

GREENPEACE

**WASTE
INCINERATION
PLANTS IN AUSTRIA**

**WITH DATA ON WASTE
MANAGEMENT IN VIENNA**

Herwig Schuster

Vienna, June 1999

WASTE INCINERATION PLANTS IN AUSTRIA	3
AIR POLLUTION	4
Air emissions of the Austrian incineration plants	4
Analyses of air pollutants	4
Exceedings of emissions	5
SEWAGE	5
SOLID WASTES FROM BURNING PLANTS	5
Slag	5
Filter ash	6
Filter cake	6
POLLUTION CONTROL EQUIPMENT	7
HUMAN RESOURCES	7
ENERGETIC OUTPUT	7
ECONOMIC PARAMETERS OF WASTE INCINERATION	8
AVOIDING AND RECYCLING	9
SUMMARY	10
SOURCES	10

This inquiry shall give an overview about the Austrian waste incineration and waste management system. It's aim is to give figures but not an assessment. This inquiry was done on request from Greenpeace International to clarify the Austrian situation, because the Austrian incinerators are - especially in Southern European countries as well as in Asia – promoted as “positive examples for incinerators from Europe”. The results of this inquiry are not planned to be “actively” published in Austria.

Waste incineration plants in Austria

In Austria there are three incineration plants for municipal solid waste:

- Two in Vienna („Spittelau“ with a capacity of about 260.000 t¹/y and „Floetzersteig“ with about 200.000 t/y)
- One in Wels (province of Upper Austria) with about 60.000 t/y

There are no other plants for municipal waste incineration but many plants burning special waste fractions (e.g. wooden or plastic waste fractions in cement industry) and industrial steam plants using internal waste. In Vienna there is also a hazardous waste burning plant called „EbS“ with a capacity of 75.000 t/y.

¹ metric tons

Air pollution

Air emissions of the Austrian incineration plants

The following table is according to industries figures. All figures are in mg/m³ referred to 11 % oxygen. This means that the emission of a plant is calculated due this oxygen concentration in waste gas. This prevents a mixing of waste gas with clean gas to “reduce” emissions and allows a comparison of different plants. The mass flow refers to the plant „Spittelau“ with a waste turnover of 260.000 tons per waste.

Compound	Legal framework ²	„Floetzersteig“	„Spittelau“	Wels ³	Mass flow of „Spittelau“
Dust	15	2-2,9	0,8-2		< 2900 kg/y
Hydrogen chloride HCl	10	0,5-1,9	0,5-0,7		< 950 kg/y
Hydrogen fluoride HF	0,7	0,04-0,13	0,03-0,04		< 58 kg/y
Sulphur dioxide SO ₂	50	3,9-8,4	4-4,2		< 5800 kg/y
Carbon monoxide CO	50	13-19,6	21-22		< 32000 kg/y
Nitrogen oxides NO _x	100	16-18,1	21		< 32000 kg/y
Hydrocarbons	20	0,4	0,5-0,6		< 800 kg/y
Sum of Lead, Zinc and Chromium	2	0,06-0,07	0,08		< 116 kg/y
Sum of Arsen, Nickel and Cobalt	0,5	0,023-0,03	0,04-0,05		< 60 kg/y
Cadmium	0,05	0,002-0,015	0,0005-0,0020		< 230 g/y
Mercury	0,05	0,01-0,025	0,003-0,025		< 2,5 kg/y
Ammonia NH ₃	5	0,86	n.n.		< 1250 kg/y
Polychlorinated Dioxins and Furans in I-TEF	0,1 ng/m ³	0,03-0,04	0,03	0,01	< 43 mg/y

Analyses of air pollutants

The following parameters are continually measured: Dust, HCl, SO₂, NO_x, CO, Hydrocarbons, NH₃. All these parameters are on-line reported to the authority.

Polychlorinated Dioxins and Furans are analysed monthly.

Heavy metals and HF are analysed once a year.

All analysis must made public, emissions exceeding allowed limits must be communicated actively to the public on tables in front of the plant and of the Town Hall.

² The Austrian incineration plants operate under Clean Air Act emission limits. Only for „Floetzersteig“ there are some parameters less restrictive due to old approval

³ Data not yet available

Exceedings of emissions

In the last years exceedings were limited to carbon monoxide (one short-time⁴ exceeding per plant and month, not more than 50 % over legal maximum) and nitrogen oxides (some short-time small exceedings a year).

The carbonmonoxide-exceeding occur if waste with a too high caloric value is burned (too much plastics).

Sewage

Quantity: 440 kg/t waste

Quality: the following table gives an overview of maximum legal emissions and real emissions of „Spittelau“ (all figures in mg/l). The mass flow refers to the plant „Spittelau“ with a turnover of 260.000 tons waste per year.

parameter	legal em.	„Spittelau“ - concentration	Mass flow per year (kg/y)
filterable substances	30	20-30	3,4 t/y
Al	2	0,1-0,2	23 kg/y
As	0,1	<0,002	0,23 kg/y
Pb	1	0,01	1,1 kg/y
Cd	0,1	<0,001	0,11 kg/y
Cr	0,1	<0,05	5,5 kg/y
Co	0,5	<0,05	5,5 kg/y
Fe	2	<0,05	5,5 kg/y
Cu	1	<0,05	5,5 kg/y
Ni	2	<0,05	5,5 kg/y
Hg	0,01	<0,001	0,11 kg/y
Ag	0,1	<0,05	5,5 kg/y
Zn	3	<0,05	5,5 kg/y
Sn	0,5	<0,02	2,2 kg/y
Cl	18000	7500-11400	1.100 t/y
CN	0,1	<0,006	0,7 kg/y
F	9	5,7-7,9	800 kg/y
TOC	30	4,1-5,8	570 kg/y
Phenole-Index	0,3	0,01	1,1 kg/y
PAK	nn	<0,13 ug	15 g/y
EOX	0,1	<0,009	1 kg/y
POX	nn	<0,018	2 kg/y
Hydrocarbons	nn	<0,05	5,5 kg/y
Dioxins/Furans	nn	38 pg/l	4 mg/y

Solid wastes from burning plants

There are three different kinds of wastes:

Slag

Slag: 230 kg/t waste („Spittelau“) – 278 kg/t („Floetzersteig“)

In Vienna, the slag is mixed up with cement and water and is used in landfill construction for border walls as a slag-filter ash concrete.

⁴ not more than 20 minutes

In Wels, most of the slag and all of the filter ash are landfilled in a landfill for residual waste. A small part of the slag is mixed with cement and used as covering of a landfill.

Analyses of slag of „Spittelau“ (in mg/kg):

Sb	As	Pb	Cd	Cl	Cr	F	Cu	Hg	Zn	Dioxins/Furans
49	15	2030	9	3000	312	300	1652	1	2000	2 ng/kg

Filter ash

Filter ash: 15 kg/t waste („Floetzersteig“) – 19 kg/t („Spittelau“)

In Vienna the filter ash is mixed with the slag and used in concrete (see above). This may be critical due to high contents of heavy metals in filter ash.

The following table gives an overview of filter ash concentrations (all figures in mg/kg):

Parameter	literature ⁵	Hinwil (CH)	Vienna	Mass flow of „Spittelau“
Zinc	4700	37010	13400	67 t/y
Lead	2000	10690	4200	21 t/y
Cadmium	21	526	230	1,1 t/y
Mercury	0,7		19	0,1 t/y
Chlorid	2800	79500	71000	350 t/y
Chromium	1200		470	2,3 t/y
Copper	2100	1863	710	3,5 t/y
Antimony			310	1,5 t/y
Arsenic			14	70 kg/y
Dioxins/ Furans			2160 ng/kg	10,67 g/y
loss of ignition			1.4 %	

Filter cake

Filter cake from water treatment: 1,1 kg/t waste („Spittelau“) – 1,3 kg/t („Floetzersteig“)

The filter cake is disposed as hazardous waste, exported to Germany and there stored in a disused salt mine in Heilbronn.

⁵ Thomé-Kozmiensky, Technologie der Abfallbehandlung

Pollution control equipment

The pollution control equipment is similar in all three Austrian plants:

Air cleaning:

- Electrostatic precipitator for dust reduction
- 2-stage flue gas scrubber (for reduction of SO₂, HCl, HF)
- Fine dust separator
- SCR-DeNO_x-facility (based on selective catalytic reaction and ammonia)

The plant in Wels has an additional activated carbon filter installed.

Water retreatment:

The heavy metal compounds dissolved in the discharge water from the first scrubber are first converted to insoluble form in a precipitation reactor, by dosing lime slurry as well as special precipitation and flocculation agents (e.g. Ferrous sulphate FeSO₄). Then the suspension is cleared in a chamber filter press. The filter cake with a water content of about 30 % is filled into big bags, the water is passed into the public sewage system or into the receiving water (e.g. „Spittelau“ into the river Danube).

Human resources

A high level of training is essential for well-working of the plant. More than 80 people are employed in a plant, more than 80 % of them have a special training (electrician, electronic engineer, welder, technical engineer, chemist,...).

Energetic output

In all plants there is a power-heat-combination. 116 kWh electricity and 1.920 kWh heat are produced per ton waste input. Thereof 78 kWh electric and 40 kWh thermic are used by the plant itself.

Referred to an average caloric value of 8.200 kJ/kg waste and an additional input of about 20 kg gas per ton waste that means a total plant efficiency of 76 %.

Economic parameters of waste incineration

The following figures refer to the plants in Vienna (with a capacity of 200.000-250.000 tons a year). The cost structure may be different at other smaller or larger incinerators.

Fees for waste take-over:

Waste from municipal waste disposal:	116 EUR ⁶
Waste from private companies:	218 EUR

Total investment cost: 182.000.000 EUR at minimum
Two thirds are due to environmental technique (air and water cleaning, burning optimization)

Cost structure (own calculation due to plant's figures) per year:

Output:

Pay-back of investment (interest: 7 %, 15 years)	15.100.000 EUR
New investments (adaptation to the level of technique)	3.600.000 EUR
Personal costs	3.500.000 EUR
Other fix costs (assurance, measures, maintainance,..)	2.300.000 EUR
Variable costs	4.400.000 EUR
thereof: gas:	1.600.000 EUR
disposal of slag/ash	1.500.000 EUR
disposal of filter cake (export)	340.000 EUR
chemicals (lime, soda lye, ammonia, precipitation agents)	440.000 EUR
All others	520.000 EUR
Total sum of costs per year	28.900.000 EUR

Input:

Heat output	4.000.000 EUR
Electricity output	300.000 EUR
Total sum of input costs per year	4.300.000 EUR

Money need per year 24.600.000 EUR

Costs per ton waste 123 EUR

All waste treatment plants in Vienna are owned by the City of Vienna. Thus there is a direct tax money flow to the plants to prevent losses.

⁶ 1 EUR = 13,7603 ATS

Avoiding and recycling

As often Vienna's incinerators are case study examples used by technology companies to sell incineration technique into developing countries like the Philippines.

The Austrian Federal Waste Law implements the following waste strategy:

First avoid, then recycle, then dispose.

Only in the third level disposal fits in. Therefore in the following chapter the Vienna municipal waste management system is described. Many activities are made for many years already to avoid waste and separate different waste streams (e.g. glass, paper) with quite high efficiency.

Example Vienna:

The following fractions are collected separately: glass (white and coloured), metals, paper/cardboard, packagings plastics and organic waste. In special centers some other fractions are collected (e.g. wood, textiles). The given figures only refer to household and household-like waste, not to industrial waste.

In 1998 the following amounts were collected and recycled:

Paper and cardboard	127.000 t
Organic waste	83.000 t for composting
Metals	28.000 t
Glass	23.700 t
Plastics	<u>6.700 t</u> for material or "thermal" recycling
Sum of these 5 fractions	268.400 t for material recycling
Other fractions (wood, textiles)	<u>76.000 t</u> for "energetic" use or downcycle
All together	344.400 t are separately collected in Vienna each year

Waste for disposal:

Municipal waste	470.000 t collected by the City of Vienna
Street cleaning	30.000 t
Others	<u>40.000 t</u> e.g. collected by private companies
All together	540.000 t
	429.000 t go to „Floetzersteig“ and „Spittelau“
	3.000 t go to other burning plants (special waste)
	108.000 t go to landfills

Besides there is a well-working collection of hazardous wastes via disposal centers (batteries, mineral oils, used vegetable oils (for soap production), chemicals,..). Roughly 5.000 tons are separately treated each year.

In Vienna 38 % of all wastes are collected separately and recycled.

Regarding the single fractions the following percentage is recycled:

Metals	92.2 % (including 25 % from incineration plants)
Paper	65.5 %
Glass	57.5 %
Organic waste	33 %
Plastics	not available (certainly under 10 %)

These figures are significantly higher in other parts of Austria. The smaller the town the better the recycling percentage (paper up to 85 %, glass up to 90 % and organic waste up to 50 %). Due to high contaminations with other waste and heavy metals the collection of organic waste cannot be increased in highly populated areas.

Summary

According to the waste management principle “avoiding-recycling-disposing” there is a quite consequent waste dividing and recycling in Austria. Waste dividing is obligatory in Austria. Currently Vienna’s recycling rate is about 38 % and this amount could still be higher by optimizing the collecting system especially for organic waste and plastics. A recycling rate of 50 % may be realised.

The Austrian incineration plants have a high environmental standard as far as air and water emissions are concerned. Compared to other sources (industry, traffic,...) air and water emissions are relatively low.

Ecologically critical is the disposal of solid wastes from incineration plants. Especially the filter ash from air cleaning is containing large amounts of dioxins and furans and toxic heavy metals. In Vienna this ash is mixed up with cement and used as slag concrete in landfill construction. As the Austrian Waste Management Act only defines leaching criteria for disposal this practise is legal but critical due to future dioxin emissions out of the concrete.

Sources

- Austrian Environmental Agency, www.ubavie.gv.at
- City of Vienna, waste management department (MA 48), telephone information
- Fernwaerme Wien, incinerator operator, companies publications and information from personal communications with „Floetzersteig“ and „Spittelau“
- WAV Wels, waste incineration company, personal communication
- Thomé-Kozmiensky, Technologie der Abfallbehandlung, 1998
- www.ctu.ch
- www.lua.nrw.de

Greenpeace Austria
Siebenbrunnengasse 44
A-1050 Vienna
phone: ++43/1/5454580
fax: ++43/1/5454588
<http://www.greenpeace.at>