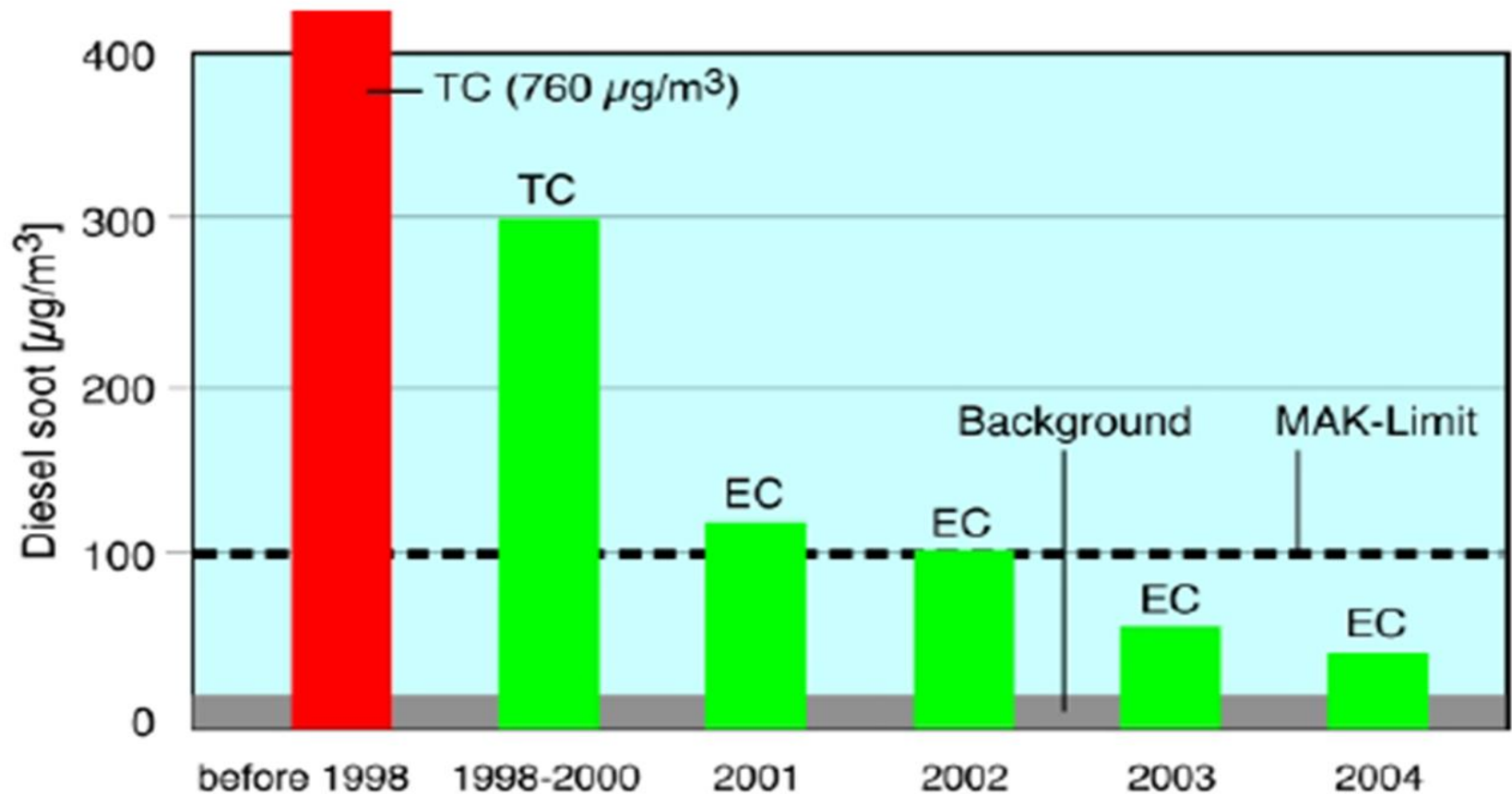
Oströhre

Weströhre



Regulation

Improvement of Air Quality in Swiss Tunneling



Regulation

1983 Federal Environmental Protection Act (EPA)

EPA Art. 1 Aim

¹ This Act is intended to **protect people, animals and plants**, their biological communities and habitats against harmful effects or nuisances and to preserve the natural foundations of life sustainably, in particular biological diversity and the fertility of the soil.

² Early **preventive measures** must be taken in order to limit effects which **could** become harmful or a nuisance.

EPA Art. 2 Polluter pays principle

Anyone **who causes** measures to be taken under this Act **must bear the costs**.

Legal Background

- September 2002 Federal Office for the Environment (FOEN) issues **Guideline** for Construction Sites:
 - all machines >37 kW
 - all urban and large non-urban sites
 - efficiency > 95% on numbers 20-300 nm
- 2008 Government enacts **By-Law** on Air Pollution Control
 - **All** machines >37 kW
 - 18-37 kW (**old and new**)
 - Efficiency >**97%** on numbers 20-300 nm

DPF Retrofit in Switzerland

Year	Fuel Sulfur ppm	Retrofits total	Retro- fitters	Failures % p.a.	VERT DPF
1988	2000	100	2	> 10	-
1992	2000	350	2	> 10	-
1995	500	500	3	> 10	5
1998	500	900	8	10	16
2000	350	2'500	12	8	23
2002	50	4'900	7	3	8
2003	50	6'500	11	2	22
2005	50	11'500	21	<2	30
2007	50	17'500	26	<2	50
2010	10	25'000	30	< 2	71
2012	10	35'000	30	< 1	80

Today there are about 50,000 retrofitted DPF are operational in Switzerland

ABGAS-WARTUNGSDOKUMENT
FICHE D'ENTRETIEN DU SYSTÈME ANTIPOLLUTION
DOCUMENTO SULLA MANUTENZIONE RELATIVA AI GAS DI SCARICO
Diesel (Baumaschinen)
Muss stets im Fahrzeug mitgeführt werden (Doi toujours rester dans le véhicule il presente documento deve sempre accompagnare il veicolo)
CH
Österreichische Vorschriften auf Seite 6 und 7 Voyez prescriptions légales aux pages 6 et 7 Prescrizioni legali, vedere pagine 6 e 7
© Herausgeber: Verband der Schweizerischen Baumaschinentechnik (VSBMT) © Éditeur: par l'Association des Fabricants et Réparateurs suisses de machines pour entrepreneurs (ASBR-Selbstbau), c/o VSBT, Postfach 555, CH-4002 Basel

1. Fahrzeugdaten / Données du véhicule / Dati del veicolo <ul style="list-style-type: none"> • Motor Marque Modèle • Fahrzeugtyp Type de véhicule Type de machine • Fahrzeug-Id- No. du châssis Tafel no. • Motor- Kennzeichen Identificateur du moteur Identificazione motore
2. Messbedingungen / Conditions de mesure / Condizioni di misurazione <ul style="list-style-type: none"> • Motor auf Betriebsleistung bringen - Alle elektrischen Verbraucher ausschalten - Weitere Angaben des Herstellers beachten • Heizen die Motor-Öl-temperatur auf - Die elektrischen Verbraucher ausschalten - Weitere Angaben des Herstellers beachten • Prüfen die Motor-Öl-temperatur - Prüfen die Motor-Öl-temperatur - Prüfen die Motor-Öl-temperatur

Sollwerte des Herstellers	Valeurs du constructeur	Dati del costruttore
3. Kontrollwerte / Indicateurs de reglage / Indicazioni di regolazione <ul style="list-style-type: none"> • Leerlaufdrehzahl Régime au ralenti Régime de ralenti • Drehmoment Régime maximal à vide Régime maximal, à vide • Fördermenge Débit maximal Débit maximal • Förderdruck Pression maximale Pression maximale • Förderleistung Débit maximal Débit maximal 		
4. Bauteilwerte / Valeurs des dimensions de pièces / Valori delle sezioni di pezzi <ul style="list-style-type: none"> • Trüffungscoefficient max. Coefficient d'opacité max. Coefficient d'opacité max. • Trüffungscoefficient max. Coefficient d'opacité max. Coefficient d'opacité max. 		
5. Bestätigung / Attestation / Attestazione <p>Österreich, Datum: montage filter, date: montage filter, date:</p> <p>Datum Date</p> <p>Stempel / Timbre / Timbre</p>		

Monitoring & Fines

- Controls are delegated to Cantons
- Inspectors check at random base (5 %)
- Inspectors check papers and smoke
- Non functioning filters must be replaced within two days
- Fines for non compliance are CHF 2000-8000 (GBP 1,500-6,000) depending on machine size

Current Legislation for Construction Equipment:

Switzerland

Austria

Germany

Berlin, Bremen

Baden-Württemberg

California

UK

London

EU Legislation:

Stage	Engine power [kW]	Type approval	Vehicle registration	NOx [g/kWh]	HC + NOx [g/kWh]	PM [g/ kWh]
I	130-560	01.01.1998	01.01.1999	9.2		0.54
II	130-560	01.01.2001	01.01.2002	6.0		0.20
III A	130-560	01.01.2005	01.01.2006		4.0	0.20
III B	130-560	01.01.2010	01.01.2011	2.0		0.025
IV	130-560	01.01.2013	01.01.2014	0.4		0.025

VERT recognised in:

Switzerland

Germany

Netherlands

London LEZ

Santiago de Chile

Colombia: Bogota

Israel: Telaviv

Iran: Teheran

Austria

USA: CARB, NY

Italy

Canada

Denmark

China: Beijing



Factors for Success:

- Selecting the right DPF (application, cycle, fuel, lub oil etc)
- Training & instruction (VERT tools available)
- Positive approach & attitude
- Monitoring & cleaning
- Electronic Filter On-board Control



Thank you!

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