Annex A: Emission factors used in the DECC 2050 Spreadsheet Calculator for 2010 and high and low innovation scenarios for 2050

Code	Name	Type	Pollutant	Units	2010	Low innovation 2050	High Innovation 2050
I.a	Biomass/coal power stations	Gaseous hydrocarbons	NO_x	kt/GWh	1.29E-04	1.15E-03	5.74E-04
I.a	Biomass/coal power stations	Liquid hydrocarbons	NO_x	kt/GWh	9.63E-04	8.67E-03	4.34E-03
I.a	Biomass/coal power stations	Solid hydrocarbons (biomass)	NO_x	kt/GWh	3.38E-04	3.19E-03	1.59E-03
I.a	Biomass/coal power stations	Solid hydrocarbons (coal)	NO_x	kt/GWh	4.27E-04	2.66E-03	1.33E-03
I.b	Carbon capture storage (CCS)	Gaseous hydrocarbons	NO_x	kt/GWh	1.29E-04	1.02E-03	5.09E-04
I.b	Carbon capture storage (CCS)	Solid hydrocarbons	NO_x	kt/GWh	1.77E-04	1.41E-03	7.07E-04
IX.a	Domestic space heating and hot water	Community scale gas CHP	NO_x	kt/GWh	3.78E-04	3.40E-03	1.70E-03
IX.a	Domestic space heating and hot water	Community scale solid-fuel CHP	NO_x	kt/GWh	6.55E-04	6.43E-03	3.21E-03
IX.a	Domestic space heating and hot water	Gas Boiler (new)	NO_x	kt/GWh	7.44E-05	6.44E-04	3.22E-04
IX.a	Domestic space heating and hot water	Gas Boiler (old)	NO_x	kt/GWh	7.44E-05	6.44E-04	3.22E-04
IX.a	Domestic space heating and hot water	Oil-fired boiler	NO_x	kt/GWh	2.49E-04	1.49E-03	7.46E-04
IX.a	Domestic space heating and hot water	Solid-fuel boiler	NO_x	kt/GWh	2.02E-04	1.96E-03	9.80E-04
IX.a	Domestic space heating and hot water	Stirling engine µCHP	NO_x	kt/GWh	7.44E-05	6.44E-04	3.22E-04
IX.c	Commercial space heating and hot water	Community scale gas CHP	NO_x	kt/GWh	1.83E-04	1.65E-03	8.24E-04
IX.c	Commercial space heating and hot water	Community scale solid-fuel CHP	NO_x	kt/GWh	6.55E-04	6.43E-03	3.21E-03
IX.c	Commercial space heating and hot water	Gas Boiler (new)	NO_x	kt/GWh	1.95E-04	1.76E-03	8.80E-04
IX.c	Commercial space heating and hot water	Gas Boiler (old)	NO_x	kt/GWh	1.95E-04	1.76E-03	8.80E-04
IX.c	Commercial space heating and hot water	Oil-fired boiler	NO_x	kt/GWh	3.25E-04	2.92E-03	1.46E-03
IX.c	Commercial space heating and hot water	Solid-fuel boiler	NO_x	kt/GWh	5.50E-04	5.17E-03	2.59E-03
IX.c	Commercial space heating and hot water	Stirling engine µCHP	NO_x	kt/GWh	1.95E-04	1.76E-03	8.80E-04
VI.a	Agriculture and land use	Gaseous hydrocarbons	NO_x	kt/GWh	1.41E-04	1.27E-03	6.36E-04
VI.a	Agriculture and land use	Liquid hydrocarbons	NO_x	kt/GWh	6.35E-04	5.71E-03	2.86E-03
VI.a	Agriculture and land use	Solid hydrocarbons	NO_x	kt/GWh	6.11E-04	5.50E-03	2.75E-03
VI.b	Volume of waste & recycling	Coal and fossil waste	NO_x	kt/GWh	2.88E-04	2.59E-03	1.29E-03
VI.b	Volume of waste & recycling	Dry biomass and waste	NO_x	kt/GWh	2.88E-04	2.59E-03	1.29E-03
VI.b	Volume of waste & recycling	Gaseous waste	NO_x	kt/GWh	1.40E-04	1.26E-03	6.31E-04
VI.b	Volume of waste & recycling	Wet biomass and waste	NO_x	kt/GWh	2.88E-04	2.59E-03	1.29E-03
VIII.a	H2 production for transport	Gaseous hydrocarbons	NO_x	kt/GWh	5.66E-04	5.09E-03	3.82E-03
X.a	Domestic lighting, appliances, and cooking	Gaseous hydrocarbons	NO_x	kt/GWh	2.52E-04	2.27E-03	2.04E-03
X.b	Commercial lighting, appliances, and cooking	Gaseous hydrocarbons	NO_x	kt/GWh	2.52E-04	2.27E-03	2.04E-03
XI.a	Industrial processes	Gaseous hydrocarbons	NO_x	kt/GWh	2.86E-04	2.25E-03	1.35E-03
XI.a	Industrial processes	Liquid hydrocarbons	NO_x	kt/GWh	8.03E-04	6.78E-03	4.07E-03

Code	Name	Type	Pollutant	Units	2010	Low innovation 2050	High Innovation 2050
XI.a	Industrial processes	Solid hydrocarbons	NO_x	kt/GWh	4.77E-04	4.15E-03	2.49E-03
XII.a.Aviation	Domestic passenger transport	AIR_AIR	NO_x	kt/GWh	8.46E-04	0	0
XII.a.Rail	Domestic passenger transport	RAIL_DIESEL	NO_x	kt/GWh	6.67E-03	0	0
XII.a.Road	Domestic passenger transport	BUS_HEV	NO_x	kt/GWh	8.84E-04	0	0
XII.a.Road	Domestic passenger transport	BUS_ICE	NO_x	kt/GWh	1.19E-03	0	0
XII.a.Road	Domestic passenger transport	CAR_ICE	NO_x	kt/GWh	3.51E-04	0	0
XII.a.Road	Domestic passenger transport	CAR_PHEV	NO_x	kt/GWh	4.12E-04	0	0
XII.b.NationalNavigation	Domestic freight	National navigation_Diesel	NO_x	kt/GWh	4.93E-03	0	0
XII.b.Rail	Domestic freight	Rail freight_Diesel	NO_x	kt/GWh	1.20E-02	0	0
XII.b.Road	Domestic freight	Road freight_Diesel	NO_x	kt/GWh	9.39E-04	0	0
XII.c	International aviation	Aviation Fuel	NO_x	kt/GWh	1.08E-03	0	0
XII.e	International shipping		NO_x	kt/GWh	5.37E-03	0	0
XV.a	Petroleum refineries	Gaseous hydrocarbons	NO_x	kt/GWh	2.13E-04	1.89E-03	1.13E-03
XV.a	Petroleum refineries	Liquid hydrocarbons	NO_x	kt/GWh	4.14E-04	3.71E-03	2.23E-03
XV.b	Indigenous fossil-fuel production	Gaseous hydrocarbons	NO_x	kt/GWh	5.65E-04	5.42E-03	4.33E-03
XV.b	Indigenous fossil-fuel production	Solid hydrocarbons	NO_x	kt/GWh	5.76E-04	5.18E-03	4.15E-03
I.a	Biomass/coal power stations	Gaseous hydrocarbons	PM_{10}	kt/GWh	3.12E-06	2.81E-05	7.02E-06
I.a	Biomass/coal power stations	Liquid hydrocarbons	PM_{10}	kt/GWh	3.83E-05	3.45E-04	8.61E-05
I.a	Biomass/coal power stations	Solid hydrocarbons (biomass)	PM_{10}	kt/GWh	1.21E-04	1.52E-03	3.79E-04
I.a	Biomass/coal power stations	Solid hydrocarbons (coal)	PM_{10}	kt/GWh	5.57E-06	5.17E-05	1.29E-05
I.b	Carbon capture storage (CCS)	Gaseous hydrocarbons	PM_{10}	kt/GWh	3.12E-06	2.50E-05	6.24E-06
I.b	Carbon capture storage (CCS)	Solid hydrocarbons	PM_{10}	kt/GWh	5.25E-06	4.20E-05	1.05E-05
IX.a	Domestic space heating and hot water	Community scale gas CHP	PM_{10}	kt/GWh	2.75E-06	2.47E-05	8.41E-07
IX.a	Domestic space heating and hot water	Community scale solid-fuel CHP	PM_{10}	kt/GWh	2.61E-04	2.88E-03	9.79E-05
IX.a	Domestic space heating and hot water	Gas Boiler (new)	PM_{10}	kt/GWh	1.80E-06	1.62E-05	5.51E-07
IX.a	Domestic space heating and hot water	Gas Boiler (old)	PM_{10}	kt/GWh	1.80E-06	1.62E-05	5.51E-07
IX.a	Domestic space heating and hot water	Oil-fired boiler	PM_{10}	kt/GWh	1.61E-05	1.41E-04	4.78E-06
IX.a	Domestic space heating and hot water	Solid-fuel boiler	PM_{10}	kt/GWh	6.04E-04	1.47E-02	4.99E-04
IX.a	Domestic space heating and hot water	Stirling engine µCHP	PM_{10}	kt/GWh	1.80E-06	1.62E-05	5.51E-07
IX.c	Commercial space heating and hot water	Community scale gas CHP	PM_{10}	kt/GWh	2.75E-06	2.47E-05	1.24E-06
IX.c	Commercial space heating and hot water	Community scale solid-fuel CHP	PM_{10}	kt/GWh	2.61E-04	2.88E-03	1.44E-04
IX.c	Commercial space heating and hot water	Gas Boiler (new)	PM_{10}	kt/GWh	2.75E-06	2.47E-05	1.24E-06
IX.c	Commercial space heating and hot water	Gas Boiler (old)	PM_{10}	kt/GWh	2.75E-06	2.47E-05	1.24E-06
IX.c	Commercial space heating and hot water	Oil-fired boiler	PM_{10}	kt/GWh	4.20E-05	3.67E-04	1.84E-05

Code	Name	Type	Pollutant	Units	2010	Low innovation 2050	High Innovation 2050
IX.c	Commercial space heating and hot water	Solid-fuel boiler	PM_{10}	kt/GWh	2.61E-04	2.88E-03	1.44E-04
IX.c	Commercial space heating and hot water	Stirling engine µCHP	PM_{10}	kt/GWh	2.75E-06	2.47E-05	1.24E-06
VI.a	Agriculture and land use	Gaseous hydrocarbons	PM_{10}	kt/GWh	2.75E-06	2.47E-05	1.24E-05
VI.a	Agriculture and land use	Liquid hydrocarbons	PM_{10}	kt/GWh	8.49E-05	7.64E-04	3.82E-04
VI.a	Agriculture and land use	Solid hydrocarbons	PM_{10}	kt/GWh	3.99E-04	3.59E-03	1.79E-03
VI.b	Volume of waste & recycling	Coal and fossil waste	PM_{10}	kt/GWh	4.47E-06	4.02E-05	2.01E-05
VI.b	Volume of waste & recycling	Dry biomass and waste	PM_{10}	kt/GWh	4.47E-06	4.02E-05	2.01E-05
VI.b	Volume of waste & recycling	Gaseous waste	PM_{10}	kt/GWh	3.56E-05	3.20E-04	1.60E-04
VI.b	Volume of waste & recycling	Wet biomass and waste	PM_{10}	kt/GWh	4.47E-06	4.02E-05	2.01E-05
X.a	Domestic lighting, appliances, and cooking	Gaseous hydrocarbons	PM_{10}	kt/GWh	1.80E-06	1.62E-05	1.46E-05
X.b	Commercial lighting, appliances, and cooking	Gaseous hydrocarbons	PM_{10}	kt/GWh	1.80E-06	1.62E-05	1.46E-05
XI.a	Industrial processes	Gaseous hydrocarbons	PM_{10}	kt/GWh	3.72E-06	3.22E-05	9.65E-06
XI.a	Industrial processes	Liquid hydrocarbons	PM_{10}	kt/GWh	3.93E-05	3.75E-04	1.13E-04
XI.a	Industrial processes	Solid hydrocarbons	PM_{10}	kt/GWh	5.58E-05	5.02E-04	1.51E-04
XII.a.Aviation	Domestic passenger transport	AIR_AIR	PM_{10}	kt/GWh	9.03E-06	0	0
XII.a.Rail	Domestic passenger transport	RAIL_DIESEL	PM_{10}	kt/GWh	1.75E-04	0	0
XII.a.Road	Domestic passenger transport	BUS_EV	PM_{10}	kt/GWh	2.95E-05	0	0
XII.a.Road	Domestic passenger transport	BUS_FCV	PM_{10}	kt/GWh	2.95E-05	0	0
XII.a.Road	Domestic passenger transport	BUS_HEV	PM_{10}	kt/GWh	3.99E-05	0	0
XII.a.Road	Domestic passenger transport	BUS_ICE	PM_{10}	kt/GWh	4.38E-05	0	0
XII.a.Road	Domestic passenger transport	CAR_EV	PM_{10}	kt/GWh	3.61E-05	0	0
XII.a.Road	Domestic passenger transport	CAR_FCV	PM_{10}	kt/GWh	3.61E-05	0	0
XII.a.Road	Domestic passenger transport	CAR_ICE	PM_{10}	kt/GWh	5.11E-05	0	0
XII.a.Road	Domestic passenger transport	CAR_PHEV	PM_{10}	kt/GWh	3.93E-05	0	0
XII.b.NationalNavigation	Domestic freight	National navigation_Diesel	PM_{10}	kt/GWh	1.64E-04	0	0
XII.b.Rail	Domestic freight	Rail freight_Diesel	PM_{10}	kt/GWh	2.46E-04	0	0
XII.b.Road	Domestic freight	Road freight_Diesel	PM_{10}	kt/GWh	4.32E-05	0	0
XII.b.Road	Domestic freight	Road freight_Electric	PM_{10}	kt/GWh	3.25E-05	0	0
XII.c	International aviation	Aviation Fuel	PM_{10}	kt/GWh	7.38E-06	0	0
XII.e	International shipping		PM_{10}	kt/GWh	1.54E-04	0	0
XV.a	Petroleum refineries	Gaseous hydrocarbons	PM_{10}	kt/GWh	2.75E-06	2.47E-05	6.19E-06
XV.a	Petroleum refineries	Liquid hydrocarbons	PM_{10}	kt/GWh	2.49E-05	2.26E-04	5.65E-05
XV.b	Indigenous fossil-fuel production	Gaseous hydrocarbons	PM_{10}	kt/GWh	3.36E-06	3.05E-05	7.62E-06

Code	Name	Type	Pollutant	Units	2010	Low innovation 2050	High Innovation 2050
XV.b	Indigenous fossil-fuel production	Solid hydrocarbons	PM_{10}	kt/GWh	3.76E-04	3.38E-03	8.45E-04
I.a	Biomass/coal power stations	Gaseous hydrocarbons	SO_2	kt/GWh	2.35E-06	2.12E-05	1.70E-05
I.a	Biomass/coal power stations	Liquid hydrocarbons	SO_2	kt/GWh	2.40E-04	1.96E-03	1.57E-03
I.a	Biomass/coal power stations	Solid hydrocarbons (biomass)	SO_2	kt/GWh	4.22E-05	3.80E-04	3.04E-04
I.a	Biomass/coal power stations	Solid hydrocarbons (coal)	SO_2	kt/GWh	2.65E-04	2.21E-03	1.77E-03
I.b	Carbon capture storage (CCS)	Gaseous hydrocarbons	SO_2	kt/GWh	2.35E-06	1.89E-05	1.51E-05
I.b	Carbon capture storage (CCS)	Solid hydrocarbons	SO_2	kt/GWh	1.77E-04	1.41E-03	1.13E-03
IX.a	Domestic space heating and hot water	Community scale solid-fuel CHP	SO_2	kt/GWh	2.07E-03	1.86E-02	5.59E-03
IX.a	Domestic space heating and hot water	Oil-fired boiler	SO_2	kt/GWh	8.03E-06	1.00E-04	3.00E-05
IX.a	Domestic space heating and hot water	Solid-fuel boiler	SO_2	kt/GWh	2.10E-03	1.15E-02	3.44E-03
IX.c	Commercial space heating and hot water	Community scale solid-fuel CHP	SO_2	kt/GWh	2.07E-03	1.86E-02	5.59E-03
IX.c	Commercial space heating and hot water	Oil-fired boiler	SO_2	kt/GWh	1.30E-03	1.14E-02	3.41E-03
IX.c	Commercial space heating and hot water	Solid-fuel boiler	SO_2	kt/GWh	2.07E-03	1.86E-02	5.59E-03
VI.a	Agriculture and land use	Liquid hydrocarbons	SO_2	kt/GWh	1.40E-03	1.26E-02	1.01E-02
VI.a	Agriculture and land use	Solid hydrocarbons	SO_2	kt/GWh	2.19E-03	1.97E-02	1.58E-02
VI.b	Volume of waste & recycling	Coal and fossil waste	SO_2	kt/GWh	2.81E-05	2.53E-04	5.05E-05
VI.b	Volume of waste & recycling	Dry biomass and waste	SO_2	kt/GWh	2.81E-05	2.53E-04	5.05E-05
VI.b	Volume of waste & recycling	Wet biomass and waste	SO_2	kt/GWh	2.81E-05	2.53E-04	5.05E-05
XI.a	Industrial processes	Liquid hydrocarbons	SO_2	kt/GWh	4.00E-04	5.19E-03	3.12E-03
XI.a	Industrial processes	Solid hydrocarbons	SO_2	kt/GWh	1.58E-03	2.02E-02	1.21E-02
XII.a.Aviation	Domestic passenger transport	AIR_AIR	SO_2	kt/GWh	6.37E-05	0	0
XII.a.Rail	Domestic passenger transport	RAIL_DIESEL	SO_2	kt/GWh	1.58E-06	0	0
XII.a.Road	Domestic passenger transport	BUS_HEV	SO_2	kt/GWh	1.58E-06	0	0
XII.a.Road	Domestic passenger transport	BUS_ICE	SO_2	kt/GWh	1.58E-06	0	0
XII.a.Road	Domestic passenger transport	CAR_ICE	SO_2	kt/GWh	1.56E-06	0	0
XII.a.Road	Domestic passenger transport	CAR_PHEV	SO_2	kt/GWh	1.56E-06	0	0
XII.b.NationalNavigation	Domestic freight	National navigation_Diesel	SO_2	kt/GWh	1.21E-03	0	0
XII.b.Rail	Domestic freight	Rail freight_Diesel	SO_2	kt/GWh	1.58E-06	0	0
XII.b.Road	Domestic freight	Road freight_Diesel	SO_2	kt/GWh	1.58E-06	0	0
XII.c	International aviation	Aviation Fuel	SO_2	kt/GWh	6.39E-05	0	0
XII.e	International shipping		SO_2	kt/GWh	1.32E-03	0	0
XV.a	Petroleum refineries	Liquid hydrocarbons	SO_2	kt/GWh	1.01E-03	2.15E-02	1.07E-02
XV.b	Indigenous fossil-fuel production	Gaseous hydrocarbons	SO_2	kt/GWh	8.56E-06	8.29E-05	4.15E-05
XV.b	Indigenous fossil-fuel production	Solid hydrocarbons	SO_2	kt/GWh	2.79E-03	2.51E-02	1.25E-02

Code	Name	Type	Pollutant	Units	2010	Low innovation 2050	High Innovation 2050
I.a	Biomass/coal power stations	Gaseous hydrocarbons	VOC	kt/GWh	4.25E-06	3.83E-05	3.44E-05
I.a	Biomass/coal power stations	Liquid hydrocarbons	VOC	kt/GWh	3.83E-05	3.45E-04	3.10E-04
I.a	Biomass/coal power stations	Solid hydrocarbons (biomass)	VOC	kt/GWh	7.08E-05	6.37E-04	5.74E-04
I.a	Biomass/coal power stations	Solid hydrocarbons (coal)	VOC	kt/GWh	2.62E-06	2.36E-05	2.12E-05
I.b	Carbon capture storage (CCS)	Gaseous hydrocarbons	VOC	kt/GWh	4.25E-06	3.40E-05	3.06E-05
I.b	Carbon capture storage (CCS)	Solid hydrocarbons	VOC	kt/GWh	2.62E-06	2.10E-05	1.89E-05
IX.c	Commercial space heating and hot water	Community scale gas CHP	VOC	kt/GWh	8.00E-06	7.20E-05	3.60E-05
IX.c	Commercial space heating and hot water	Community scale solid-fuel CHP	VOC	kt/GWh	6.08E-06	5.47E-05	2.74E-05
IX.c	Commercial space heating and hot water	Gas Boiler (new)	VOC	kt/GWh	8.00E-06	7.20E-05	3.60E-05
IX.c	Commercial space heating and hot water	Gas Boiler (old)	VOC	kt/GWh	8.00E-06	7.20E-05	3.60E-05
IX.c	Commercial space heating and hot water	Oil-fired boiler	VOC	kt/GWh	1.08E-05	9.55E-05	4.77E-05
IX.c	Commercial space heating and hot water	Solid-fuel boiler	VOC	kt/GWh	6.08E-06	5.47E-05	2.74E-05
IX.c	Commercial space heating and hot water	Stirling engine µCHP	VOC	kt/GWh	8.00E-06	7.20E-05	3.60E-05
VI.b	Volume of waste & recycling	Coal and fossil waste	VOC	kt/GWh	1.76E-06	1.58E-05	7.90E-06
VI.b	Volume of waste & recycling	Dry biomass and waste	VOC	kt/GWh	1.76E-06	1.58E-05	7.90E-06
VI.b	Volume of waste & recycling	Gaseous waste	VOC	kt/GWh	1.30E-05	1.17E-04	5.86E-05
VI.b	Volume of waste & recycling	Wet biomass and waste	VOC	kt/GWh	1.76E-06	1.58E-05	7.90E-06
VIII.a	H2 production for transport	Gaseous hydrocarbons	VOC	kt/GWh	8.00E-06	7.20E-05	6.48E-05
XII.a.Aviation	Domestic passenger transport	AIR_AIR	VOC	kt/GWh	2.41E-04	0	0
XII.a.Rail	Domestic passenger transport	RAIL_DIESEL	VOC	kt/GWh	6.72E-04	0	0
XII.a.Road	Domestic passenger transport	BUS_HEV	VOC	kt/GWh	5.17E-06	0	0
XII.a.Road	Domestic passenger transport	BUS_ICE	VOC	kt/GWh	2.28E-05	0	0
XII.a.Road	Domestic passenger transport	CAR_ICE	VOC	kt/GWh	9.95E-05	0	0
XII.a.Road	Domestic passenger transport	CAR_PHEV	VOC	kt/GWh	1.09E-04	0	0
XII.b.NationalNavigation	Domestic freight	National navigation_Diesel	VOC	kt/GWh	2.28E-04	0	0
XII.b.Rail	Domestic freight	Rail freight_Diesel	VOC	kt/GWh	1.17E-03	0	0
XII.b.Road	Domestic freight	Road freight_Diesel	VOC	kt/GWh	1.47E-05	0	0
XII.c	International aviation	Aviation Fuel	VOC	kt/GWh	9.95E-05	0	0
XII.e	International shipping		VOC	kt/GWh	2.25E-04	0	0
XV.a	Petroleum refineries	Gaseous hydrocarbons	VOC	kt/GWh	8.00E-06	7.20E-05	5.76E-05
XV.a	Petroleum refineries	Liquid hydrocarbons	VOC	kt/GWh	9.91E-06	8.88E-05	7.11E-05
XVI.a	Fossil fuel transfers	Distribution losses	VOC	kt/GWh	4.56E-02	1.38E-01	8.28E-02