D5.1 Database of emissions, secondary aerosols and toxicity rating (Excel file)

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PAREMPI
Particle emission prevention and impact: from real-world emissions of traffic to secondary PM of urban air

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PAREMPI Particle emission prevention and impact: from real-world emissions of traffic to secondary PM of urban air

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01.11.2024	0.1	H. Timonen, L. Barreira, FMI H. Barošová, J. Topinka, IEM P. Aakko-Saksa, VTT	Initial draft database
31.12.2024	1.0	H. Timonen, FMI P. Aakko-Saksa, VTT	Review, database design
09.06.2026	2.0	T. Červená, IEM H. Timonen and L. Barreira, FMI P. Aakko-Saksa, VTT	Database update

CONSORTIUM:

ORGANISATION NAME	SHORT NAME	COUNTRY
VTT Technical Research Centre of Finland	VTT	Finland
Tampere University	TAU	Finland
Finnish Meteorological Institute	FMI	Finland
Automotive Research and Development Institute	BOSMAL	Poland
Lund University	ULUND	Sweden
Office national d'études et de recherches aérospatiales	ONERA	France
Institute of Experimental Medicine	IEM	Czechia
Magellan Circle	MAGELLAN CIRCLE	Portugal

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1. Executive Summary

In the PAREMPI project (https://parempi.eu/), a new database of emissions, secondary aerosols and toxicity rating was developed. Database provides a comprehensive collection and analysis of data on the emission rates of fresh and aged secondary aerosol species, their precursors and toxicity of fresh and aged aerosols emitted from various transportation sources. The database is complemented with the other data available from the measurements including various types of gaseous and particle emissions. The database is an Excel file constantly updated with the newest results from PAREMPI project and literature.

The database has two separate parts; emission studies and toxicity studies. In the emission database we considered only direct measurement results from single sources, such as those from engines, passenger cars, and heavy-duty vehicles, while excluding mixed emissions like those from ambient roadside or tunnel measurements or results obtained through indirect calculation. The focus is in most recent studies from past 10 years where the aged emissions were studied using oxidation flow reactors (OFRs), the older studies or studies utilizing other chambers were included when newer studies were not available for specific applications. In the toxicity emission database, we considered the studies with toxicity measured from the different transport sources.

A large amount of information related to all studies were collected. Parameters related to study, engine, aftertreatment and fuel as well as large number of parameters related to precursors of secondary emissions, fresh particulate emissions and aged emissions. For toxicity part, the database includes study and engine information, as well as information about toxicologican endpoints and toxicity rating.

The database is in the format of an Excel file to ensure easy access and possibility to modify the resulting dataset as needed. Furthermore, the database is constantly updated to include the most recent results from the consortium and literature. Currently, the database consists of four tabs: Readme (Appendix 1), Versions, Parameters (Appendix 2), Emissions (Appendix 3) and Toxicity (Appendix 4).

2. Future outlook

During the upcoming year we will constantly update the database and include the new studies from consortium's previous projects, PAREMPI project as well as literature. Furthermore our aim is to make a scientific article describing the database as well as promote the database in conferences.

Updated database (Excel): https://parempi.eu/research/deliverables/ and 10.5281/zenodo.20647748

Appendix 1. Database – Readme tab

The following table provides the content of the Readme tab of the current database.

Secondary emissions from transport – database

Authors	See Versions tab
PAREMPI SecA Database	In the PAREMPI project (https://parempi.eu/) a new database was developed. Database provides a comprehensive collection and analysis of data on the emission rates of aged PM, secondary aerosol precursors and toxicity of aerosols emitted from various transport sources. The database is complemented with the other data available from the measurements including e.g. fresh PM results.
Criteria for emissions tab	In order to be included to the database, following criteria needed to be met; 1) Only direct measurement results from single sources, such as those from engines, passenger cars, and heavy-duty vehicles were considered, while excluding mixed emissions like those from ambient roadside or tunnel measurements or results obtained through indirect calculation, 2) Article includes SecA results. Oxidation flow reactor (OFR) results were considered most important as they are currently the most widely used technique for simulating atmospheric aerosol formation in emission studies, 2) Articles from the past 10 years were prioritized, but older articles were included in the database if more recent data is missing or insufficient, 3) Articles need to be peer-reviewed scientific literature, European Union (EU) reviews, or published/unpublished results from previous projects within the Consortium.
Criteria for toxicity tab	The database considered only direct measurement results from single sources, such as those from engines, passenger cars, and heavy-duty vehicles, while excluding mixed emissions like those from ambient roadside or tunnel measurements or results obtained through indirect calculation.
Units	Original units are presented. For aged PM, an additional unit of mg/MJ has been calculated according to the principles presented in Table 12 of PAREMPI Deliverable D5.2.
Format	The database is in the format of an excel table to ensure easy access and possibility to modify the resulting dataset as needed.
Parameters	See Parameters tab
Contact info	Hilkka Timonen (hilkka.timonen@fmi.fi), Päivi Aakko-Saksa (paivi.aakko-saksa@vtt.fi)
Date	Version 1.0, 30.12.2024; Version 2.0, 9.6.2026

Appendix 2. Database – Parameters tab

The following table provides the content of the parameters of the current database.

List of parameters updated: **09.06.2026**

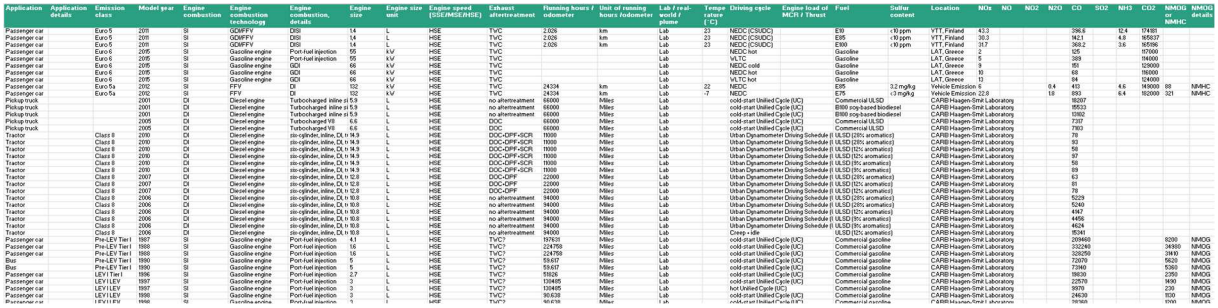
Parameter	Explanation	Value (NA=Not available)
Transport sector	Transport sector studied	LD=Light-duty; HD=heavy-duty (HD); NRMM= non-road mobile machinery; Marine; Aviation
Application	Transport application studied	Car; Bus; Truck; Tractor; Ship; Aircraft etc.
Application details	Description of application	E.g. lab engine
Emission class	Emission class of vehicle, engine, ship, aircraft	Euro 5; Euro 6d; Euro VI; Stage III etc.
Model year	Model year of the studied engine, vehicle etc.	Numerical
Engine combustion	Diesel (DI), Spark-ignited (SI), Dual-fuel (DF)	Main classification of internal combustion engine
Engine combustion technology	Engine combustion technology	PHEV=Plug-in hybrid electric vehicle; FFV=Flex fuel vehicle; GDI=Gasoline direct injection; Common rail; Gasoline, Diesel, Turbine etc.
Engine combustion details	Turbo, injection etc.	Details if available
Engine size	Size of studied engine	Numerical
Engine size unit	Unit used to give the engine size	Liter (L); Power (kW)
Engine speed (SSE/MSE/HSE)	Engine speed	SSE=Low-speed engine; MSE=Medium-speed engine, HSE=High-speed engine
Exhaust aftertreatment	Emission control system	DOC=Diesel oxidation catalyst; SCR=Selective Catalytic Reduction; DPF=Diesel particulate filter; GPF=Gasoline particle filter; TWC=Three-way catalyst; MOC=Methane oxidation catalyst; WESP=Wet Electrostatic Precipitator
Running hours/odometer	Running hours/odometer of an engine, vehicle etc.	Numerical
Unit of running hours/odometer	Unit for running hours/odometer of an engine, vehicle etc.	Hours (h), kilometers (km)
Lab/real-world/plume	The location of sampling	Laboratory; Real-world (on-road; on-board); plume
Temperature (°C)	Temperature of application during test	Numerical
Driving cycle	Driving cycle used in experiment	SSC=Steady state cycle; NRSC=Non-Road Steady-state Cycle ; FTP=Federal Test Procedure; NEDC=New European Driving Cycle; CSUDC=Urban driving with a cold start
Load	Engine load (% of MCR) or roughness	Numerical or Low/Mid/High
Fuel	Specific fuel	EN228=European standard for gasoline; EN590=European standard for diesel fuel; E85=85% ethanol and 15% gasoline (E10 etc. similar principle); FAME; HVO=Hydrotreated vegetable oil; FT=Fischer-Tropsch fuel; CNG=Compressed natural gas; NG=Natural gas; ULSD=Ultra-Low Sulfur Diesel; MDO=Marine diesel oil; MGO=Marine gas oil;HFO=Heavy fuel oil etc.
Fuel sulfur content	Sulfur content of fuel	Numerical or Low (<10 ppm or <15 ppm)
Location	Geographical location of measurements	City; country
Leading organization	Organization in charge of campaign (or publication)	Institute; country
NOx	Nitrogen oxides	Numerical
NO2	Nitrogen dioxide	Numerical

N2O	Nitrous oxide	Numerical
CO	Carbon monoxide	Numerical
SO2	Sulfur dioxide	Numerical
NH3	Ammonia	Numerical
CO2	Carbon dioxide	Numerical
NMOG/NMHC	Non-methane organic gases or hydrocarbons	Numerical
THC	Total hydrocarbons measured by flame ionisation detector (FID)	Numerical
Alkanes, individual	C1-C22 alkanes, individual	Numerical
Alkanes, sum	C1-C22 alkanes, sum	Numerical
Alkenes, individual	C2-C6 alkenes, individual	Numerical
Alkenes, sum	C2-C6 alkenes, sum	Numerical
Alkynes, Individual	C2 alkynes, individual	Numerical
Alkynes, sum	C2 alkyne, sum	Numerical
OOC, individual	Oxygenated organic compounds, individual	Numerical
OOC, sum	Oxygenated organic compounds, sum	Numerical
Aromatics (1-ring), individual	Single-ring aromatics, Individual	Numerical
Aromatics (1-ring), sum	Single-ring aromatics, sum	Numerical
Unit for gases	Unit for gases	mg/km, mg/kWh etc.
PN total	Particle number emissions, fresh total	Numerical
PN total details	Particle number emissions, aged, total, instrument used	Fresh, aged, ELPI, SMPS etc.
PN non-volatile 23	Particle number emissions, non-volatile, above 23 nm	Numerical
PN non-volatile 10	Particle number emissions, non-volatile, above 10 nm	Numerical
PN unit	Unit of particle number emissions	#/m3 (temperature, pressure), #/km, #/kWh etc.
Organics fresh (AMS)	Organic aerosol (fresh) from AMS measurement	Numerical
Nitrate fresh (AMS)	Nitrate aerosol (fresh) from AMS measurement	Numerical
Ammonium fresh (AMS)	Ammonium aerosol (fresh) from AMS measurement	Numerical
Sulfate fresh (AMS)	Sulphate aerosol (fresh) from AMS measurement	Numerical
Chloride fresh (AMS)	Chloride aerosol (fresh) from AMS measurement	Numerical
Ions sum, fresh (AMS))	Sum of ions measured from AMS measurement	Numerical
BC or EC, fresh	Black carbon (BC) or elemental carbon (EC), fresh	Numerical
BC fresh, details	Instrument or method for measuring BC or EC	rBC, eBC or EC depending on instrument (MSS, MAAP, aethalometer, TOA, LII, AMS)
PM fresh (PN-to-PM)	Particulate matter emission (fresh), PN to PM conversion	Numerical
PM fresh, selected	Particulate matter emission (fresh), depending on reported method	Numerical
PM fresh, details	Particulate matter emission (fresh), method	Filter-based, PN-to-PM, Components (fresh) measured by AMS plus BC/EC
Unit, fresh aerosol	Unit of fresh aerosol components	mg/m3 (temperature, pressure), mg/km, mg/kWh etc.

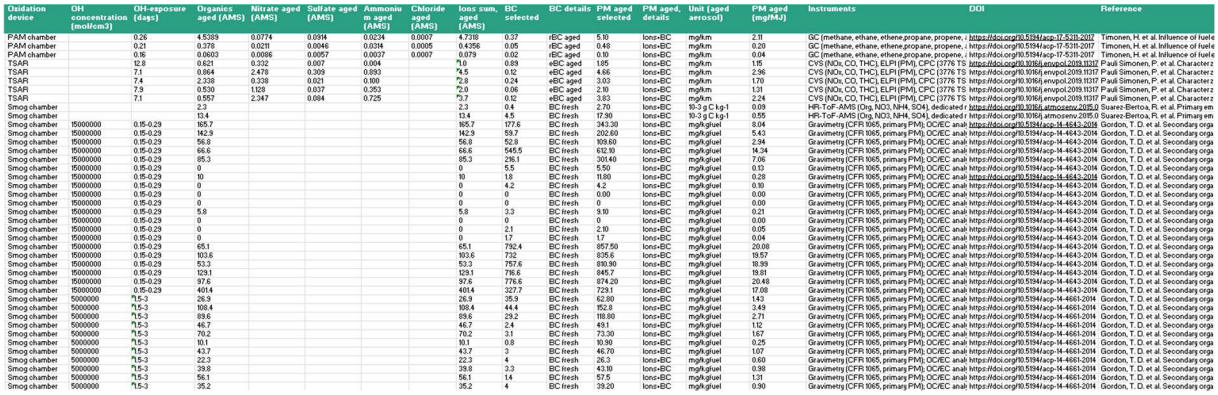
Oxidation device	Instrument for oxidation, oxidation flow chamber type	Instrument e.g. OFR (type)
OH concentration	OH concentration	Numerical
OH-exposure (days)	OH exposure used in studies of aged aerosol	Numerical
Organics aged (AMS)	Organic aerosol (aged, secondary) from AMS measurement	Numerical
Nitrate aged (AMS)	Nitrate aerosol (aged) from AMS measurement	Numerical
Ammonium aged (AMS)	Ammonium aerosol (aged) from AMS measurement	Numerical
Sulfate aged (AMS)	Sulphate aerosol (aged) from AMS measurement	Numerical
Chloride aged (AMS)	Chloride aerosol (aged) from AMS measurement	Numerical
Ions sum, aged (AMS)	Sum of ions measured by AMS	Numerical
BC selected	Black carbon	Numerical
BC details	Instrument or method for measuring BC or EC	rBC, eBC or EC depending on instrument (MSS, MAAP, aethalometer, TOA, LII, AMS)
PM aged, selected	Particulate matter emission (aged)	Numerical
PM aged, details	Particulate matter emission, method	Components (fresh) measured by AMS plus BC, PN-to-PM etc.
Unit, aged aerosol	Unit of aged aerosol components	mg/m3 (temperature, pressure), mg/km, mg/kWh etc.
Exposure class	Exposure method	ALI, PM pre-collected, SVOC
Emission source	Source of emissions studied	PM fresh exhaust, PM aged, Non-exhaust
Particle specification	Toxicity related specification	
Model	Model for toxicity testing	Human TCCC etc.
End points tested	Testing for toxicity	LDH, OxyDNA adducts etc.
Repetitions	Number of repetitions of the toxicity tests	Numerical
C	Cytotoxicity effects	nd=No data; 0=no harmful effects found; x=unclear; 1=potentially harmful ($p<0.05$); 2=slightly harmful ($p<0.01$); 1=potentially harmful ($p<0.05$); 3=clearly harmful ($p<0.001$); 4=harmful in high confidence level ($p<0.0001$); 5=Very harmful in high confidence level
G	Genotoxicity effects	nd=No data; 0=no harmful effects found; x=unclear; 1=potentially harmful ($p<0.05$); 2=slightly harmful ($p<0.01$); 1=potentially harmful ($p<0.05$); 3=clearly harmful ($p<0.001$); 4=harmful in high confidence level ($p<0.0001$); 5=Very harmful in high confidence level
I	Inflammation effects	nd=No data; 0=no harmful effects found; x=unclear; 1=potentially harmful ($p<0.05$); 2=slightly harmful ($p<0.01$); 1=potentially harmful ($p<0.05$); 3=clearly harmful ($p<0.001$); 4=harmful in high confidence level ($p<0.0001$); 5=Very harmful in high confidence level
O	Oxidative stress effects	nd=No data; 0=no harmful effects found; x=unclear; 1=potentially harmful ($p<0.05$); 2=slightly harmful ($p<0.01$); 1=potentially harmful ($p<0.05$); 3=clearly harmful ($p<0.001$); 4=harmful in high confidence level ($p<0.0001$); 5=Very harmful in high confidence level
D	Other endpoints	nd=No data; 0=no harmful effects found; x=unclear; 1=potentially harmful ($p<0.05$); 2=slightly harmful ($p<0.01$); 1=potentially harmful ($p<0.05$); 3=clearly harmful ($p<0.001$); 4=harmful in high confidence level ($p<0.0001$); 5=Very harmful in high confidence level
Toxicity rating	Combined toxicity rating code of C, G, I, O, D	
Other info	Other relevant information	
DOI	DOI number of reference	
Reference	Reference with author, journal/report identification and publication year.	

Appendix 3. Database – Emissions tab

The following clips provide examples of the content contained in the emissions tab of database.



Application	Application details	Emission class	Model year	Engine combustion	Engine combustion technology	Engine combustion, details	Engine size	Engine size unit	Engine speed [SSE/MSE/HSE]	Exhaust aftertreatment	Running hours / odometer	Unit of running hours /odometer	Lab / real-world / plume	Temperature (°C)	Driving cycle	Engine load of MCR / Thrust	Fuel	Sulfur content	Location	NOx	NO	NO2	N2O	CO	SO2	NH3	CO2	NMOG or NMHC	NMOG details
Passenger car		Euro 5	2011	SI	GDI+FF	DI	1.4	L	HSE	TWC	2.62E+	km	Lab	23	NEDC (CSIDC)		E30	<10 ppm	YTT, Finland	43.2				296.6		12.4	17493		
Passenger car		Euro 5	2011	SI	GDI+FFV	DISI	1.4	L	HSE	TWC	2.62E	km	Lab	23	NEDC (CSIDC)		E85	<10 ppm	YTT, Finland	30.3				142.1		4.8	165837		
Passenger car		Euro 5	2011	SI	GDI+FFV	DISI	1.4	L	HSE	TWC	2.62E	km	Lab	23	NEDC (CSIDC)		E30	<10 ppm	YTT, Finland	31.7				368.2		3.6	165096		
Passenger car		Euro 6	2015	SI	Gasoline engine	Port-fuel injection	55	kW	HSE	TWC			Lab		NEDC hot		Gasoline		LAT, Greece	2				125			157000		
Passenger car		Euro 6	2015	SI	Gasoline engine	Port-fuel injection	55	kW	HSE	TWC			Lab		VLTC		Gasoline		LAT, Greece	5				388			194000		
Passenger car		Euro 6	2015	SI	Gasoline engine	GDI	66	kW	HSE	TWC			Lab		NEDC cold		Gasoline		LAT, Greece	9				193			129000		
Passenger car		Euro 6	2015	SI	Gasoline engine	GDI	66	kW	HSE	TWC			Lab		NEDC hot		Gasoline		LAT, Greece	10				68			116000		
Passenger car		Euro 6	2015	SI	Gasoline engine	GDI	66	kW	HSE	TWC			Lab		VLTC hot		Gasoline		LAT, Greece	13				84			124000		
Passenger car		Euro 5a	2012	SI	FFV	DI	102	kW	HSE	TWC	24324	km	Lab	22	NEDC		E95	3.2 mg/kg	Vehicle Emission	6			0.4	410		4.6	145000	89	NMHC
Passenger car		Euro 5a	2012	SI	FFV	DI	102	kV	TVC		24324	km	Lab	-7	NEDC		E75	<3 mg/kg	Vehicle Emission	22.8			1.8	693		6.4	162000	321	NMHC
Pickup truck			2003	DI	Diesel engine	Turbocharged inline pl	5.9	L	HSE	no aftertreatment	60000	Miles	Lab		cold-start Unified Cycle (UC)		Commercial ULSD		CARB Haagen-Smit Laboratory					18207					
Pickup truck			2001	DI	Diesel engine	Turbocharged inline pl	5.9	L	HSE	no aftertreatment	60000	Miles	Lab		cold-start Unified Cycle (UC)		B100 soy-based biodiesel		CARB Haagen-Smit Laboratory					15533					
Pickup truck			2001	DI	Diesel engine	Turbocharged inline pl	5.9	L	HSE	no aftertreatment	60000	Miles	Lab		cold-start Unified Cycle (UC)		B100 soy-based biodiesel		CARB Haagen-Smit Laboratory					12982					
Pickup truck			2005	DI	Diesel engine	Turbocharged V8	6.6	L	HSE	DOC	60000	Miles	Lab		cold-start Unified Cycle (UC)		Commercial ULSD		CARB Haagen-Smit Laboratory					7337					
Pickup truck			2005	DI	Diesel engine	Turbocharged V8	6.6	L	HSE	DOC	60000	Miles	Lab		cold-start Unified Cycle (UC)		Commercial ULSD		CARB Haagen-Smit Laboratory					7303					
Tractor		Class 8	2010	DI	Diesel engine	six-cylinder, inline, DI, n	14.9	L	HSE	DOC-DPF-SCR	10000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (28% aromatics)		CARB Haagen-Smit Laboratory					78					
Tractor		Class 8	2010	DI	Diesel engine	six-cylinder, inline, DI, n	14.9	L	HSE	DOC-DPF-SCR	10000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (12% aromatics)		CARB Haagen-Smit Laboratory					93					
Tractor		Class 8	2010	DI	Diesel engine	six-cylinder, inline, DI, n	14.9	L	HSE	DOC-DPF-SCR	10000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (12% aromatics)		CARB Haagen-Smit Laboratory					58					
Tractor		Class 8	2010	DI	Diesel engine	six-cylinder, inline, DI, n	14.9	L	HSE	DOC-DPF-SCR	10000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (12% aromatics)		CARB Haagen-Smit Laboratory					97					
Tractor		Class 8	2010	DI	Diesel engine	six-cylinder, inline, DI, n	14.9	L	HSE	DOC-DPF-SCR	10000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (5% aromatics)		CARB Haagen-Smit Laboratory					56					
Tractor		Class 8	2010	DI	Diesel engine	six-cylinder, inline, DI, n	14.9	L	HSE	DOC-DPF-SCR	10000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (5% aromatics)		CARB Haagen-Smit Laboratory					69					
Tractor		Class 8	2007	DI	Diesel engine	six-cylinder, inline, DI, n	12.8	L	HSE	DOC-DPF	22000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (28% aromatics)		CARB Haagen-Smit Laboratory					63					
Tractor		Class 8	2007	DI	Diesel engine	six-cylinder, inline, DI, n	12.8	L	HSE	DOC-DPF	22000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (12% aromatics)		CARB Haagen-Smit Laboratory					81					
Tractor		Class 8	2007	DI	Diesel engine	six-cylinder, inline, DI, n	12.8	L	HSE	DOC-DPF	22000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (12% aromatics)		CARB Haagen-Smit Laboratory					78					
Tractor		Class 8	2006	DI	Diesel engine	six-cylinder, inline, DI, n	10.8	L	HSE	no aftertreatment	94000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (28% aromatics)		CARB Haagen-Smit Laboratory					5229					
Tractor		Class 8	2006	DI	Diesel engine	six-cylinder, inline, DI, n	10.8	L	HSE	no aftertreatment	94000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (28% aromatics)		CARB Haagen-Smit Laboratory					5240					
Tractor		Class 8	2006	DI	Diesel engine	six-cylinder, inline, DI, n	10.8	L	HSE	no aftertreatment	94000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (12% aromatics)		CARB Haagen-Smit Laboratory					4747					
Tractor		Class 8	2006	DI	Diesel engine	six-cylinder, inline, DI, n	10.8	L	HSE	no aftertreatment	94000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (5% aromatics)		CARB Haagen-Smit Laboratory					4456					
Tractor		Class 8	2006	DI	Diesel engine	six-cylinder, inline, DI, n	10.8	L	HSE	no aftertreatment	94000	Miles	Lab		Urban Dynamometer Driving Schedule (I		ULSD (5% aromatics)		CARB Haagen-Smit Laboratory					4624					
Tractor		Class 8	2006	DI	Diesel engine	six-cylinder, inline, DI, n	10.8	L	HSE	no aftertreatment	94000	Miles	Lab		Creep + idle		ULSD (12% aromatics)		CARB Haagen-Smit Laboratory					15341					
Passenger car		Pre-LEV Tier I	1997	SI	Gasoline engine	Port-fuel injection	4.1	L	HSE	TWC?	107631	Miles	Lab		cold-start Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					209468			8280	NMOG	
Passenger car		Pre-LEV Tier I	1988	SI	Gasoline engine	Port-fuel injection	16	L	HSE	TWC?	224769	Miles	Lab		cold-start Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					332249			34380	NMOG	
Passenger car		Pre-LEV Tier I	1988	SI	Gasoline engine	Port-fuel injection	16	L	HSE	TWC?	224759	Miles	Lab		cold-start Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					329259			31410	NMOG	
Bus		Pre-LEV Tier I	1990	SI	Gasoline engine	Port-fuel injection	5	L	HSE	TWC?	59307	Miles	Lab		cold-start Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					72070			5620	NMOG	
Bus		Pre-LEV Tier I	1990	SI	Gasoline engine	Port-fuel injection	5	L	HSE	TWC?	59307	Miles	Lab		cold-start Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					72060			5360	NMOG	
Passenger car		LEV I Tier I	1996	SI	Gasoline engine	Port-fuel injection	2.7	L	HSE	TWC?	51626	Miles	Lab		cold-start Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					19830			2350	NMOG	
Passenger car		LEV I LEV	1997	SI	Gasoline engine	Port-fuel injection	3	L	HSE	TWC?	130495	Miles	Lab		cold-start Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					22579			1690	NMOG	
Passenger car		LEV I LEV	1997	SI	Gasoline engine	Port-fuel injection	3	L	HSE	TWC?	130495	Miles	Lab		hot Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					9979			230	NMOG	
Passenger car		LEV I LEV	1998	SI	Gasoline engine	Port-fuel injection	3	L	HSE	TWC?	95638	Miles	Lab		cold-start Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					24639			1530	NMOG	
Passenger car		LEV I LEV	1998	SI	Gasoline engine	Port-fuel injection	3	L	HSE	TWC?	95638	Miles	Lab		cold-start Unified Cycle (UC)		Commercial gasoline		CARB Haagen-Smit Laboratory					29368			1990	NMOG	



Oxidation device	OH concentration (molcm3)	OH-exposure (days)	Organics aged (AMS)	Nitrate aged (AMS)	Sulfate aged (AMS)	Ammonium aged (AMS)	Chloride aged (AMS)	Ions sum, aged (AMS)	BC selected	BC details	PM aged selected	PM aged, details	Unit (aged aerosol)	PM aged (mg/MJ)	Instruments	DOI	Reference
PAM chamber		0.26	4.5389	0.0774	0.0914	0.0234	0.0007	4.7318	0.37	rBC aged	5.10	Ions+BC	mg/km	2.11	GC (methane, ethane, ethene,propane, propene, i	https://doi.org/10.5194/acp-17-5311-2017	Timonen, H. et al. Influence of fuel e
PAM chamber		0.21	0.378	0.0211	0.0046	0.0314	0.0005	0.4356	0.05	rBC aged	0.49	Ions+BC	mg/km	0.20	GC (methane, ethane, ethene,propane, propene, i	https://doi.org/10.5194/acp-17-5311-2017	Timonen, H. et al. Influence of fuel e
PAM chamber		0.16	0.0603	0.0086	0.0057	0.0037	0.0007	0.079	0.02	rBC aged	0.10	Ions+BC	mg/km	0.04	GC (methane, ethane, ethene,propane, propene, i	https://doi.org/10.5194/acp-17-5311-2017	Timonen, H. et al. Influence of fuel e
TSAR		12.8	0.621	0.332	0.007	0.004		1.0	0.89	eBC aged	1.85	Ions+BC	mg/km	1.15	CVS (NOx, CO, THC), ELPI (PM), CPC (3776 TS	https://doi.org/10.1016/j.envpol.2019.113127	Pauli Simonen, P. et al. Characterz
TSAR		7.1	0.864	2.478	0.309	0.693		4.5	0.12	eBC aged	4.66	Ions+BC	mg/km	2.96	CVS (NOx, CO, THC), ELPI (PM), CPC (3776 TS	https://doi.org/10.1016/j.envpol.2019.113127	Pauli Simonen, P. et al. Characterz
TSAR		7.4	2.338	0.338	0.021	0.100		2.8	0.24	eBC aged	3.03	Ions+BC	mg/km	1.70	CVS (NOx, CO, THC), ELPI (PM), CPC (3776 TS	https://doi.org/10.1016/j.envpol.2019.113127	Pauli Simonen, P. et al. Characterz
TSAR		7.9	0.530	1.129	0.037	0.353		2.0	0.06	eBC aged	2.10	Ions+BC	mg/km	1.31	CVS (NOx, CO, THC), ELPI (PM), CPC (3776 TS	https://doi.org/10.1016/j.envpol.2019.113127	Pauli Simonen, P. et al. Characterz
TSAR		7.1	0.557	2.347	0.084	0.725		3.7	0.12	eBC aged	3.83	Ions+BC	mg/km	2.24	CVS (NOx, CO, THC), ELPI (PM), CPC (3776 TS	https://doi.org/10.1016/j.envpol.2019.113127	Pauli Simonen, P. et al. Characterz
Smog chamber			2.3					2.3	0.4	BC fresh	2.70	Ions+BC	10-3 g C kg-1	0.09	HR-ToF-AMS (Org, NO3, NH4, SO4), dedicated r	https://doi.org/10.1016/j.atmosenv.2015.0	Suarez-Bertoa, R. et al. Primary em
Smog chamber			13.4					13.4	4.5	BC fresh	17.90	Ions+BC	10-3 g C kg-1	0.55	HR-ToF-AMS (Org, NO3, NH4, SO4), dedicated r	https://doi.org/10.1016/j.atmosenv.2015.0	Suarez-Bertoa, R. et al. Primary em
Smog chamber	15000000	0.15-0.29	165.7					165.7	177.6	BC fresh	343.30	Ions+BC	mg/kgfuel	8.04	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	142.9					142.9	59.7	BC fresh	202.60	Ions+BC	mg/kgfuel	5.43	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	56.8					56.8	52.8	BC fresh	109.60	Ions+BC	mg/kgfuel	2.94	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	66.6					66.6	545.5	BC fresh	612.10	Ions+BC	mg/kgfuel	14.34	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	85.3					85.3	216.1	BC fresh	301.40	Ions+BC	mg/kgfuel	7.06	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	0					0	5.5	BC fresh	5.50	Ions+BC	mg/kgfuel	0.13	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	10					10	1.8	BC fresh	11.80	Ions+BC	mg/kgfuel	0.28	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	0					0	4.2	BC fresh	4.2	Ions+BC	mg/kgfuel	0.10	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	0					0	0	BC fresh	0.00	Ions+BC	mg/kgfuel	0.00	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	0					0	0	BC fresh	0	Ions+BC	mg/kgfuel	0.00	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	5.8					5.8	3.3	BC fresh	9.10	Ions+BC	mg/kgfuel	0.21	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	0					0	0	BC fresh	0	Ions+BC	mg/kgfuel	0.00	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	0					0	2.1	BC fresh	2.10	Ions+BC	mg/kgfuel	0.05	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	0					0	1.7	BC fresh	1.7	Ions+BC	mg/kgfuel	0.04	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	65.1					65.1	792.4	BC fresh	857.50	Ions+BC	mg/kgfuel	20.08	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	103.6					103.6	732	BC fresh	835.6	Ions+BC	mg/kgfuel	19.57	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	53.3					53.3	757.6	BC fresh	810.90	Ions+BC	mg/kgfuel	18.99	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	129.1					129.1	716.6	BC fresh	845.7	Ions+BC	mg/kgfuel	19.81	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	97.6					97.6	776.6	BC fresh	874.20	Ions+BC	mg/kgfuel	20.48	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	15000000	0.15-0.29	401.4					401.4	327.7	BC fresh	729.1	Ions+BC	mg/kgfuel	17.08	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4643-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	26.9					26.9	35.9	BC fresh	62.80	Ions+BC	mg/kgfuel	1.43	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	108.4					108.4	44.4	BC fresh	152.8	Ions+BC	mg/kgfuel	3.49	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	89.6					89.6	29.2	BC fresh	118.80	Ions+BC	mg/kgfuel	2.71	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	46.7					46.7	2.4	BC fresh	49.1	Ions+BC	mg/kgfuel	1.12	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	70.2					70.2	3.1	BC fresh	73.30	Ions+BC	mg/kgfuel	1.67	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	10.1					10.1	0.8	BC fresh	10.90	Ions+BC	mg/kgfuel	0.25	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	43.7					43.7	3	BC fresh	46.70	Ions+BC	mg/kgfuel	1.07	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	22.3					22.3	4	BC fresh	26.3	Ions+BC	mg/kgfuel	0.60	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	39.8					39.8	3.3	BC fresh	43.10	Ions+BC	mg/kgfuel	0.98	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	56.1					56.1	1.4	BC fresh	57.5	Ions+BC	mg/kgfuel	1.31	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga
Smog chamber	50000000	1.5-3	35.2					35.2	4	BC fresh	39.20	Ions+BC	mg/kgfuel	0.90	Gravimetry (CFR 1065, primary PM), OC/EC anal	https://doi.org/10.5194/acp-14-4661-2014	Gordon, T. D. et al. Secondary orga

Appendix 4. Database – Toxicity tab

The following clips provide examples of the content contained in the database.

Exposure class	Emission source	Transport sector	Application	Emission class	Model year	Engine combust	Engine combustion	Engine combustion	Engine size	Engine size unit	Stroke / cylinder	Engine speed [SSE/MSE/H	After treatment	Running hours/od	Unit of running	Laboratory/ real-world/	Temperature (°C)	Driving cycle
ALI	PM fresh exhaust	LD	Car	Euro 5a	2012	SI	FFV, GDI	N/A	N/A	N/A	4	HSE	TVC	10000–15000	km	Laboratory	Normal	SSC 6 hours, 95 km/h, 61 km/h, 45 k
ALI	PM fresh exhaust	LD	Car	Euro 5a	2012	SI	FFV, GDI	N/A	N/A	N/A	4	HSE	TVC	10000–15000	km	Laboratory	Normal	SSC 6 hours, 95 km/h, 61 km/h, 45 k
ALI	PM fresh exhaust	LD	Car	Euro 5a	2012	SI	FFV, GDI	N/A	N/A	N/A	4	HSE	TVC	10000–15000	km	Laboratory	Normal	SSC 6 hours, 95 km/h, 61 km/h, 45 k
ALI	PM fresh exhaust	LD	Car	Euro 2	1998	DI	Diesel	N/A	N/A	N/A	4	HSE	DOC	NA	NA	Laboratory	Normal	VLTC 6 hours
PM pre-collected	PM fresh exhaust	LD	Car	Euro 6a	2014	SI	NGV	Turbocharged, di	1.4; 81	L; kW	4	HSE	TVC	5239	km	Laboratory	-7	NEDC
PM pre-collected	PM fresh exhaust	LD	Car	Euro 6a	2015	SI	FFV		1.4; 92	L; kW	4	HSE	TVC	5717	km	Laboratory	-7	NEDC
PM pre-collected	PM fresh exhaust	LD	Car	Euro 6a	2015	SI	Gasoline	Direct injection	1.4; 110	L; kW	4	HSE	TVC	6789	km	Laboratory	-7	NEDC
PM pre-collected	PM fresh exhaust	LD	Car	Euro 6a	2015	DI	Diesel		1.6; 88	L; kW	4	HSE	N/A	2498	km	Laboratory	-7	NEDC
PM pre-collected	PM fresh exhaust	LD	Car	Euro 2	1999	DI	Diesel		1.9	L	4	HSE	N/A	102603	km	Laboratory	-7	NEDC
PM pre-collected (water	PM fresh exhaust	LD	Car	Euro 3	N/A	SI	Gasoline		N/A	N/A	4	HSE				Laboratory		Dynamometer, NEDC+ Artemis cycl
PM pre-collected (water	PM fresh exhaust	LD	Car	Euro 1	N/A	DI	Diesel		N/A	N/A	4	HSE	No			Laboratory		Dynamometer, NEDC+ Artemis cycl
PM pre-collected (water	PM fresh exhaust	LD	Car	Euro 4+	N/A	DI	Diesel		N/A	N/A	4	HSE	DPF retrofitted			Laboratory		Dynamometer, NEDC+ Artemis cycl
ALI	PM fresh exhaust	LD	Car	Euro 6b+	2013	SI	Gasoline		N/A	N/A	4	HSE	TVC, GPF	N/A	N/A	Laboratory	Normal	NEDC for 6 hours
ALI	PM fresh exhaust	LD	Car	Euro 6b+	2013	SI	Gasoline		N/A	N/A	4	HSE	TVC, no GPF	N/A	N/A	Laboratory	Normal	NEDC for 6 hours
On-line exposure	PM fresh exhaust	LD	Engine	Euro 3	N/A	DI	Diesel	Direct injection ≤ 2		L	4	HSE	No	N/A	N/A	Laboratory	Normal	Artemis
On-line exposure	PM fresh exhaust	LD	Engine	Euro 3	N/A	DI	Diesel	Direct injection ≤ 2		L	4	HSE	DOC	N/A	N/A	Laboratory	Normal	Artemis
On-line exposure	PM fresh exhaust	LD	Engine	Euro 3	N/A	DI	Diesel	Direct injection ≤ 2		L	4	HSE	DPF	N/A	N/A	Laboratory	Normal	Artemis
On-line exposure	PM fresh exhaust	LD	Engine	Euro 3	N/A	DI	Diesel	Direct injection ≤ 2		L	4	HSE	No	N/A	N/A	Laboratory	Normal	Artemis
On-line exposure	PM fresh exhaust	LD	Engine	Euro 3	N/A	DI	Diesel	Direct injection ≤ 2		L	4	HSE	DOC	N/A	N/A	Laboratory	Normal	Artemis
On-line exposure	PM fresh exhaust	LD	Engine	Euro 3	N/A	DI	Diesel	Direct injection ≤ 2		L	4	HSE	DPF	N/A	N/A	Laboratory	Normal	Artemis
On-line exposure	PM fresh exhaust	LD	Engine	Euro 3	N/A	DI	Diesel	Direct injection ≤ 2		L	4	HSE	No	N/A	N/A	Laboratory	Normal	Artemis
On-line exposure	PM fresh exhaust	LD	Engine	Euro 3	N/A	DI	Diesel	Direct injection ≤ 2		L	4	HSE	DOC	N/A	N/A	Laboratory	Normal	Artemis
On-line exposure	PM fresh exhaust	LD	Engine	Euro 3	N/A	DI	Diesel	Direct injection ≤ 2		L	4	HSE	DPF	N/A	N/A	Laboratory	Normal	Artemis
ALI	PM fresh exhaust	LD	Car	Euro 2	1998	DI	Diesel	Direct injection	1998/60/4300	cm3/k W/rpm	4	HSE	no	80000	km	Laboratory	Normal	N/A
ALI	PM fresh exhaust	LD	Car	Euro 2	1998	DI	Diesel	Direct injection	1998/60/4300	cm3/k W/rpm	4	HSE	no	80000	km	Laboratory	Normal	N/A
ALI	PM fresh exhaust	LD	Car	Euro 2-	1998	DI	Diesel	Direct injection	1998/60/4300	cm3/k W/rpm	4	HSE	DPF	80000	km	Laboratory	Normal	N/A
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR, DOC, DPF	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR, DOC, DPF	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR, DOC, DPF	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR, DOC, DPF	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR, DOC, DPF	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR, DOC, DPF	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR	N/A	N/A	Laboratory	Normal	SSC
ALI	PM fresh exhaust	HD	Generator	N/A	N/A	DI	Diesel	Direct injection	4.5	L	4 / 4	HSE	EGR	N/A	N/A	Laboratory	Normal	SSC

								Toxicity testing			
Load	Fuel	Fuel sulfur content	Location	Leading organization	Particle specification	Model	End points tested				
Mid	E85	NA	Bern University for Applied Sciences, 2560, Nidau,	AMI Switzerland		Human TCCC - 16HBE14o-, MDDCs, MDMs	LDH, GSH, cell morphology, OxyDNA adducts, TNFa, IL8, HMOX1, SOD2, GSF				
Mid	E0	NA	Bern University for Applied Sciences, 2560, Nidau,	AMI Switzerland		Human TCCC - 16HBE14o-, MDDCs, MDMs	LDH, GSH, cell morphology, OxyDNA adducts, TNFa, IL8, HMOX1, SOD2, GSF				
Mid	E10 (mixture of E85 and E0)	NA	Bern University for Applied Sciences, 2560, Nidau,	AMI Switzerland		Human TCCC - 16HBE14o-, MDDCs, MDMs	LDH, GSH, cell morphology, OxyDNA adducts, TNFa, IL8, HMOX1, SOD2, GSF				
Mid	Diesel	NA	Bern University for Applied Sciences, 2560, Nidau,	AMI Switzerland		Human TCCC - 16HBE14o-, MDDCs, MDMs	LDH, GSH, cell morphology, OxyDNA adducts, TNFa, IL8, HMOX1, SOD2, GSF				
Mid	CNG	<10 ppm	VTT, Finland	VTT, Finland		RAW264.7 mouse macrophages	Inflammatory markers, cellular metabolic activity (CMA), cell membrane integri				
Mid	E85	<10 ppm	VTT, Finland	VTT, Finland		RAW264.7 mouse macrophages	Inflammatory markers, cellular metabolic activity (CMA), cell membrane integri				
Mid	E10	<10 ppm	VTT, Finland	VTT, Finland		RAW264.7 mouse macrophages	Inflammatory markers, cellular metabolic activity (CMA), cell membrane integri				
Mid	Diesel	<10 ppm	VTT, Finland	VTT, Finland		RAW264.7 mouse macrophages	Inflammatory markers, cellular metabolic activity (CMA), cell membrane integri				
Mid	Diesel	<10 ppm	VTT, Finland	VTT, Finland		RAW264.7 mouse macrophages	Inflammatory markers, cellular metabolic activity (CMA), cell membrane integri				
	Gasoline	low	Laboratory of Applied Thermodynamics, Greece	Laboratory of Applied Thermodynamics, Greece	1:120 dilution	Female mice	Inflammatory response (No. Of neutrophils) and alveolar tissue injury (protein c				
	100% soybean derived biodiesel	low	Laboratory of Applied Thermodynamics, Greece	Laboratory of Applied Thermodynamics, Greece	1:12000 dilution	Female mice	Inflammatory response (No. Of neutrophils) and alveolar tissue injury (protein c				
	Diesel	low	Laboratory of Applied Thermodynamics, Greece	Laboratory of Applied Thermodynamics, Greece	E4 1:12000 dilution, E4+ 1:120 dil	Female mice	Inflammatory response (No. Of neutrophils) and alveolar tissue injury (protein c				
Mid	Gasoline RON 95	<10 ppm	Bern University for Applied Sciences, 2560, Nidau,	AMI Switzerland		Human TCCC - 16HBE14o-, MDDCs, MDMs	LDH, GSH, cell morphology, TNFa, IL8, HMOX1, SOD2, GSR, IDO1, NFE2L2, C				
Mid	Gasoline RON 95	<10 ppm	Bern University for Applied Sciences, 2560, Nidau,	AMI Switzerland		Human TCCC - 16HBE14o-, MDDCs, MDMs	LDH, GSH, cell morphology, TNFa, IL8, HMOX1, SOD2, GSR, IDO1, NFE2L2, C				
Mid	standard diesel (DF0)	<10 ppm	N/A	UNICAEN, France		A549	Cytotoxicity, oxidative stress, DNA damage				
Mid	standard diesel (DF0)	<10 ppm	N/A	UNICAEN, France		A549	Cytotoxicity, oxidative stress, DNA damage				
Mid	standard diesel (DF0)	<10 ppm	N/A	UNICAEN, France		A549	Cytotoxicity, oxidative stress, DNA damage				
Mid	BD7 (with 7% rapeseed methyl este	<10 ppm	N/A	UNICAEN, France		A549	Cytotoxicity, oxidative stress, DNA damage				
Mid	BD7 (with 7% rapeseed methyl este	<10 ppm	N/A	UNICAEN, France		A549	Cytotoxicity, oxidative stress, DNA damage				
Mid	BD7 (with 7% rapeseed methyl este	<10 ppm	N/A	UNICAEN, France		A549	Cytotoxicity, oxidative stress, DNA damage				
Mid	BD30 (with 30% rapeseed methyl e	<10 ppm	N/A	UNICAEN, France		A549	Cytotoxicity, oxidative stress, DNA damage				
Mid	BD30 (with 30% rapeseed methyl e	<10 ppm	N/A	UNICAEN, France		A549	Cytotoxicity, oxidative stress, DNA damage				
Mid	BD30 (with 30% rapeseed methyl e	<10 ppm	N/A	UNICAEN, France		A549	Cytotoxicity, oxidative stress, DNA damage				
N/A	SN-EN590	<10 ppm	Bern University for Applied Sciences, 2560, Nidau,	AMI Switzerland		Human TCCC - 16HBE14o-, MDDCs, MDMs	Cytotoxicity, oxidative stress, pro-inflammation,				
N/A	SN-EN590 + Sataceni (iron conter	<10 ppm	Bern University for Applied Sciences, 2560, Nidau,	AMI Switzerland		Human TCCC - 16HBE14o-, MDDCs, MDMs	Cytotoxicity, oxidative stress, pro-inflammation,				
N/A	SN-EN590 + Sataceni (iron conter	<10 ppm	Bern University for Applied Sciences, 2560, Nidau,	AMI Switzerland		Human TCCC - 16HBE14o-, MDDCs, MDMs	Cytotoxicity, oxidative stress, pro-inflammation,				
0.75	Petrodiesel	ultra-low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Petrodiesel	ultra-low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Petrodiesel	ultra-low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Petrodiesel	ultra-low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Petrodiesel	ultra-low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Petrodiesel	ultra-low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Biodiesel B99	low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Biodiesel B99	low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Biodiesel B99	low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Biodiesel B99	low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				
0.75	Biodiesel B99	low	Department of Mechanical Engineering, Colorado	Colorado State University, USA		Primary human bronchial cells - healthy	Cytotoxicity, expression of CYP1A1 and heme oxygenase-1 (HO-1),				

	Toxicity rating					Other info	References
Repetitions	C	G	O	D	Rating code		
8	0.0	0.0	0.0	0.00	C.0-G.0-O.0-D.0		https://doi.org/10.1016/j.envres.2016.09.010 Bisig et al. Environmental Research. Volume 151, November 2016, Pages 789-796.
8	0.0	0.0	0.0	0.00	C.0-G.0-O.0-D.0		https://doi.org/10.1016/j.envres.2016.09.010 Bisig et al. Environmental Research. Volume 151, November 2016, Pages 789-796.
8	0.0	0.0	0.0	0.00	C.0-G.0-O.0-D.0		https://doi.org/10.1016/j.envres.2016.09.010 Bisig et al. Environmental Research. Volume 151, November 2016, Pages 789-796.
6	0	0	1	1	C.0-G.0-O.1-D.1		https://doi.org/10.1016/j.envres.2016.09.010 Bisig et al. Environmental Research. Volume 151, November 2016, Pages 789-796.
4	0	0	0	0	C.0-G.0-O.0-D.0	Ames test also done	https://doi.org/10.1186/s12989-020-00348-0 Hakkarainen, H., Aakko-Saksa, P., Sainio, M. et al. Toxicological evaluation of exhaust emissions from light-d
4	1	0	0	1	C.1-G.0-O.0-D.1	Ames test also done	https://doi.org/10.1186/s12989-020-00348-0 Hakkarainen, H., Aakko-Saksa, P., Sainio, M. et al. Toxicological evaluation of exhaust emissions from light-d
4	1	0	0	1	C.1-G.0-O.0-D.1	Ames test also done	https://doi.org/10.1186/s12989-020-00348-0 Hakkarainen, H., Aakko-Saksa, P., Sainio, M. et al. Toxicological evaluation of exhaust emissions from light-d
4	0	0	0	1	C.0-G.0-O.0-D.1	Ames test also done	https://doi.org/10.1186/s12989-020-00348-0 Hakkarainen, H., Aakko-Saksa, P., Sainio, M. et al. Toxicological evaluation of exhaust emissions from light-d
4	0	0	0	1	C.0-G.0-O.0-D.1	Ames test also done	https://doi.org/10.1186/s12989-020-00348-0 Hakkarainen, H., Aakko-Saksa, P., Sainio, M. et al. Toxicological evaluation of exhaust emissions from light-d
5 micel1x repeated	nd	nd	nd	1	C.nd-G.nd-O.nd-D.1		https://doi.org/10.3109/08958378.2010.519408 Tzamkiozis, T., Stoeger, T., Cheung, K., Ntziachristos, L., Sioutas, C., & Samaras, Z. (2010). Monitoring the infla
6 micel1x repeated	nd	nd	nd	1	C.nd-G.nd-O.nd-D.1		https://doi.org/10.3109/08958378.2010.519408 Tzamkiozis, T., Stoeger, T., Cheung, K., Ntziachristos, L., Sioutas, C., & Samaras, Z. (2010). Monitoring the infla
7 micel1x repeated	nd	nd	nd	1	C.nd-G.nd-O.nd-D.1		https://doi.org/10.3109/08958378.2010.519408 Tzamkiozis, T., Stoeger, T., Cheung, K., Ntziachristos, L., Sioutas, C., & Samaras, Z. (2010). Monitoring the infla
4	0	0	0	0	C.0-G.0-O.0-D.0	Ames test also done	doi.org/10.1007/s40825-015-0019-6 Bisig, C., Steiner, S., Comte, P. et al. Biological Effects in Lung Cells In Vitro of Exhaust Aerosols from a Gaso
3	0	0	0	0	C.0-G.0-O.0-D.0	Ames test also done	doi.org/10.1007/s40825-015-0019-6 Bisig, C., Steiner, S., Comte, P. et al. Biological Effects in Lung Cells In Vitro of Exhaust Aerosols from a Gaso
3	1	2	0	nd	C.1-G.2-O.0-D.nd		https://doi.org/10.1016/j.tiv.2017.04.025 C. Barraud et al. Impact of after-treatment devices and biofuels on diesel exhausts genotoxicity in A549 cells e
3	0	1	0	nd	C.0-G.1-O.0-D.nd		https://doi.org/10.1016/j.tiv.2017.04.025 C. Barraud et al. Impact of after-treatment devices and biofuels on diesel exhausts genotoxicity in A549 cells e
3	0	1	0	nd	C.0-G.1-O.0-D.nd		https://doi.org/10.1016/j.tiv.2017.04.025 C. Barraud et al. Impact of after-treatment devices and biofuels on diesel exhausts genotoxicity in A549 cells e
3	1	2	0	nd	C.1-G.2-O.0-D.nd		https://doi.org/10.1016/j.tiv.2017.04.025 C. Barraud et al. Impact of after-treatment devices and biofuels on diesel exhausts genotoxicity in A549 cells e
3	0	1	0	nd	C.0-G.1-O.0-D.nd		https://doi.org/10.1016/j.tiv.2017.04.025 C. Barraud et al. Impact of after-treatment devices and biofuels on diesel exhausts genotoxicity in A549 cells e
3	0	2	0	nd	C.0-G.2-O.0-D.nd		https://doi.org/10.1016/j.tiv.2017.04.025 C. Barraud et al. Impact of after-treatment devices and biofuels on diesel exhausts genotoxicity in A549 cells e
3	1	2	0	nd	C.1-G.2-O.0-D.nd		https://doi.org/10.1016/j.tiv.2017.04.025 C. Barraud et al. Impact of after-treatment devices and biofuels on diesel exhausts genotoxicity in A549 cells e
3	0	0	0	nd	C.0-G.0-O.0-D.nd		https://doi.org/10.1016/j.tiv.2017.04.025 C. Barraud et al. Impact of after-treatment devices and biofuels on diesel exhausts genotoxicity in A549 cells e
3	0	1	0	nd	C.0-G.1-O.0-D.nd		https://doi.org/10.1016/j.tiv.2017.04.025 C. Barraud et al. Impact of after-treatment devices and biofuels on diesel exhausts genotoxicity in A549 cells e
N/A	0	nd	1	0	C.0-G.nd-O.1-D.0	Ames test also done	https://doi.org/10.1007/s00216-014-7878-5 Steiner, S., Czerwinski, J., Comte, P. et al. Effects of an iron-based fuel-borne catalyst and a diesel particle filter
N/A	1	nd	1	0	C.1-G.nd-O.1-D.0	Ames test also done	https://doi.org/10.1007/s00216-014-7878-5 Steiner, S., Czerwinski, J., Comte, P. et al. Effects of an iron-based fuel-borne catalyst and a diesel particle filter
N/A	0	nd	1	1	C.0-G.nd-O.1-D.1	Ames test also done	https://doi.org/10.1007/s00216-014-7878-5 Steiner, S., Czerwinski, J., Comte, P. et al. Effects of an iron-based fuel-borne catalyst and a diesel particle filter
12	0	nd	0	nd	C.0-G.nd-O.0-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
12	0	nd	0	nd	C.0-G.nd-O.0-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
12	0	nd	4	nd	C.0-G.nd-O.4-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
12	0	nd	0	nd	C.0-G.nd-O.0-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
12	0	nd	1	nd	C.0-G.nd-O.1-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
12	0	nd	4	nd	C.0-G.nd-O.4-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
12	0	nd	0	nd	C.0-G.nd-O.0-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
12	0	nd	0	nd	C.0-G.nd-O.0-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
12	0	nd	4	nd	C.0-G.nd-O.4-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
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12	0	nd	1	nd	C.0-G.nd-O.1-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E
12	0	nd	4	nd	C.0-G.nd-O.4-D.nd		https://doi.org/10.1093/toxsci/kfu147 Hawley, B. et al., Oxidative Stress and Aromatic Hydrocarbon Response of Human Bronchial Epithelial Cells E