

**Table S1.** Emission standards for on-road vehicles in the EU and Russia.

Passenger cars*	Introduced in the EU	Introduced in Russia	Heavy-duty diesel engines	Introduced in the EU	Introduced in Russia
Euro 1	1992	-	Euro I	1992	-
Euro 2	1996	2006	Euro II	1996	2006
Euro 3	2000	2008	Euro III	2000	2008
Euro 4	2005	2013	Euro IV	2005	2013
Euro 5	2009	2014	Euro V	2008	2016
Euro 6	2014	n/a	Euro VI	2013	n/a

\* By convention, light-duty vehicles are marked with Arabic numerals while Roman numbers are used for heavy-duty vehicles (trucks and buses).

**Table S2.** COPERT and NIIAT emission factors and BC speciation for hot operation stage.

Type	Subcategory	COPERT EF, g/km			Blended NIIAT EFs, g/km			EC/PM*	OC/EC*
Cars		Urban	Rural	Highway	Urban	Rural	Highway		
Euro 0		0.271	0.199	0.146	0.250	0.150	0.170	0.55	0.70
Euro 1		0.07	0.057	0.087	0.073	0.040	0.050	0.70	0.40
Euro 2		0.058	0.047	0.045	0.073	0.040	0.050	0.80	0.23
Euro 3		0.035	0.029	0.038	0.053	0.030	0.030	0.85	0.15
Euro 4		0.034	0.029	0.025	0.016	0.090	0.090	0.87	0.13
Euro 5		0.003	0.002	0.002	0.004	0.002	0.002	0.20	2.00
<b>LCV</b>									
Euro 0		0.281	0.285	0.337	0.290	0.210	0.230	0.55	0.70
Euro 1		0.099	0.07	0.118	0.087	0.060	0.100	0.70	0.40
Euro 2		0.099	0.07	0.118	0.087	0.060	0.100	0.80	0.23
Euro 3		0.066	0.047	0.079	0.057	0.040	0.060	0.85	0.15
Euro 4		0.035	0.024	0.041	0.033	0.020	0.030	0.87	0.13
Euro 5		0.002	0.001	0.001	0.002	0.001	0.002	0.20	2.00
<b>Trucks</b>									
Euro 0	<=7,5 t	0.4	0.297	0.211	0.543	0.180	0.180	0.50	0.80
Euro I	<=7,5 t	0.157	0.116	0.09	0.360	0.140	0.140	0.65	0.40
Euro II	<=7,5 t	0.069	0.056	0.064	0.220	0.080	0.080	0.65	0.40
Euro III	<=7,5 t	0.082	0.061	0.04	0.153	0.060	0.060	0.70	0.30
Euro IV	<=7,5 t	0.017	0.014	0.015	0.030	0.010	0.010	0.75	0.25
Euro V	<=7,5 t	0.021	0.018	0.015	0.030	0.010	0.010	0.75	0.25
Euro 0	7,5 - 12 t	0.423	0.301	0.201	0.893	0.400	0.400	0.50	0.80
Euro I	7,5 - 12 t	0.262	0.182	0.129	0.640	0.330	0.330	0.65	0.40
Euro II	7,5 - 12 t	0.115	0.087	0.098	0.230	0.100	0.100	0.65	0.40
Euro III	7,5 - 12 t	0.133	0.095	0.062	0.153	0.060	0.060	0.70	0.30
Euro IV	7,5 - 12 t	0.027	0.021	0.02	0.030	0.010	0.010	0.75	0.25
Euro V	7,5 - 12 t	0.034	0.026	0.021	0.030	0.010	0.010	0.75	0.25

Euro 0	12 - 14 t	0.452	0.32	0.232	1.073	0.550	0.550	0.50	0.80
Euro I	12 - 14 t	0.28	0.199	0.147	0.697	0.480	0.480	0.65	0.40
Euro II	12 - 14 t	0.128	0.095	0.109	0.310	0.180	0.180	0.65	0.40
Euro III	12 - 14 t	0.141	0.099	0.071	0.193	0.130	0.130	0.70	0.30
Euro IV	12 - 14 t	0.03	0.023	0.02	0.040	0.020	0.020	0.75	0.25
Euro V	12 - 14 t	0.036	0.028	0.023	0.040	0.020	0.020	0.75	0.25
Euro 0	> 14 t	0.625	0.439	0.29	1.073	0.550	0.550	0.50	0.80
Euro I	> 14 t	0.386	0.271	0.175	0.697	0.480	0.480	0.65	0.40
Euro II	> 14 t	0.164	0.118	0.129	0.310	0.180	0.180	0.65	0.40
Euro III	> 14 t	0.199	0.139	0.087	0.193	0.130	0.130	0.70	0.30
Euro IV	> 14 t	0.039	0.029	0.023	0.040	0.020	0.020	0.75	0.25
Euro V	> 14 t	0.049	0.037	0.028	0.040	0.020	0.020	0.75	0.25
<b>Buses</b>									
Euro 0	<=15 t	0.858	0.574	0.388	0.880	0.270	0.295	0.50	0.80
Euro I	<=15 t	0.294	0.221	0.173	0.650	0.215	0.230	0.65	0.40
Euro II	<=15 t	0.142	0.114	0.107	0.398	0.195	0.175	0.65	0.40
Euro III	<=15 t	0.146	0.11	0.099	0.197	0.105	0.100	0.70	0.30
Euro IV	<=15 t	0.035	0.027	0.022	0.040	0.025	0.025	0.75	0.25
Euro V	<=15 t	0.042	0.031	0.038	0.037	0.025	0.025	0.75	0.25
Euro 0	15 - 18 t	0.767	0.52	0.312	1.523	0.430	0.500	0.50	0.80
Euro I	15 - 18 t	0.412	0.294	0.217	0.890	0.310	0.400	0.65	0.40
Euro II	15 - 18 t	0.197	0.157	0.138	0.680	0.310	0.270	0.65	0.40
Euro III	15 - 18 t	0.195	0.148	0.108	0.250	0.130	0.120	0.70	0.30
Euro IV	15 - 18 t	0.049	0.037	0.027	0.050	0.030	0.030	0.75	0.25
Euro V	15 - 18 t	0.055	0.042	0.036	0.050	0.030	0.030	0.75	0.25
Euro 0	>18 t	0.957	0.675	0.395	1.523	0.430	0.500	0.50	0.80
Euro I	>18 t	0.517	0.37	0.227	0.757	0.310	0.400	0.65	0.40
Euro II	>18 t	0.265	0.212	0.174	0.583	0.310	0.270	0.65	0.40
Euro III	>18 t	0.24	0.17	0.125	0.250	0.130	0.120	0.70	0.30
Euro IV	>18 t	0.06	0.045	0.029	0.050	0.030	0.030	0.75	0.25
Euro V	>18 t	0.066	0.049	0.04	0.050	0.030	0.030	0.75	0.25

Sources: (Emisia, 2015; NIIAT, 2012).

\* EC/PM and OC/EC speciation factors are derived from the COPERT model.

**Table S3.** Number of active diesel vehicles by type and emission standard in Russia, 2014.

	Cars	LCVs	Trucks	Buses
Euro 0	100 620	150 345	470 737	24 994
Euro 1	103 529	119 732	43 093	10 038
Euro 2	113 576	94 135	173 337	17 541
Euro 3	144 298	140 923	293 520	49 725
Euro 4	691 199	353 189	271 189	19 481
Euro 5	329 941*	58 703	77 404	1 615
Total	1 483 163	917 027	1 329 280	123 394

\* - includes 2110 Euro 6 cars

Calculated based on (Avtostat, 2015).

**Table S4.** The annual average distance traveled by type of vehicles, thousand kmyr<sup>-1</sup>.

	Cars	LCVs	Trucks	Buses
NIIAT (1998)	15 10 for 5-year old Russian cars 10 for 10-year old foreign cars		35 in cities 60 suburban 100 intercity	Russian: 50 in cities 65 suburban 80 intercity Foreign: 60 in cities 80 suburban 105 intercity
NIIAT (2008)	14-16 owned by individuals 25-30 owned by companies		30-40	40-50
Avtostat (2010)	16.7 15.3 Russian 18 foreign-made	55	63	65
ICCT (2015)	10	10	13-38	56

**Table S5.** Average number kilometers traveled by type of vehicles.

Vehicle type	Subsector	Emission standard	Annual kilometers traveled
Passenger Cars	Diesel 1,4 - 2,0 l	Conventional	10 000
	Diesel 1,4 - 2,0 l	PC Euro 1 - 91/441/EEC	10 000
	Diesel 1,4 - 2,0 l	PC Euro 2 - 94/12/EEC	15 000
	Diesel 1,4 - 2,0 l	PC Euro 3 - 98/69/EC Stage2000	15 000
	Diesel 1,4 - 2,0 l	PC Euro 4 - 98/69/EC Stage2005	18 000

	Diesel 1,4 - 2,0 l	PC Euro 5 - EC 715/2007	20 000
Light Commercial Vehicles	Diesel <3,5 t	Conventional	37 000
	Diesel <3,5 t	LD Euro 1 - 93/59/EEC	37 000
	Diesel <3,5 t	LD Euro 2 - 96/69/EEC	55 000
	Diesel <3,5 t	LD Euro 3 - 98/69/EC Stage2000	55 000
	Diesel <3,5 t	LD Euro 4 - 98/69/EC Stage2005	66 000
	Diesel <3,5 t	LD Euro 5 - 2008 Standards	73 000
Heavy Duty Trucks	Rigid <=7,5 t	Conventional	42 000
	Rigid <=7,5 t	HD Euro I - 91/542/EEC Stage I	42 000
	Rigid <=7,5 t	HD Euro II - 91/542/EEC Stage II	63 000
	Rigid <=7,5 t	HD Euro III - 2000 Standards	63 000
	Rigid <=7,5 t	HD Euro IV - 2005 Standards	75 000
	Rigid <=7,5 t	HD Euro V - 2008 Standards	84 000
	Rigid 7,5 - 12 t	Conventional	42 000
	Rigid 7,5 - 12 t	HD Euro I - 91/542/EEC Stage I	42 000
	Rigid 7,5 - 12 t	HD Euro II - 91/542/EEC Stage II	63 000
	Rigid 7,5 - 12 t	HD Euro III - 2000 Standards	63 000
	Rigid 7,5 - 12 t	HD Euro IV - 2005 Standards	75 000
	Rigid 7,5 - 12 t	HD Euro V - 2008 Standards	84 000
	Rigid 12 - 14 t	Conventional	42 000
	Rigid 12 - 14 t	HD Euro I - 91/542/EEC Stage I	42 000
	Rigid 12 - 14 t	HD Euro II - 91/542/EEC Stage II	63 000
	Rigid 12 - 14 t	HD Euro III - 2000 Standards	63 000
	Rigid 12 - 14 t	HD Euro IV - 2005 Standards	75 000
Buses	Rigid 12 - 14 t	HD Euro V - 2008 Standards	84 000
	Rigid 14 - 20 t	Conventional	42 000
	Rigid 14 - 20 t	HD Euro I - 91/542/EEC Stage I	42 000
	Rigid 14 - 20 t	HD Euro II - 91/542/EEC Stage II	63 000
	Rigid 14 - 20 t	HD Euro III - 2000 Standards	63 000
	Rigid 14 - 20 t	HD Euro IV - 2005 Standards	75 000
	Rigid 14 - 20 t	HD Euro V - 2008 Standards	84 000
	Urban Buses Midi <=15 t	Conventional	43 000
	Urban Buses Midi <=15 t	HD Euro I - 91/542/EEC Stage I	43 000
	Urban Buses Midi <=15 t	HD Euro II - 91/542/EEC Stage II	65 000
	Urban Buses Midi <=15 t	HD Euro III - 2000 Standards	65 000
	Urban Buses Midi <=15 t	HD Euro IV - 2005 Standards	78 000
	Urban Buses Midi <=15 t	HD Euro V - 2008 Standards	87 000
	Urban Buses Standard 15 - 18 t	Conventional	43 000
	Urban Buses Standard 15 - 18 t	HD Euro I - 91/542/EEC Stage I	43 000
	Urban Buses Standard 15 - 18 t	HD Euro II - 91/542/EEC Stage II	65 000
	Urban Buses Standard 15 - 18 t	HD Euro III - 2000 Standards	65 000
	Urban Buses Standard 15 - 18 t	HD Euro IV - 2005 Standards	78 000

Urban Buses Standard 15 - 18 t	HD Euro V - 2008 Standards	87 000
Urban Buses Articulated >18 t	Conventional	43 000
Urban Buses Articulated >18 t	HD Euro I - 91/542/EEC Stage I	43 000
Urban Buses Articulated >18 t	HD Euro II - 91/542/EEC Stage II	65 000
Urban Buses Articulated >18 t	HD Euro III - 2000 Standards	65 000
Urban Buses Articulated >18 t	HD Euro IV - 2005 Standards	78 000
Urban Buses Articulated >18 t	HD Euro V - 2008 Standards	87 000

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## Results of emission calculations

The COPERT 4 model with NIIAT emission factors. The assumptions on average annual kilometers traveled remain the same.

**Table S6.** OC emissions from the adjusted fleet with superemitters (t).

	Cars	LCVs	Trucks	Buses	Total
Euro 0	86	577	3253	184	4100
Euro 1	21	125	153	39	338
Euro 2	25	107	478	84	694
Euro 3	17	78	466	98	659
Euro 4	28	121	85	10	244
Euro 5	13	5	28	1	46
Total	190	1012	4463	415	6080

**Table S7.** BC emissions, assuming that all trucks and buses use diesel fuel (t).

	Cars	LCVs	Trucks	Buses	Total
Euro 0			30 742	2687	33 429
Euro 1			1005	238	1243
Euro 2			2346	584	2930
Euro 3			2200	638	2837
Euro 4			384	63	447
Euro 5			110	3	113
Total			36 788	4212	41 000

**Table S8.** BC emissions from all registered diesel vehicles (t).

	Cars	LCVs	Trucks	Buses	Total
Euro 0	330	1750	14 248	663	16 990
Euro 1	92	545	1004	203	1844
Euro 2	162	683	2167	325	3337
Euro 3	144	654	2138	420	3356
Euro 4	242	988	383	45	1658
Euro 5	6	2	110	3	122
Total	976	4622	20 051	1658	27 307

**Table S9.** BC emissions from the adjusted diesel fleet without accounting for superemitters (t).

	Cars	LCVs	Trucks	Buses	Total
Euro 0	181	1225	5699	331	7437
Euro 1	69	409	502	122	1102
Euro 2	130	546	1300	227	2203
Euro 3	123	556	1604	336	2617
Euro 4	45	939	345	40	1369
Euro 5	6	2	110	3	122
Total	554	3677	9560	1060	14 851

## References

- Avtostat: Park of PC, LCV, HCV, BUS as of 01. 01.2015 (Russia, Russian regions). Dataset, Avtostat, Togliatti, Russia, 2015.
- Emisia: COPERT (COmputer Programme to Calculate Emissions from Road Transport). Prepared for the European Environment Agency, Available at <http://www.emisia.com/copert/> (last access:15 July), 2015.
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