

Minamata Convention: Initial Assessment of Turkey

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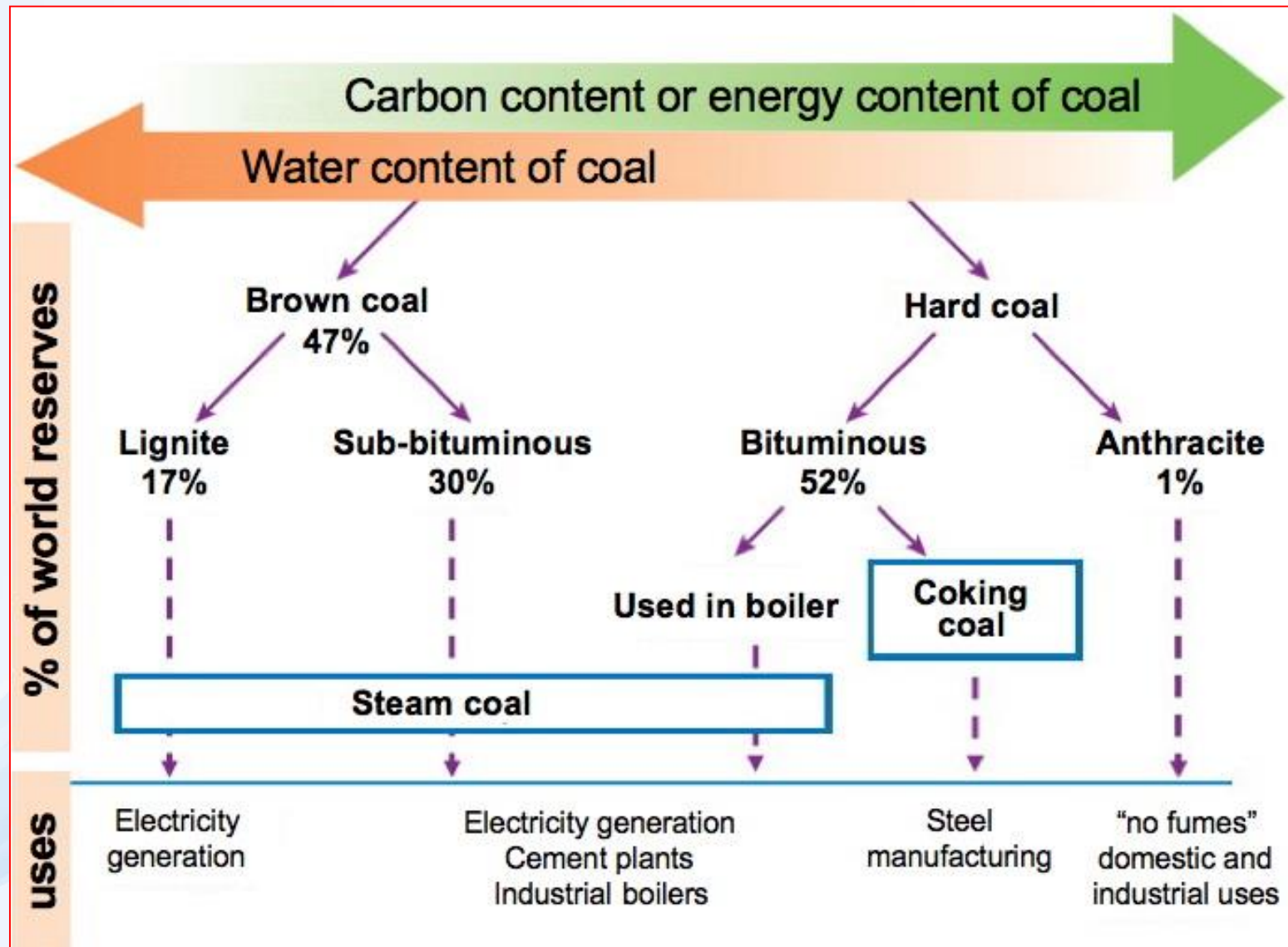
Inventory Mercury Training Meeting

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Lecture 6

Energy fuels, consumption and production

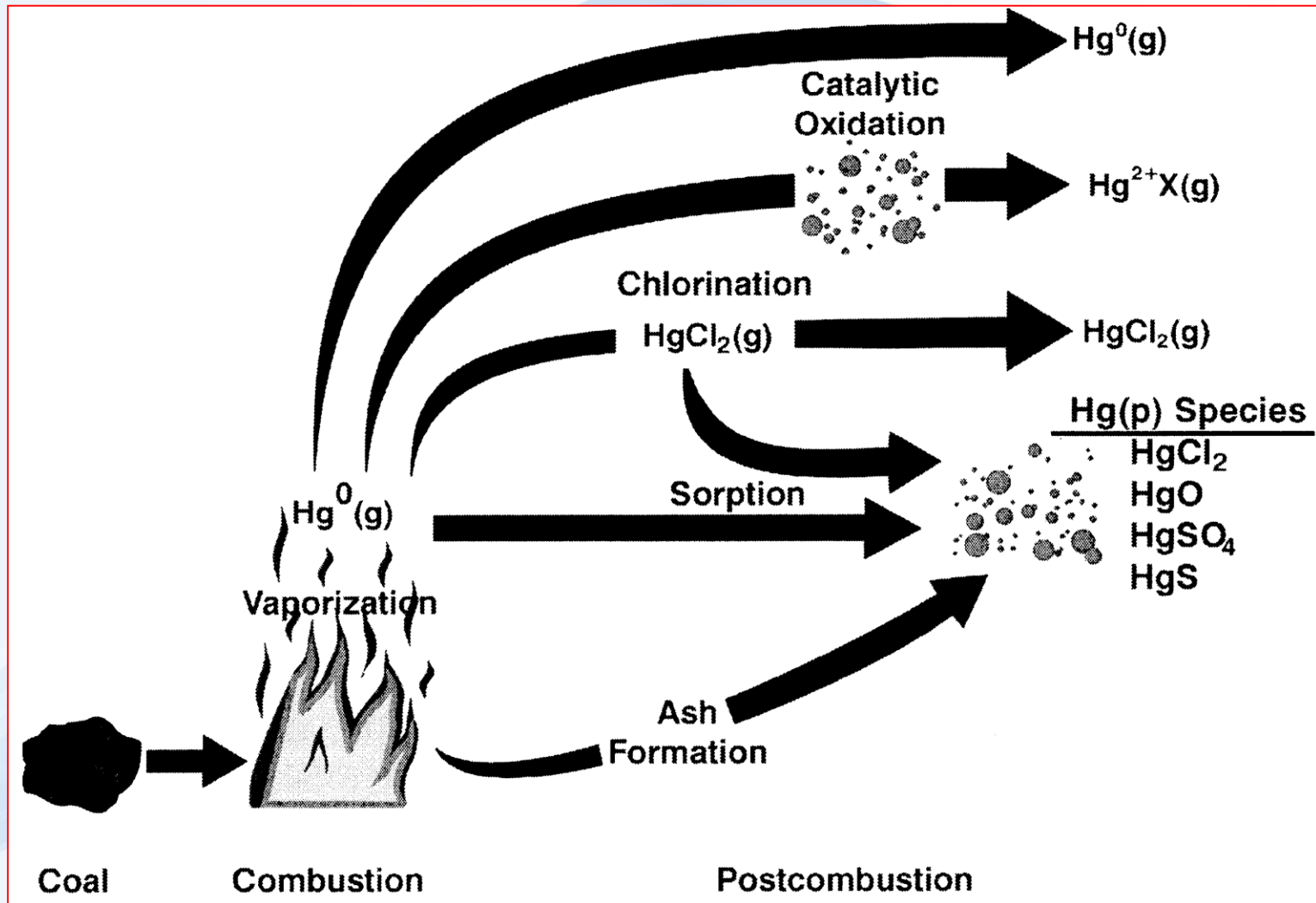
Use of different ranks of coal (WCA 2014)



Mercury content in coals (mg/kg)

Country	Coal type	Average of all samples	Range	Reference
Australia	Bituminous	0.075	0.01-0.31	Nelson, 2007; Tewalt et al., 2010
Argentina	Bituminous	0.19	0.02-0.96 (8)	Finkelman, 2004; Tewalt et al., 2010
Botswana	Bituminous	0.10	0.04-0.15 (28)	Finkelman, 2004; Tewalt et al., 2010
Brazil	Bituminous	0.20	0.04-0.81 (23)	Finkelman, 2004; Tewalt et al., 2010
	Subbituminous	0.3	0.06-0.94 (45)	
Canada		0.058	0.033-0.12 (12)	Tewalt et al., 2010
Chile	Bituminous	0.21	0.03-2.2 (19)	Tewalt et al., 2010
	Subbituminous	0.033	0.022-0.057 (4)	
China	Bituminous/Subbituminous	0.17	0.01-2.248 (482)	Zhang et al., 2012; UNEP, 2011
Colombia	Subbituminous	0.069	>0.02-0.17 (16)	Finkelman, 2004
Czech Rep.	Lignite	0.338	<0.03-0.79 (16)	Finkelman, 2003
	Bituminous	0.126	0.03-0.38 (21)	Tewalt et al., 2010
Egypt	Bituminous	0.12	0.02-0.37 (24)	Tewalt et al., 2010
France	Bituminous	0.044	0.03-0.071 (3)	Tewalt et al., 2010
Germany	Bituminous		0.7-1.4	Pirrone et al., 2001
	Lignite	0.05	Max: 0.09	MUNLV 2005
Hungary	Bituminous	0.354	0.091-1.2 (5)	Tewalt et al., 2010
	Subbituminous	0.138	0.04-0.31 (19)	
	Lignite	0.242	0.075-0.44 (12)	
India	Bituminous	0.106	0.02-0.86 (99)	Tewalt et al., 2010; UNEP, 2014
	Lignite	0.071	0.053-0.093 (8)	
Indonesia	Lignite	0.11	0.02-0.19 (8)	Finkelman, 2003; Tewalt et al., 2010
	Subbituminous	0.03	0.01-0.05 (78)	US EPA, 2002
Iran	Bituminous	0.168	0.02-0.73 (57)	Tewalt et al., 2010
Japan	Bituminous	0.0454	0.01-0.21 (86)	Ito et al., 2004

Potential mercury transformations during combustion and post-combustion



Process diagram of a typical configuration of coal-fired power plants in Japan

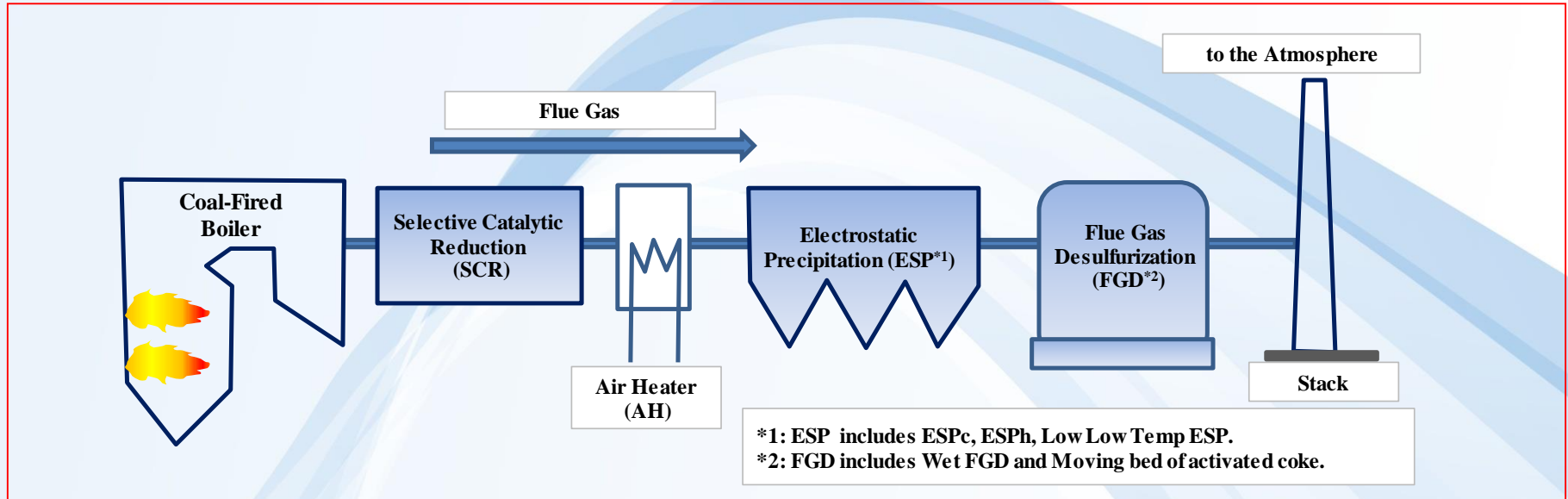
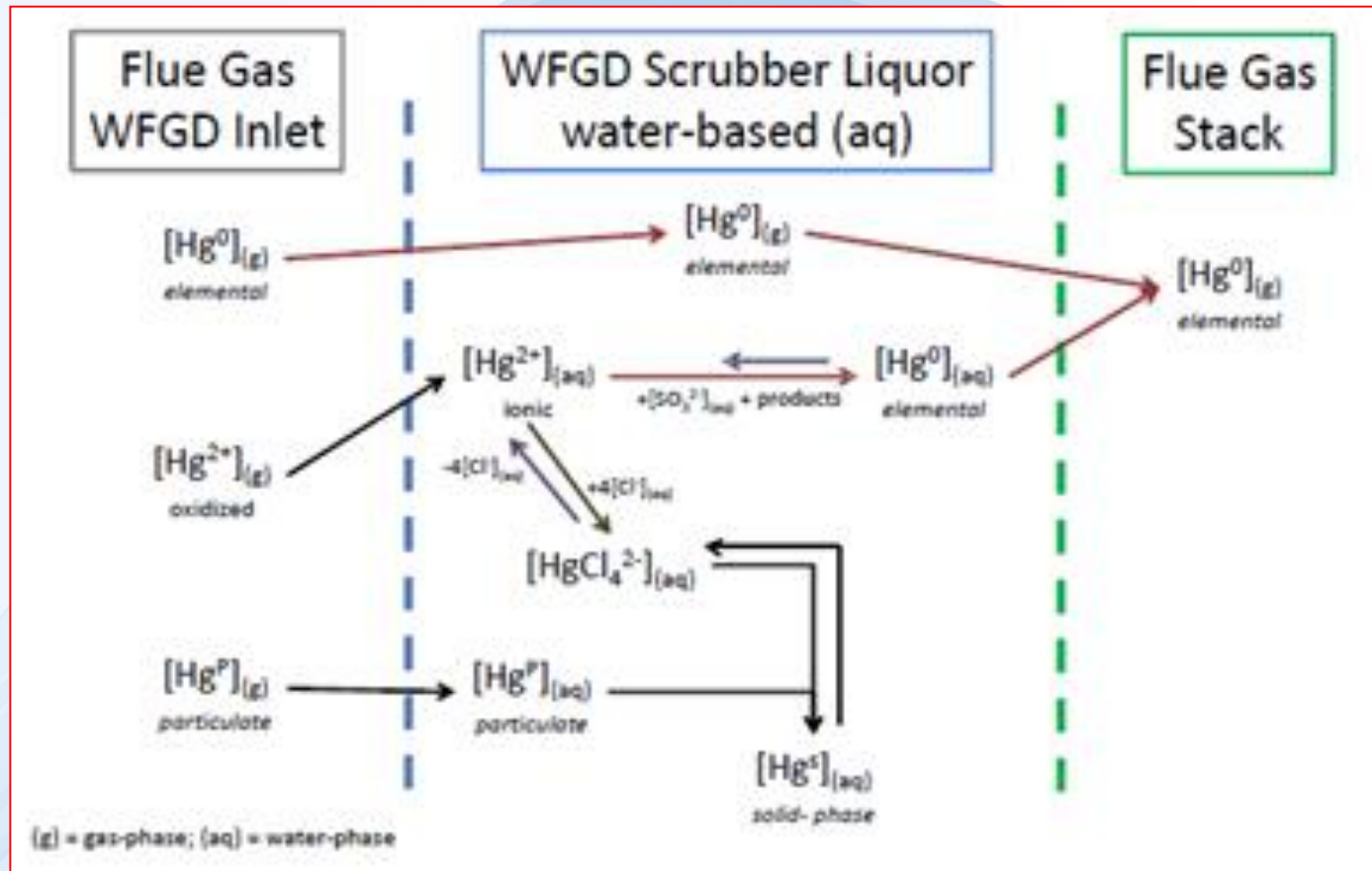


Illustration of flue gas mercury absorption /desorption across WFGD (Keiser et al., 2014)



Source sub-categories covered, with reference to the Toolkit Reference Report sections

Fuel consumption	Category reference
Coal combustion in large power plants (typically with thermal boiler effect above 300 MW)	5.1.1
Other coal uses (sum for all other uses)	5.1.2
Combustion/use of petroleum coke and heavy oil	5.1.3
Combustion/use of diesel, gasoil, petroleum, kerosene	5.1.3
Combustion/use of natural gas	5.1.4
Biomass fired power and heat production (wood, etc.)	5.1.6
Charcoal combustion	5.1.6
Fuel production	
Oil extraction	5.1.3
Oil refining	5.1.3
Extraction and processing of natural gas	5.1.4

Data collection

Source sub-category	Input data types and units	Possible data sources
Energy consumption		
Coal combustion in large power plants	Coal combusted, t/y	<p>For many countries, fuel consumption and production data are provided on the International Energy Agency's statistics website at http://www.iea.org/stats/.</p> <p>Study the many tables carefully to find the right numbers, make sure they have the right units, and add up contributing numbers carefully. For guidance on which IEA numbers to use, see Appendix 3 to this guideline.</p> <p>Otherwise, contact your ministry of energy (or other ministry responsible for energy planning), or your national statistics bureau for these data. In some cases, it may be useful contacting individual power plants, etc.</p> <p>If possible, get advice for selecting the data from resource persons with knowledge of energy and fuels. If you need to convert energy units, EIA's unit converter may be useful (many other converters exist on the Internet also): http://www.iea.org/stats/unit.asp.</p>
Other coal uses	Coal used, t/y	
Combustion/use of petroleum coke and heavy oil	Oil product combusted, t/y	
Combustion/use of diesel, gasoil, petroleum, kerosene	Oil product combusted, t/y	

Data collection

Source sub-category	Input data types and units	Possible data sources
Use of pipeline natural gas (consumer quality)	Gas used, Nm ³ /y	See advice above. Natural gas production data may be given as TJ (Terajoule), which can be converted to the unit needed in the Toolkit, Nm ³ (normal cubic meters), by multiplying the TJ number with 25 600 Nm ³ /TJ (an average gross calorific value of natural gas derived from http://www.iea.org/stats/docs/statistics_manual.pdf , p182) if no specific conversion values are available. If no details are available on the quality of the gas, consider it cleaned pipeline quality.
Use of raw or pre-cleaned natural gas	Gas used, Nm ³ /y	See advice above. If no details are available on the quality of the gas used, consider it cleaned pipeline quality.

Data collection

Source sub-category	Input data types and units	Possible data sources
Biomass fired power and heat production (wood, etc.)	Biomass combusted, t (dry weight)/y	<p>See advice above. Your ministry responsible for forestry will likely have estimates of the annual consumption of wood and charcoal for combustion purposes. Otherwise consult the FAO Yearbooks of Forest Products (entry: Wood Fuel, Including Wood for Charcoal) at http://www.fao.org/forestry/statistics/80570/en/).</p> <p>Make sure you do not count the wood used for domestic production of charcoal twice. This means that under "Biomass fired power and heat production" you should ideally subtract the wood amounts used for charcoal production. If you have data for wood consumption for combustion and charcoal, and you do not import charcoal, you can enter the whole amount under "Biomass fired power and heat production ". If you import all your charcoal, you simply enter the consumption under "Charcoal combustion", and you need not worry about double-counting.</p>
Charcoal combustion	Charcoal combusted, t (dry weight)/y	

Data collection

Source sub-category	Input data types and units	Possible data sources
Fuel production		
Oil extraction	Crude oil produced, t/y	See advice above.
Oil refining	Crude oil refined, t/y	See advice above; refined crude oil amounts may be reported as "petroleum refineries" and "crude oil" usage.
Extraction and processing of natural gas	Gas produced, Nm ³ /y	See advice above.

Step 1 – Screening matrix

Chapter	Main Source Category	Air	Water	Land	Products	Waste/ residue
5.1	Extraction and use of fuels/energy sources	X	X	x	x	X
5.2	Primary (virgin) metal production	X	X	X	X	X
5.3	Production of other minerals and materials with mercury impurities	X	x	x	x	x
5.4	Intentional use of mercury in industrial processes	X	X	X	X	X
5.5	Consumer products with intentional use of mercury	X	X	X	X	X
5.6	Other intentional products/process uses	X	X	X	X	X
5.7	Production of recycled metals ("secondary" metal production)	X	X	X	X	X
5.8	Waste incineration	X	X	X	x	X
5.9	Waste deposition/landfilling and waste water treatment	X	X	X		X
5.10	Crematoria and cemeteries	X		X		x
5.11	Identification of potential hot-spots	Probably registration only, to be followed by site-specific evaluation				

Sub-categories - example

Main category - Extraction and use of fuels/energy sources

This category covers the following main sub-categories:

- ↙ **Coal combustion in large power plants**, with thermal boiler capacity above 300MW;
- ↙ **Other coal combustion**, such as smaller combustion plants, domestic heating and other coal uses;
- ↙ **Extraction, refining and use of mineral oil**, i.e. all mercury releases in the life-cycle of mineral oil), such as heating, power production, use in transportation, synthesis of chemicals and polymers, carbon black production, etc.;
- ↙ **Extraction, refining and use of natural gas**, i.e. all mercury releases in the life-cycle of natural gas), such as heating, power production, use in transportation, synthesis of chemicals and polymers, carbon black production, etc.;
- ↙ **Extraction and use of other fossil fuels**, such as oil shale, peat, etc.;
- ↙ **Biomass fired power and heat production**, using wood, straw, etc.;
- ↙ **Geothermal power production.**

Sub-categories - example

Main category - Extraction and use of fuels/energy sources

Chapter	Sub-category	Air	Water	Land	Product	Waste/ residue	Main inventory approach
5.1.1	Coal combustion in large power plants	X	x	x	x	X	PS
5.1.2	Other coal combustion	X		x	x	x	OW
5.1.3	Extraction, refining and use of mineral oil	X	X	x	x	x	OW/PS
5.1.4	Extraction, refining and use of natural gas	X	X	X	x	X	OW/PS
5.1.5	Extraction and use of other fossil fuels	X	x	x		x	OW
5.1.6	Biomass fired power and heat production	X	x	x		x	OW
5.1.7	Geothermal power production	X					PS

Notes: PS = Point source by point source approach; OW = National/overview approach;
 X - Release pathway expected to be predominant for the sub-category;
 x - Additional release pathways to be considered, depending on specific source and national situation.

Relevant mercury controls that can be included in the Level 1 inventory step

Source sub-category	Mercury control name in IL1 spreadsheet	Explanation
Coal combustion in large power plants /	0: No filters	
	1: Simple particle filters	Electrostatic precipitators (ESP), particle scrubbers (PS), cyclones (CYC) or similar particle filters with low mercury retention
	2: Fabric filters	Fabric filters (FF; also called bag filters)
Coal combustion in coal fired industrial boilers	3: Efficient APC	Particle filters (PM) + spray dryer absorption (SDA) or wet flue gas de-sulphurisation (wFGD)
	4: Very efficient APC	Particle filters (PM) plus + flue gas de-sulphurisation (FGD) + selective catalytic reduction (SCR)
	5: Mercury specific	Activated carbon injection (ACI) or other mercury specific filters
Combustion/use of petroleum coke and heavy oil AND	ESP or scrubber	Electrostatic precipitators (ESP), particle scrubbers (PS), or other particle filters with similar performance
	cESP and FGD	Cold-side electrostatic precipitators (cESP) + flue gas de-sulphurisation (FGD), or other advanced filter configuration with similar performance
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates		
Extraction and processing of natural gas	Without mercury removal	
	With mercury removal	Cleaning of gas in fixed bed filters with mercury absorbants (or similar)



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