



The POP protocol in practice

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Introduction

- The POP Protocol in a nutshell
- Substances and sources
- General approach to BAT
- Examples of BAT
- Implementation of the POP Protocol in the Netherlands
- Examples from the Netherlands
- Conclusions



The POP Protocol in a nutshell

What (article 2)

- Control, reduce or eliminate discharges, emissions and losses of POPs

How

- Ban: to eliminate production and use (Annex I)
- Restricted use (Annex II)
- Reduce emissions by application of BAT (Annex III)



12 Substances Annex I

- Aldrin
- Chlordane
- Chlordecone
- Endrin
- DDT
- Dieldrin
- Heptachlor
- Hexabrombiphenyl
- Hexachlorobenzene
- Mirex
- PCB's
- Toxaphene



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Substances Annex II and III

Annex II

- DDT
- HCH
- PCB

Annex III

- PAHs
- PCDD/Fs
- Hexachlorobenzene



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Pathways of emissions of POPs

- Unintentional releases of unintentional by-products
- Product use (e.g.pesticides)
- Releases from products in use
- Releases after service life (waste)



Source categories under the POP protocol

1. Public heat and power production
2. Residential combustion
3. Industrial combustion and processes
4. Solvent and product use
5. Road transport
6. Non-road transport
7. Waste incineration
8. Agriculture



Source categories and substances

1. Public heat and power production (PCB)
2. Residential combustion (PCDD/F, PAH)
3. Industrial combustion and processes
(HCB, PCB, PCDD/F, PAH)
4. Solvent and product use (PCB, HCH)
5. Road transport (PAH)
6. Non-road transport
7. Waste incineration (PCDD/F)
8. Agriculture (HCH)

**Estimate of emissions, 2000, UNECE/Europe
tonnes/year, kg Teq/year**

| Source | HCB | HCH | PCB | PCDD/F | PAH |
|---------------|--------------------|-------------------|-------------------|-------------------|--------------------|
| 1.PHP | | | 4,0 | 0,65 | 5,8 |
| 2.RCO | 0,1 | | 0,9 | 2,4 | <u>2041</u> |
| 3.IND | <u>11,3</u> | | 3,2 | 2,1 | 863 |
| 4.SPU | 0,1 | <u>207</u> | <u>125</u> | 0,03 | 29 |
| 5.ROT | | | 0,1 | 0,07 | 158 |
| 6.NRT | | | | 0,05 | 6,8 |
| 7.WAS | 0,5 | | 0,3 | <u>6,4</u> | 4,6 |
| 8.AGR | 6,2 | 47 | | 0,01 | |
| Total | 18 | 254 | 133 | 11,7 | 3208 |



Stationary sources

- Industrial combustion and processes
- Public heat and power production
- Waste incineration

Annex V of the POP Protocol gives information on BAT



General approach to BAT (Annex V, art 10)

Prevention

- Replace feed materials
- Best practice (good housekeeping, maintenance)
- Modify process design

Abatement

- Flue gas cleaning (end of pipe)
 - by destruction or separation

Control

- Treat residuals



General approach to BAT: Prevention

- Feed materials:
 - reduce chlorine content of fuel, raw materials and waste
- Best practices:
 - cleaning, maintenance, management
- Process design:
 - temperature > 850 C
 - residence time > 2 sec
 - Oxygen content, mixing conditions



General approach to BAT: Abatement

Destruction

- Incineration
- Catalytic oxidation

Separation

- Filters (fabric filter, electrostatic precipitator, ceramic filter)
- Absorption: wet scrubber
- Adsorption: activated carbon



General approach to BAT: Control of residuals

- Combustion in a waste treatment plant
- Controlled landfill



Integrated approach

Abatement of POPs can be combined with:

- Heavy metals
- Other VOCs
- Particulate matter
- SO₂ and NO_x



Example BAT: PCDD/F waste incineration

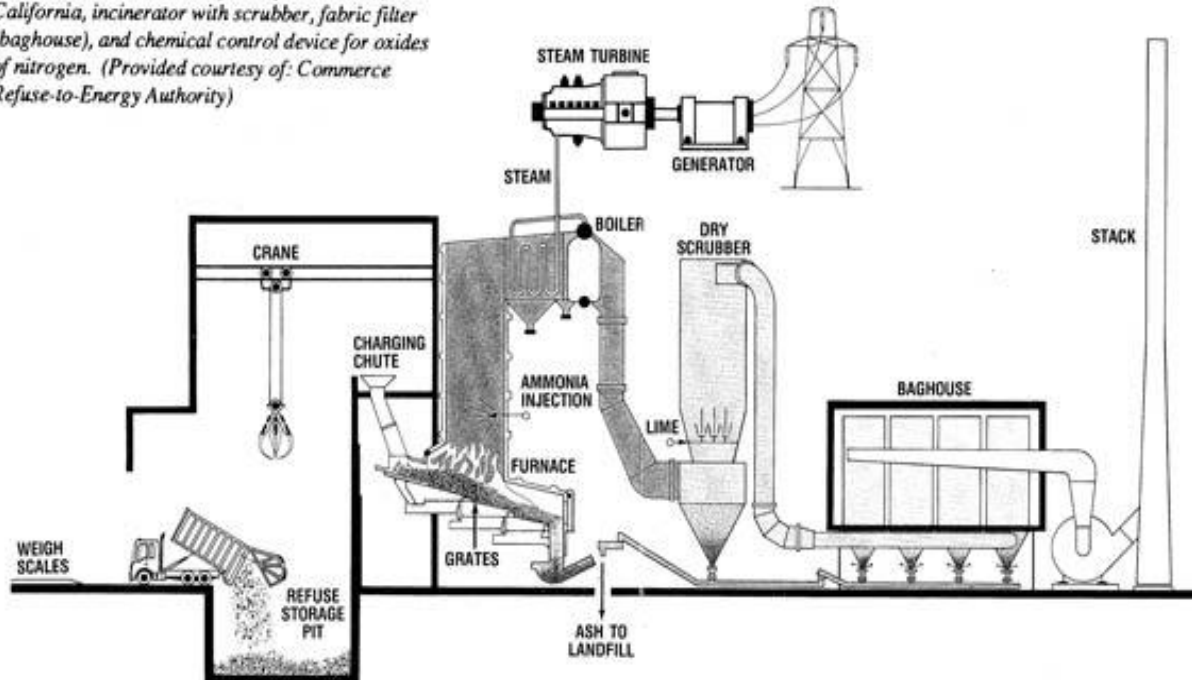
Waste incineration (Annex V, chapter IV)

- Control of chlorine content in the waste feed (PCBs)
- Process design: temperature, residence time
- Dust filtration: ESP or fabric filter
- Adsorption: fixed bed activated carbon

Performance: TEQ \ll 0,1 ng/m³

Example BAT: PCDD/F waste incineration

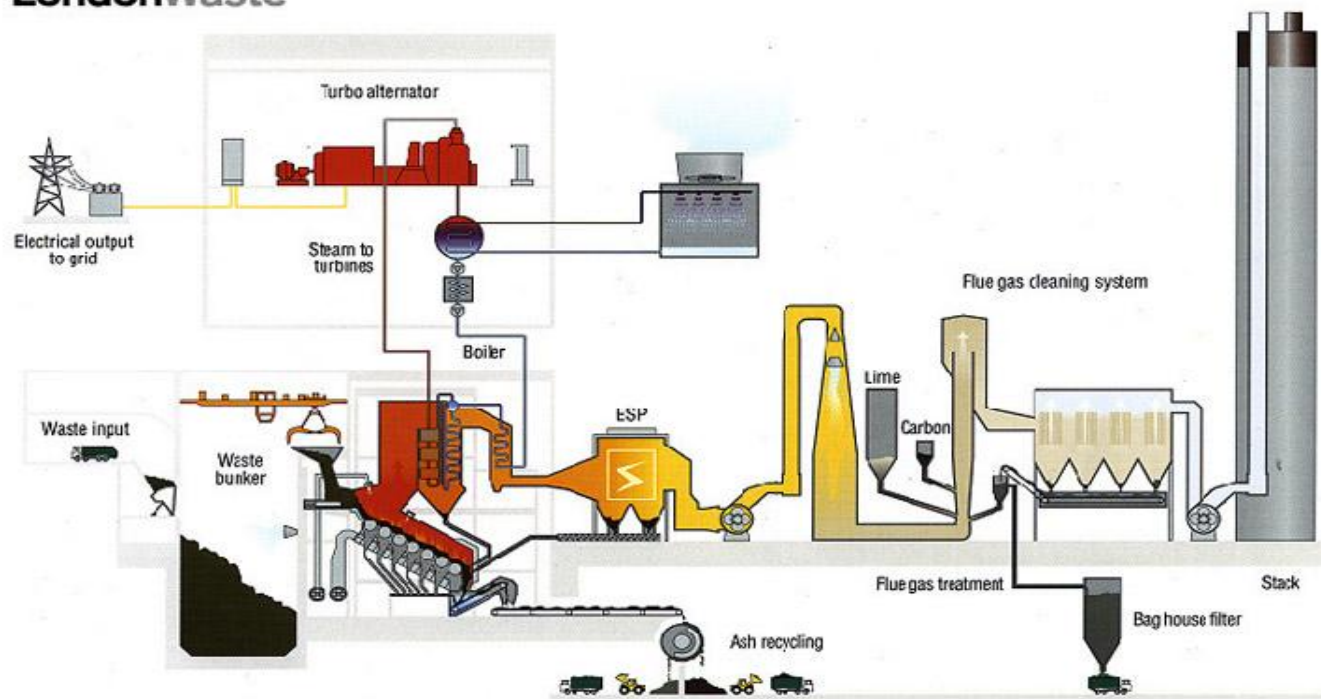
Figure 3-7 Schematic diagram of Commerce, California, incinerator with scrubber, fabric filter (baghouse), and chemical control device for oxides of nitrogen. (Provided courtesy of: Commerce Refuse-to-Energy Authority)



Example BAT: PCDD/F waste incineration



Waste to Energy Plant Schematic

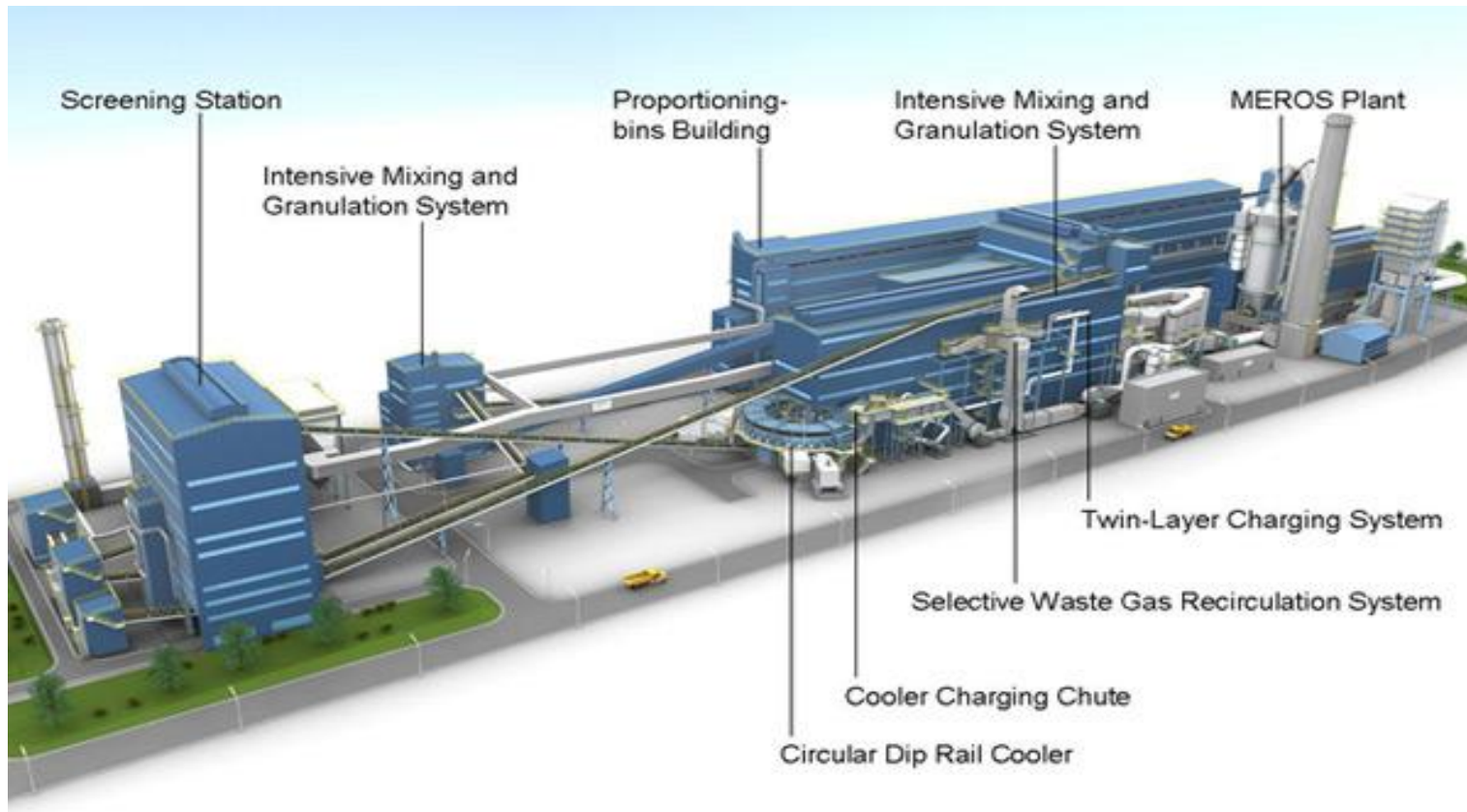


Example BAT: PCDD/F metallurgical industry

Sinterplant in steelworks (Annex V, chapter IV)

- Encapsulation of sinter strand
- Waste gas recirculation
- ESP : < 4 ng/m³ TEQ
- ESP + limestone/activated carbon: < 0,1 ng/m³ TEQ
- high efficiency scrubber: < 0,4 ng/m³ TEQ

Example BAT: PCDD/F metallurgical industry



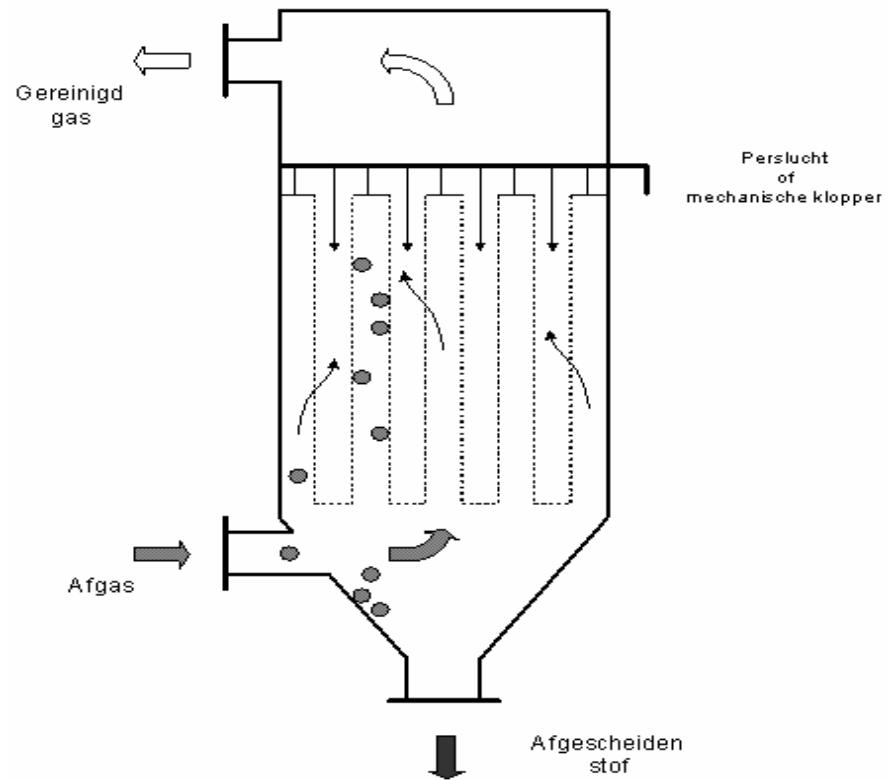


Example BAT: PCDD/F secondary aluminium

- Avoiding halogenated material
- Cleaning aluminium scrap
- Fabric filter
- Fabric filter + limestone/activated carbon: < 0,1 ng/m³ TEQ

Example BAT: PCDD/F secondary aluminium

Doekenfilter



Example BAT: PCDD/F secondary aluminium





Example BAT: PAH Residential combustion

Wood stoves, coal fired stoves (Annex V, chapter V)

- Fuel selection (dry coal, dry wood)
- Product standards, e.g. CEN
- Public information programme



Implementation of the POP Protocol in the Netherlands (NI)

- Ban of substances
use in NI not allowed
- Limitations of use
legislation
- Implementation of BAT through
guidelines and environmental licenses
national programmes
- Implementation of ELVs
in national legislation



NI example: general measures to reduce PCDD/F

Reduction of chlorine content and PCB content in fuels.

- National legislation for all fuels:
 1. Chlorine content < 50 mg/kg
 2. PCB content < 0,5 mg/kg
- Result
 - Reduction of PCDD/F levels in environment



NI example: reduction of PCDD/F from MWIs

Policy instruments for reduction of PCDD/F from municipal waste incinerators (MWIs)

- International policy framework
 - EU-WID 2000/76/EC, IPPC 96/62/EC and BREFs
 - UN/ECE POP Protocol
- National legislation for municipal waste incinerators
- National guideline and licensing for small incinerators
- Management of chlorine content of waste



NI example: reduction of PCDD/F from MWI's

Emission limit value for PCDD/F from waste incineration

- POP Protocol Annex IV art 7 and Annex V chapter IVA
 1. ELV = 0,1 ng/m³ TEQ
 2. Residence time = 2 sec, temperature 850 C
- BAT based on activated carbon adsorption
- Result:
 1. MWI's: PCDD/F << 0,1 ng/m³ TEQ
 2. > 99% Emission reduction from 400 gram TEQ / year to < 4 gram TEQ/year



NI example: reduction of PCDD/F from a sinterplant

BAT emission level for PCDD/F from sinter plants

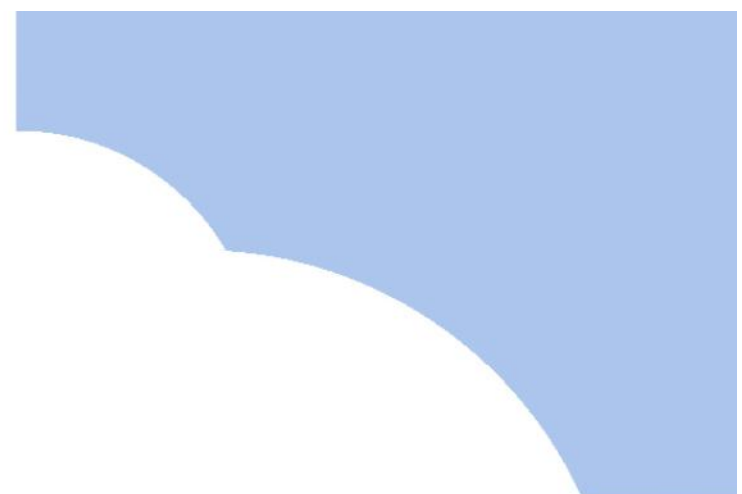
POP Protocol Annex V, chapter IV B

1. Emission level 0,1 – 0,4 ng/m³ TEQ
 2. BAT = activated carbon adsorption or high efficiency scrubber
- National emission guideline:
 1. ELV in permit PCDD/F < 0,4 ng/m³ TEQ
 - Result:
 1. Air fine scrubber installed
 2. emission < 0,4 ng/m³ TEQ



Conclusions

- BAT in Annex V of the Protocol is sufficient to reach ELVs in Annex IV
- Implementation of BAT in Annex V will bring large reductions of emissions of POPs
- BAT to reduce POPs can also reduce other pollutants (HM, PM, VOC, SO₂, NO_x)



Thank you for your attention