Technical Report for the MVB (MSW & Biomass) Waste to Energy Plants and the AVG Hazardous WTE Plant in Hamburg, Germany

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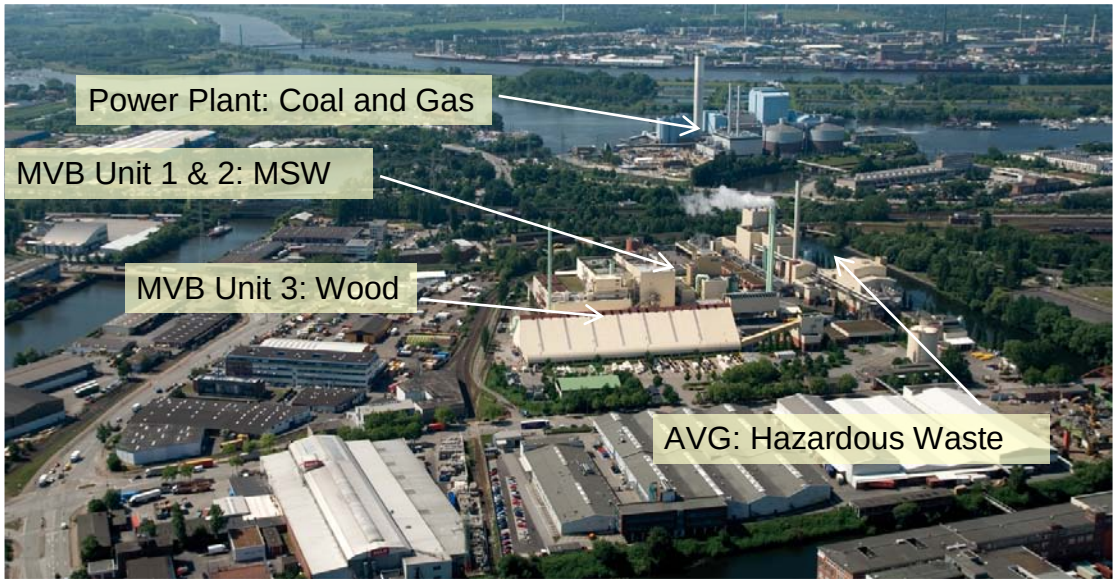

1. MVB Waste to Energy (WtE) Plant (Unit 1&2)

Main Technical Details:

- The WTE plant was commissioned on 1994 and acquired an investment cost of 186 million €
- There are 2 incineration lines, treating an overall waste capacity of 325,000 tpa (LHV 9 Mj/kg), from which 92% is MSW, 4% is commercial waste and 4% is bulky refuse
- The shareholders are per 85.5% the Vattenfall Europe New Energy GmbH and per 14.5% the E.ON Energy from Waste AG
- The flowrate of the produced steam is 70 tph per line, at 19 bar and 380° C
- The main energy product is heat, which is supplied to the municipal district system of Hamburg
- On 2009 the plant functioned for 315 days and delivered 736,340 MWh of steam energy
- The plant is also equipped with a small steam-turbine producing 3 MW for the plant's internal needs
- The filtration part of the plant is equipped with SNCR technology, baghouse filters, HCl & SO_2 scrubbers

- The plant's residuals are 61,721 tpa bottom ash (19% of the initial feed), 8,177 tpa fly ash (2.5% of the initial feed) and 9,117 tpa scrap metals (2.8 % of the initial feed)
- The plant's emissions are showed to the following tables:

Continuously Measured Emissions	**NO_x**	**CO**	**Dust**	**Cges**	**HCl**	**SO_2**	**Hg**
Average 2009 (mg/m3)	98.3	7.4	0.3	0.2	0.2	5.5	0.0038
Legal Limits (mg/m3)	200	50	10	10	10	50	0.03

Discontinuously Measured Emissions	**HF**	**Cd+Tl**	**Sb-Sn**	**As-BaP**	**PCDD/F**
Average 2009 (mg/m3)	0.045	0.0006	0.0066	0.0017	0.0085
Legal Limits (mg/m3)	4	0.05	0.5	0.05	0.1

2. MVB Wood Residuals & Waste Wood (Biomass) Energy Recovery Plant (Unit3)

- The Biomass energy recovery plant was commissioned on 2005 and acquired an investment cost of 42 million €
- The overall biomass capacity of 158,000 tpa (LHV 13 Mj/kg) is treated in one incineration line, from which 65% is A1 - A3 waste wood category and the rest 35% is A4 category, according to the following table:

Category A1	natural or only mechanically treated waste wood (not more than insignificantly contaminated with foreign substances)
Category A2	glued, varnished, coated, painted or otherwise treated waste wood without organic halogen compound and without wood protection agents
Category A3	waste wood coating with organic halogen compound, wihtout wood protection agents
Category A4	waste wood treated with wood protection agents such as railway sleepers, line poles, hop poles, vine stakes and other types of waste wood

- The shareholders are per 85.5% the Vattenfall Europe New Energy GmbH and per 14.5% the E.ON Energy from Waste AG
- The applied boiler technology is circulating fluidised bed having an efficiency rate of 92.24 %
- The flowrate of the produced steam is 90 tph per line, at 90 bar and 500° C
- The plant is equipped with a steam turbine of 20 MWe
- On 2009 the plant functioned for 330 days and delivered 159,420 MWh of electrical energy

- The filtration part of the plant is equipped with cyclones, calcium hydroxide activated carbon and baghouse filters.
- The plant's residuals are 6,417 tpa fine combusted bed ash (4% of the initial feed), 4,967 tpa rough combusted bed ash (3.15% of the initial feed) and 6,978 tpa flue dust (4.4 % of the initial feed)
- The plant's emissions are showed to the following tables:

Continuously Measured Emissions	**NO_x**	**CO**	**Dust**	**Cges**	**HCl**	**SO_2**	**Hg**	**HF**
Average 2009 (mg/m3)	86	13	0.6	0.8	2.0	2.7	0.1	0.1
Legal Limits (mg/m3)	200	50	10	10	10	50	0.03	4

Discontinuously Measured Emissions	**Cd+Tl**	**Sb-Sn**	**As-BaP**	**PCDD/F**
Average 2009 (mg/m3)	0.0008	0.011	0.0023	0.0012
Legal Limits (mg/m3)	0.05	0.5	0.05	0.1

3. AVG Hazardous Waste To Energy Recovery Plant

- The AVG plant was established on 1971 and between 1994 - 1997 were spent 200 million € for reconstruction
- There are 2 incineration lines feeded with an overall annual waste capacity of 159.000 tons (HWI), from which the 40% is international waste (out of Germany boundaries)
- The 2 incineration lines are equipped with rotary kilns, in which hazardous wastes remain for 2 sec at a temperature greater than 1,100 ° C (up to 1250 ° C)
- The high temperature incineration plant is equipped with storage units according to the kind of waste, chemical-physical treatment units, separation units and temporary storage of waste
- Between 750 and 840 kinds of different hazardous waste are acceptable (according to EWC) to be treated in the AVG plant. Mainly the following categories:
  1. Residues from production and off-spec-products from pharmaceutical, chemical industry and others
  2. Organic and inorganic laboratory wastes
  3. Hospital wastes
  4. Pesticides
  5. Paints, varnishes, resins
  6. PCB-oils
  7. Wastes containing dioxin
  8. Wastes containing halogen
  9. Contaminated filter materials and absorbent materials

10. Soil from contaminated sites

- The flowrate of the produced steam is 34 tph per line, at 20 bar and 380° C
- The main energy product is heat, from which the 70% is supplied to the municipal district system of Hamburg and the rest 30% covers internal needs
- The filtration part of the plant is equipped with electrostatic precipitator, HCl & SO_2 scrubbers and activated carbon filters
- The plant's emissions are showed to the following tables:

Measured Emissions	**NO_x**	**CO**	**Dust**	**HCl**	**SO_2**
Average 2009 (mg/m3)	< 95	< 45	< 8	< 5	< 30
Legal Limits (mg/m3)	200	50	10	10	50

Measured Emissions	**Cd+Tl**	**Sb-Sn**	**PCDD/F**	**Hg**	**HF**
Average 2009 (mg/m3)	< 0.01	< 0.2	< 0.05	< 0.02	< 0.1
Legal Limits (mg/m3)	0.05	0.5	0.1	0.03	4


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