

Attachment K
Mercury Emission Modification Factors Used in v.2.1.6

Emission modification factors (EMFs) represent the mercury reductions attributable to different burner types and different configurations of SO₂, NO_x, and particulate controls at an electric generating unit. An EMF is the ratio of outlet mercury concentration to inlet mercury concentration and depends on the unit's burner type, particulate control, post-combustion NO_x control and SO₂ scrubber control. In other words, the mercury reduction achieved (relative to the inlet rate) during combustion and flue-gas treatment processes is (1-EMF). The EMF varies by the type of coal (i.e. bituminous, sub-bituminous and lignite) used during the combustion process. Table K1 shows the EMFs used in v.2.1.6. These replace the EMFs previously assumed in v.2.1 that were listed in Table 5.7a in "Documentation of EPA Modeling Applications (V.2.1) Using the Integrated Planning Model" which can be viewed and downloaded at www.epa.gov/airmarkets/epa-ipm. Table K2 provides a key to the burner type designations appearing in Table K-1. This table reproduces Table 5.7b from the previously cited v.2.1 documentation report.

Table K1 Mercury Emission Modification Factors Used in v.2.1.6

Burner Type	Particulate Control	Post Combustion Control -- NO _x	Post Combustion Control -- SO ₂	Bituminous EMF	Sub-bituminous EMF	Lignite EMF
Cyclone	No Control	None	None	1	1	1
Cyclone	No Control	None	Wet FGD	0.45	0.6	1
Cyclone	No Control	SCR	None	1	1	1
Cyclone	No Control	SCR	Wet FGD	0.1	0.49	1
Cyclone	No Control	SNCR	None	1	1	1
Cyclone	No Control	SNCR	Wet FGD	0.45	0.6	1
Cyclone	Cold side ESP	None	None	0.64	0.97	0.93
Cyclone	Cold side ESP	None	Wet FGD	0.46	0.84	0.58
Cyclone	Cold side ESP	None	Dry FGD	0.64	0.65	0.93
Cyclone	Cold side ESP	SCR	None	0.64	0.97	0.93
Cyclone	Cold side ESP	SCR	Wet FGD	0.1	0.34	0.58
Cyclone	Cold side ESP	SCR	Dry FGD	0.64	0.65	0.93
Cyclone	Cold side ESP	SNCR	None	0.64	0.97	0.93
Cyclone	Cold side ESP	SNCR	Wet FGD	0.46	0.84	0.58
Cyclone	Fabric Filter	None	None	0.11	0.27	1
Cyclone	Fabric Filter	None	Wet FGD	0.03	0.27	0.58
Cyclone	Fabric Filter	None	Dry FGD	0.4	0.95	0.91
Cyclone	Fabric Filter	SCR	None	0.11	0.27	1
Cyclone	Fabric Filter	SCR	Wet FGD	0.1	0.15	0.58
Cyclone	Fabric Filter	SCR	Dry FGD	0.4	0.95	0.91
Cyclone	Fabric Filter	SNCR	None	0.11	0.27	1
Cyclone	Fabric Filter	SNCR	Wet FGD	0.03	0.27	0.58
Cyclone	Fabric Filter	SNCR	Dry FGD	0.4	0.95	0.91
Cyclone	Hot side ESP	None	None	0.9	1	1
Cyclone	Hot side ESP	None	Wet FGD	0.58	0.6	1
Cyclone	Hot side ESP	None	Dry FGD	0.9	1	1
Cyclone	Hot side ESP	SCR	None	0.9	1	1
Cyclone	Hot side ESP	SNCR	None	0.9	1	1
Cyclone	PM Scrubber	None	None	0.8	1	1
Cyclone	No Control	SCR	Dry FGD	1	1	1
Cyclone	Hot side ESP	SCR	Dry FGD	0.9	1	1
Cyclone	Hot side ESP	SCR	Wet FGD	0.1	0.6	1
Cyclone	Hot side ESP	SNCR	Wet FGD	0.58	0.6	1
Cyclone	No Control	None	Dry FGD	1	1	1
Cyclone	Hot side ESP	SNCR	Dry FGD	0.9	1	1
Cyclone	No Control	SNCR	Dry FGD	1	1	1
Cyclone	Cold side ESP	SNCR	Dry FGD	0.64	0.65	0.93
FBC	No Control	None	None	1	1	1
FBC	No Control	None	Wet FGD	1	1	1
FBC	No Control	None	Dry FGD	0.45	0.45	1
FBC	No Control	SCR	None	1	1	1
FBC	No Control	SCR	Wet FGD	0.1	0.49	1
FBC	No Control	SNCR	None	1	1	1
FBC	No Control	SNCR	Dry FGD	0.45	0.45	1

Burner Type	Particulate Control	Post Combustion Control -- NO _x	Post Combustion Control -- SO ₂	Bituminous EMF	Sub-bituminous EMF	Lignite EMF
FBC	Cold side ESP	None	None	0.65	0.65	0.62
FBC	Cold side ESP	None	Wet FGD	0.65	0.65	0.62
FBC	Cold side ESP	SCR	Wet FGD	0.1	0.34	0.62
FBC	Cold side ESP	SNCR	Wet FGD	0.65	0.65	0.62
FBC	Fabric Filter	None	None	0.05	0.43	0.43
FBC	Fabric Filter	None	Wet FGD	0.05	0.43	0.43
FBC	Fabric Filter	SCR	None	0.05	0.43	0.43
FBC	Fabric Filter	SCR	Wet FGD	0.05	0.43	0.43
FBC	Fabric Filter	SNCR	Wet FGD	0.05	0.43	0.43
FBC	No Control	SCR	Dry FGD	0.45	0.45	1
FBC	No Control	SNCR	Wet FGD	1	1	1
FBC	Fabric Filter	None	Dry FGD	0.05	0.43	0.43
FBC	Fabric Filter	SCR	Dry FGD	0.05	0.43	0.43
FBC	Fabric Filter	SNCR	Dry FGD	0.05	0.43	0.43
FBC	Fabric Filter	Fuel Return	Dry FGD	0.05	0.43	0.43
Other	No Control	None	None	1	1	1
Other	No Control	None	Wet FGD	0.58	0.7	1
Other	No Control	SCR	None	1	1	1
Other	No Control	SCR	Wet FGD	0.1	0.49	1
Other	No Control	SNCR	None	1	1	1
Other	No Control	SNCR	Wet FGD	0.58	0.7	1
Other	Cold side ESP	None	None	0.64	0.97	1
Other	Cold side ESP	None	Wet FGD	0.34	0.84	0.56
Other	Cold side ESP	None	Dry FGD	0.64	0.65	1
Other	Cold side ESP	SCR	None	0.64	0.97	1
Other	Cold side ESP	SNCR	None	0.64	0.97	1
Other	Fabric Filter	None	None	0.11	0.27	1
Other	Fabric Filter	None	Wet FGD	0.03	0.27	0.56
Other	Fabric Filter	None	Dry FGD	0.4	0.75	1
Other	Fabric Filter	SCR	None	0.11	0.27	1
Other	Fabric Filter	SCR	Wet FGD	0.1	0.27	0.56
Other	Fabric Filter	SCR	Dry FGD	0.4	0.75	1
Other	Fabric Filter	SNCR	Wet FGD	0.03	0.27	0.56
Other	Fabric Filter	SNCR	Dry FGD	0.4	0.75	1
Other	No Control	None	Dry FGD	1	1	1
Other	Hot side ESP	None	None	1	1	1
Other	Hot side ESP	None	Wet FGD	0.58	1	1
Other	Hot side ESP	None	Dry FGD	1	1	1
Other	Hot side ESP	SCR	None	1	1	1
Other	Hot side ESP	SNCR	None	1	1	1
Other	Cold side ESP	SCR	Wet FGD	0.1	0.73	0.56
Other	Cold side ESP	SNCR	Wet FGD	0.34	0.73	0.56
Other	Hot side ESP	SCR	Wet FGD	0.1	0.75	1
Other	Hot side ESP	SNCR	Wet FGD	0.58	1	1
Other	Cold side ESP	SCR	Dry FGD	0.64	0.65	1

Burner Type	Particulate Control	Post Combustion Control -- NO _x	Post Combustion Control -- SO ₂	Bituminous EMF	Sub-bituminous EMF	Lignite EMF
Other	Hot side ESP	SCR	Dry FGD	1	1	1
Other	No Control	SCR	Dry FGD	1	1	1
Other	Cold side ESP	SNCR	Dry FGD	0.64	0.65	1
Other	Hot side ESP	SNCR	Dry FGD	1	1	1
Other	No Control	SNCR	Dry FGD	1	1	1
Other	Fabric Filter	SNCR	None	0.45	0.75	1
PC	No Control	None	None	1	1	1
PC	No Control	None	Dry FGD	0.6	0.85	1
PC	No Control	SCR	None	1	1	1
PC	No Control	SCR	Wet FGD	0.1	0.49	1
PC	No Control	SCR	Dry FGD	0.6	0.85	1
PC	No Control	SNCR	None	1	1	1
PC	No Control	SNCR	Wet FGD	0.58	0.7	1
PC	No Control	SNCR	Dry FGD	0.6	0.85	1
PC	Cold side ESP	None	None	0.64	0.97	1
PC	Cold side ESP + FF	None	None	0.2	0.75	1
PC	Cold side ESP + FF	None	Wet FGD	0.3	0.3	0.56
PC	Cold side ESP + FF	None	Dry FGD	0.05	0.75	1
PC	Cold side ESP + FF	SCR	None	0.2	0.75	1
PC	Cold side ESP + FF	SCR	Wet FGD	0.1	0.3	0.56
PC	Cold side ESP + FF	SCR	Dry FGD	0.05	0.75	1
PC	Cold side ESP + FF	SNCR	None	0.2	0.75	1
PC	Cold side ESP + FF	SNCR	Wet FGD	0.1	0.3	0.56
PC	Cold side ESP	None	Wet FGD	0.34	0.84	0.56
PC	Cold side ESP	None	Dry FGD	0.64	0.65	1
PC	Cold side ESP	None	DSI	0.55	0.85	1
PC	Cold side ESP	SCR	None	0.64	0.97	1
PC	Cold side ESP	SCR	Wet FGD	0.1	0.34	0.56
PC	Cold side ESP	SCR	Dry FGD	0.64	0.65	1
PC	Cold side ESP	SNCR	None	0.64	0.97	1
PC	Cold side ESP	SNCR	Wet FGD	0.34	0.65	0.56
PC	Cold side ESP	SNCR	Dry FGD	0.64	0.65	1
PC	No Control	None	Wet FGD	0.58	0.7	1
PC	Cyclone	None	Wet FGD	0.45	0.7	1
PC	Fabric Filter	None	None	0.11	0.27	1
PC	Fabric Filter	None	Wet FGD	0.03	0.27	0.56
PC	Fabric Filter	None	Dry FGD	0.05	0.75	1
PC	Fabric Filter	SCR	None	0.11	0.27	1
PC	Fabric Filter	SCR	Wet FGD	0.1	0.15	0.56
PC	Fabric Filter	SCR	Dry FGD	0.05	0.75	1
PC	Fabric Filter	SNCR	None	0.11	0.27	1
PC	Fabric Filter	SNCR	Wet FGD	0.03	0.27	0.56
PC	Fabric Filter	SNCR	Dry FGD	0.05	0.75	1
PC	Hot side ESP	None	None	0.9	0.94	1
PC	Hot side ESP + FF	None	Wet FGD	0.03	0.27	0.56

Burner Type	Particulate Control	Post Combustion Control -- NO _x	Post Combustion Control -- SO ₂	Bituminous EMF	Sub-bituminous EMF	Lignite EMF
PC	Hot side ESP + FF	None	Dry FGD	0.05	0.75	1
PC	Hot side ESP + FF	SCR	Wet FGD	0.1	0.15	0.56
PC	Hot side ESP + FF	SCR	Dry FGD	0.05	0.75	1
PC	Hot side ESP + FF	SNCR	Wet FGD	0.03	0.27	0.56
PC	Hot side ESP + FF	SNCR	Dry FGD	0.05	0.75	1
PC	Hot side ESP	None	Wet FGD	0.58	0.8	1
PC	Hot side ESP	None	Dry FGD	0.6	0.85	1
PC	Hot side ESP	SCR	None	0.9	0.9	1
PC	Hot side ESP	SCR	Wet FGD	0.1	0.75	1
PC	Hot side ESP	SCR	Dry FGD	0.6	0.85	1
PC	Hot side ESP	SNCR	None	0.9	0.9	1
PC	Hot side ESP	SNCR	Wet FGD	0.58	0.75	1
PC	Hot side ESP	SNCR	Dry FGD	0.6	0.85	1
PC	PM Scrubber	None	None	0.9	0.91	1
PC	PM Scrubber	SCR	None	0.9	1	1
PC	Cold side ESP + FF	SNCR	Dry FGD	0.05	0.75	1
PC	Hot side ESP + FF	SCR	None	0.11	0.27	1
PC	Hot side ESP + FF	SNCR	None	0.11	0.27	1
PC	Hot side ESP + FF	None	None	0.11	0.27	1
Stoker	Hot side ESP	SCR	Dry FGD	1	1	1
Stoker	No Control	None	None	1	1	1
Stoker	No Control	None	Wet FGD	0.58	1	1
Stoker	No Control	SCR	None	1	1	1
Stoker	No Control	SNCR	None	1	1	1
Stoker	Cold side ESP	None	None	0.65	0.97	1
Stoker	Cold side ESP	None	Wet FGD	0.34	0.84	0.56
Stoker	Cold side ESP	None	Dry FGD	0.65	0.65	1
Stoker	Cold side ESP	SCR	None	0.65	0.97	1
Stoker	Cold side ESP	SCR	Dry FGD	0.65	0.65	1
Stoker	Cold side ESP	SNCR	None	0.65	0.97	1
Stoker	Fabric Filter	None	None	0.11	0.27	1
Stoker	Fabric Filter	None	Wet FGD	0.03	0.27	0.56
Stoker	Fabric Filter	None	Dry FGD	0.1	0.75	1
Stoker	Fabric Filter	SCR	None	0.11	0.27	1
Stoker	Fabric Filter	SCR	Dry FGD	0.1	0.75	1
Stoker	Fabric Filter	SNCR	None	0.11	0.27	1
Stoker	No Control	None	Dry FGD	1	1	1
Stoker	Hot side ESP	None	None	1	1	1
Stoker	Hot side ESP	None	Wet FGD	0.58	1	1
Stoker	Hot side ESP	None	Dry FGD	1	1	1
Stoker	Hot side ESP	SCR	None	1	1	1
Stoker	Hot side ESP	SNCR	None	1	1	1
Stoker	No Control	SCR	Dry FGD	1	1	1
Stoker	Cold side ESP	SCR	Wet FGD	0.1	0.73	0.56

Burner Type	Particulate Control	Post Combustion Control -- NO_x	Post Combustion Control -- SO₂	Bituminous EMF	Sub-bituminous EMF	Lignite EMF
Stoker	Cold side ESP	SNCR	Wet FGD	0.34	0.73	0.56
Stoker	Hot side ESP	SCR	Wet FGD	0.1	0.75	1
Stoker	Hot side ESP	SNCR	Wet FGD	0.58	1	1
Stoker	Fabric Filter	SCR	Wet FGD	0.1	0.15	0.56
Stoker	Fabric Filter	SNCR	Wet FGD	0.03	0.27	0.56
Stoker	No Control	SCR	Wet FGD	0.1	0.75	1
Stoker	No Control	SNCR	Wet FGD	0.58	1	1
Stoker	Cold side ESP	SNCR	Dry FGD	0.65	0.65	1
Stoker	Hot side ESP	SNCR	Dry FGD	1	1	1
Stoker	Fabric Filter	SNCR	Dry FGD	0.1	0.75	1
Stoker	No Control	SNCR	Dry FGD	1	1	1

Table K2. Key to Burner Type Designations in Table 5.7a

“PC” refers to conventional pulverized coal boilers. Typical configurations include wall-fired and tangentially fired boilers (also called T-fired boilers). In wall-fired boilers the burner’s coal and air nozzles are mounted on a single wall or opposing walls. In tangentially fired boilers the burner’s coal and air nozzles are mounted in each corner of the boiler.

“Cyclone” refers to cyclone boilers where air and crushed coal are injected tangentially into the boiler through a “cyclone burner” and “cyclone barrel” which create a swirling motion allowing smaller coal particles to be burned in suspension and larger coal particles to be captured on the cyclone barrel wall where they are burned in molten slag.

“Stoker” refers to stoker boilers where lump coal is fed continuously onto a moving grate or chain which moves the coal into the combustion zone in which air is drawn through the grate and ignition takes place. The carbon gradually burns off, leaving ash which drops off at the end into a receptacle, from which it is removed for disposal.

“FBC” refers to “fluidized bed combustion” where solid fuels are suspended on upward-blowing jets of air, resulting in a turbulent mixing of gas and solids and a tumbling action which provides especially effective chemical reactions and heat transfer during the combustion process.

“Other” refers to miscellaneous burner types including cell burners and arch- , roof- , and vertically-fired burner configurations.