

A photograph of an industrial facility, likely a power plant or refinery, under a blue sky with scattered white clouds. In the foreground, two workers wearing grey uniforms and white hard hats are walking on a paved path. A tall, silver street lamp stands to the left of the workers. The background shows complex metal structures, pipes, and scaffolding of the industrial plant.

uni per

Emission standards and regulations for biomass heat and power

Dr Steve Griffiths, Environmental Compliance January 2019

Involvement with IED / BREF /MCPD

- Environmental Compliance Team
- Cover planning and environmental permit applications
- Air quality, water quality, noise modelling, monitoring and assessment
- Abatement and cost benefit assessments
- Emission measurements
- Advice on bioenergy
- Implications of Environmental Regulation

- Involved with IED / MCPD since initial proposals from European Commission
- Provided Technical support for industry positions – Uniper, Energy UK, TWG
- Member of stakeholder groups on UK implementation of the IED / BREFs / MCPD and specified generator arrangements
- Drafted compliance protocols, generic BAT positions, consultation responses
- Member of Defra sub-group on MCPD/specified generator monitoring

Contents (and acronyms)

- Regulatory Regimes for Biomass
- The Industrial Emissions Directive (IED)
 - Large Combustion Plant BREF
 - Waste Incineration BREF
- The Medium Combustion Plant Directive (MCPD)

BAT - Best Available Techniques

BREF - BAT Reference document

ELV – Emission Limit Value

AEL – BAT Associated Emission Limit

Regulatory Regimes for Biomass

Thermal rating is in MW_{th} of fuel input unless otherwise stated

Regulatory Regime	Coverage	Species
Industrial Emissions Directive (IED) and associated BREFs	Combustion Sites $\geq 50 MW_{th}$ (BAT) Combustion Plant $\geq 50 MW_{th}$ (ELVs) All waste Incineration installations (BAT/ELVs)	Many SO_2 , NO_x , Dust Many
Medium Combustion Plant Directive (MCPD)	Combustion Plant $\geq 1MW_{th}$ and $< 50MW_{th}$	SO_2 , NO_x , Dust
Specified Generator Requirements	Combustion plant generating electricity commercially $< 50 MW_{th}$	NO_x
Eco Design Directive	Solid Fuel Boilers $\leq 0.5 MW_{th}$ output Space Heaters $\leq 0.4 MW_{th}$ output	NO_x , dust, CO, organic gases
Clean Air Act 1993	Prohibition Abatement requirements Chimney height requirements	Dark Smoke Dust and grit

Some schemes also set emission criteria for qualification e.g. Renewable Heat Incentive

Exempt Biomass or Waste – IED / MCPD

- **“Biomass” is defined in the IED (Article 3,31) and MCPD as:**

products consisting of any whole or part of a vegetable matter from agriculture or forestry which can be used as a fuel for the purpose of recovering its energy content **and** the following **waste** used as a fuel:

(a) vegetable waste from agriculture and forestry;

(b) vegetable waste from the food processing industry, if the heat generated is recovered;

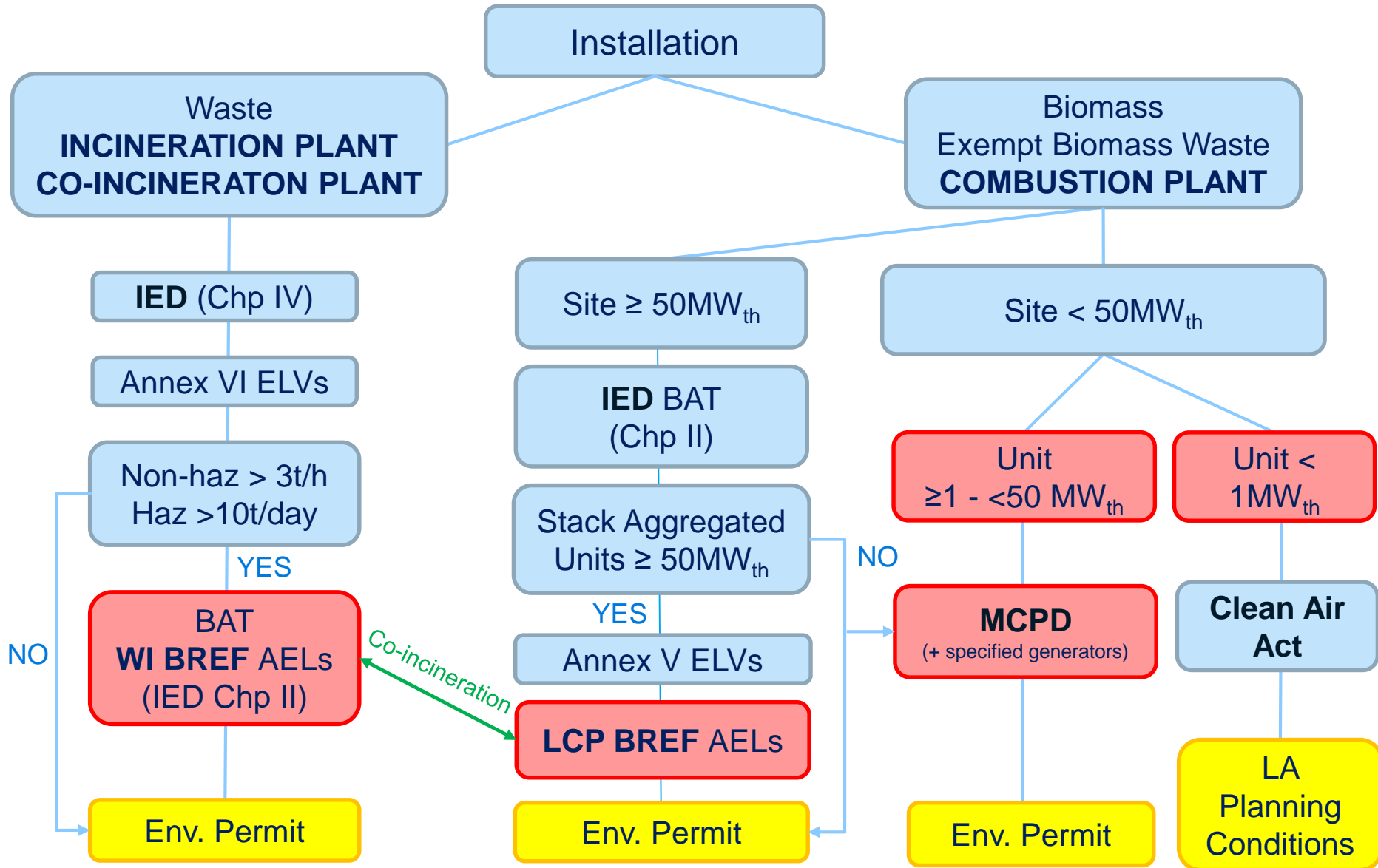
(c) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and the heat generated is recovered;

(d) cork waste;

(e) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating, and which includes in particular such wood waste originating from construction and demolition waste;

- **Any other waste biomass will be classified as “Waste”**

Regulations for Biomass / Waste Plant



IED and BREF

IED

- Full effect from 1 Jan 2016
- Must hold an environmental permit
- Sets minimum emission standard ELVs
- Requires Best Available Techniques (BAT) compliance
- Combustion sites $\geq 50\text{MW}_{\text{th}}$
- Waste incinerators and co-incinerators

BREFs

- Produced for each IED activity
- Set BAT Associated Emission Limits AELs
- BAT conclusions are legally binding
- Four years from publication to comply
- Derogation from AELs where costs are disproportionate to environmental benefits due to geographical location, local environmental conditions or technical characteristics of installation

LCP BREF	NOx	CO	NH ₃	SO ₂	HCl	HF	Dust	Hg	TM	Cd+Pb	PCDD/F	TVOC
Biomass	✓ IED	✓	✓	✓ IED	✓	✓	✓ IED	✓				
Co-Incineration	✓ IED	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
WI BREF												
All Fuels	✓ IED	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓*	✓

IED definitions – Combustion Plant

Combustion Plant

any technical apparatus in which fuels are oxidised in order to use the heat thus generated;

BAT APPLIES TO

Combustion of fuels in **installations** with a total rated thermal input of 50 MW or more

‘installation’ means a stationary technical unit within which one or more activities listed in **Annex I** are carried out, and any other directly associated activities on the same site which have a technical connection with those activities and which could have an effect on emissions and pollution;

So you must aggregate all combustion plants on site to determine if the installation is IED regulated – and all individual plant are then subject to BAT requirements, regardless of size, if sum of site thermal ratings $\geq 50\text{MW}_{\text{th}}$

ELVs AND BAT APPLY TO

LARGE COMBUSTION PLANT ONLY $\geq 50\text{MW}_{\text{th}}$ aggregated at stack level*
ELVs in IED Chp III and Annex V
BAT in LCP BREF

IED definitions – Incinerators & Co-incinerators

Incineration Plant

Undertakes thermal treatment of waste with or without recovery of combustion heat

Co-Incineration Plant

Main purpose is the production of energy or material products using waste as a regular or additional fuel

EXCEPT PLANT BURNING CERTAIN BIOMASS WASTES – These are combustion plants

ELVs APPLY TO

All waste incineration and co-incineration plants

ELVs AND BAT APPLY TO

Waste incineration and co-incineration plants
for non-hazardous waste with a capacity exceeding 3 tonnes per hour;
for hazardous waste with a capacity exceeding 10 tonnes per day.

definitions include gasification, pyrolysis and plasma process treatment of waste if the gases are then incinerated*

Current BAT status – LCP BREF

- **Scope:** Stack aggregated LCPs > 50MW_{th}, excluding units < 15MW_{th}
Co-incineration in the above for >3t/hour non-haz waste
Co-incineration in the above for >10t/day haz waste
Not MSW or where >40% of heat is from haz waste or if 100% waste
Mixing rules and cross-reference to WI BREF
- **Development:** Started 2011, Draft 1 June 2016, Finalised 31 July 2017
- **Published:** 17 August 2017
- **Status:** In force
- **Compliance Date:** 18 August 2021

IED Annex V	BREF
Monthly, Daily and Hourly ELVs	Annual and Daily BAT AELs
SO ₂ , NO _x , dust	SO ₂ , NO _x , dust, HCl, HF, Hg, CO*
	Energy Efficiency

*indicative only

Current BAT status – LCP BREF (Biomass)

Biomass Existing and New Plant IED ELVs (monthly) and BAT-AELs (yearly)
ELV concentrations in mg/Nm³ at 6%O₂, dry, 0degC, 1atm

MW _{th}	SO ₂		NOx		Dust	
	IED	BREF	IED	BREF	IED	BREF
EXISTING PLANT						
50-100	200	15-100	300	70-225	30	2-15
100-300	200	10-70	250	50-180	20	2-12
>300	200	10-50	200	40-150	20	2-10
NEW PLANT						
50-100	200	15-70	250	70-150	20	2-5
100-300	200	10-50	200	50-140	20	2-5
>300	150	10-35	150	40-140	10	2-5

Current BAT status – LCP BREF (Biomass)

- Electrical Efficiency 33.5-38% (new), 28-38% (existing)
- Net fuel utilisation 73-99% (new and existing)
- Mercury 1-5 $\mu\text{g}/\text{Nm}^{-3}$
- HF < 1 mg/Nm^3 (1.5 mg/Nm^3 for existing plant <100MW_{th})
- HCl (e.g. 50-100MW_{th}) annual 1-7 mg/Nm^3 (new), 1-15 mg/Nm^3 (existing)

- IED Monitoring of SO₂, NO_x and dust – Continuous $\geq 100\text{MW}_{\text{th}}$, 6 monthly < 100MW_{th} and annually for Hg
- EN standards or if not available, ISO, international or national standards

- BAT Monitoring (>50MW_{th})
 - Continuous for SO₂, NO_x, Dust, HCl, CO, NH₃ (SCR/SNCR)
 - Annually for HF and Hg, N₂O, metals and metalloids
 - Specific or generic EN standards referenced

Current BAT status – LCP BREF (Co-incineration)

- Generally references the BAT conclusions associated with the non-waste component and sets these for the both the non-waste flue gas volume and the whole flue gas volume
- BAT AELs only set for metal emissions (co-incineration of waste + biomass) and apply to the whole flue gas volume

Species	IED (mg/Nm ³)	LCP BREF (mg/Nm ³)
Cd + Tl	0.05	<0.005
Total of Sb, As , Pb, Cr, Co, Cu, Mn, Ni, V	0.5	0.075-0.3

- BAT for co-incineration is also not to exceed BAT set in WI BREF for the flue gas volume attributable to waste (mixing rule)

Current BAT status – WI BREF

- **Scope:** Disposal or recovery of waste in incineration plants
 - >3t/hour non-haz waste
 - >10t/day haz waste
 - Co-incinerators burning MSW, 100% waste or > 40% heat from haz waste
- **Development:** Started 2014, Pre-Final Draft Sep 2018
- **Published:** ?? 2019
- **Status:** Pre Final Draft

IED Annex VI	BREF
Daily & 30 minute averages for dust, NO _x , SO ₂ , HCl, HF, CO, TOC	Daily average for dust, NO _x , SO ₂ , HCl, ~HF, CO, NH ₃ , TVOC, ~Hg
Spot sampling for Hg, Cd+Tl, total metals, dioxins and furans	Spot sampling for Cd+Tl, total metals, ~HF, dioxins and furans, ~Hg

Current BAT status – WI BREF

Comparison between IED ELVs and BAT-AELs (daily averages and samples)
 ELV concentrations in mg/Nm³ at 11%O₂, dry, 0degC, 1atm

	IED	BREF	IED	BREF	IED	BREF
	NO_x		Dust		NH₃	
New	200	50-120	10	<2-5	n/a	2-10
Existing	200*	50-150			n/a	2-10
	HCl		HF		SO₂	
New	10	<2-6	1	<1	50	5-30
Existing		<2-8		<1		5-40
	Hg		Tl+Cd		Metals	
New	0.05	<0.005-0.02	0.05	0.005-0.02	0.5	0.01-0.3
Existing		<0.005-0.02				

Medium Combustion Plant Directive

- **Scope:** Units of 1-<50 MW_{th} including biomass and exempt biomass and units on IED sites (double regulation)
- **Scope Excludes:** waste and co-incinerators, units > 15MW_{th} in a LCP
- **Development:** Directive published 28/11/2015, 2 years for implementation
- **Status:** In force
- **ELV Compliance Date (permit 1 year earlier):**
 - 01/01/2025 for >5-50 MW_{th}
 - 01/01/2030 for 1-5 MW_{th}
 - From start of operation for new plants

MCPD	Monitoring Frequency
ELVs for SO ₂ , NO _x , dust CO monitoring required No compliance for <500 h/year*	Annual for >20 MW _{th} , 3 yearly for 1-20 MW _{th} First measurement within 4 months of permit (existing) or operation (new)

*5 year rolling average for existing plant
 3 year rolling average for new plant

Medium Combustion Plant Directive

Biomass emissions given as mg/Nm³ at 6% O₂ dry (0°C, 101.325 kPa) – periodic monitoring as minimum standard (annual for >20MW_{th}, 3 yearly for 1-20MW_{th}). First measurement within 4 months of start or permit being granted.

	Existing plant		New plant
Input	1-5MW _{th}	>5-<50MW _{th}	1-<50MW _{th}
SO ₂	200 (1,2)	200 (1,2)	200 (1)
NO _x	650	650	300 (4)
Dust	50	30 (3)	20 (5)

- 1) The value does not apply in the case of plants firing exclusively woody solid biomass.
- 2) 300 mg/Nm³ in the case of plants firing straw.
- 3) 50 mg/Nm³ in the case of plants with a rated thermal input >5 MW and ≤20 MW.
- 4) 500 mg/Nm³ in the case of plants with a total rated thermal input ≥1 MW and ≤5 MW
- 5) 50 mg/Nm³ in the case of plants with a total rated thermal input ≥1 MW and ≤ 5 MW; 30 mg/Nm³ in the case of plants with a total rated thermal input >5 MW and ≤20 MW.

UK specific compliance

- Previous UK regime regulated only Part B (20-50 MW_{th}) plant, with sub 20MW_{th} units regulated through planning permission
- ELVs were set in guidance for Part B regulated facilities - Now revised
- UK has introduced additional measures for electricity generation plant
 - NOx emission limit of 190 mg/Nm³ (15%O₂)
 - Achieve limit within 20 minutes (existing) and 10 minutes (new) where secondary abatement is used
 - No persistent visible emissions
 - Apply to new plant from 1 Jan 2019
 - Aggregate onsite capacity
 - 1 Jan 2025 (>5-50 MW_{th}) or 1 Jan 2030 (1-5MW_{th}) for existing plant
- Exemptions for back up plant running < 50 hours per year for testing purposes
- Delayed for certain contracted plant e.g. 2014/2015 capacity auction

Environmental Permitting Regulations

- Implement the requirements of the IED, MCPD and Specified generator requirements in England and Wales (EPR 2016 as amended)

1.1 Combustion activities	<p>Part A(1)(a) combustion of any fuel $\geq 50 \text{ MW}_{\text{th}}$ based on aggregation of all combustion units on site including individual large combustion plant</p> <p>Part B(a) - combustion of any fuel in the range 20-50 MW_{th} - single unit</p>
5.1 Incineration and co-incineration of waste	<p>Part A(1)(a) hazardous waste (co-)incineration $> 10 \text{ t/day}$</p> <p>Part A(1)(b) non-hazardous waste (co-)incineration $> 3 \text{ t/h}$</p> <p>Part B(a) waste biomass $> 50 \text{ kg/h}$ (exempted biomass)</p>
Schedule 13A	Applies to (co)incineration plant below IED Annex 1 capacity limits – Small Waste Incineration Plants
U4 and D6 small appliances	Exemptions for small appliances $< 50 \text{ kg/h}$ burning clean biomass
Schedule 25A and 25B	Covers Medium Combustion plants and Specified Generators respectively

Conclusions

- Regulation of biomass and waste plant will undergo significant changes as a result of:
 - The implementation of the Large Combustion Plant Directive BREF
 - The finalisation and implementation of the Waste Incineration BREF
 - The implementation of the Medium Combustion Plant Directive
- Key impacts will be increased costs for upgrade or replacement of existing plants as emissions limits and monitoring requirements are tightened
- Operators should evaluate current emission performance against new limits
- Cost-Benefit assessments likely to be required to support any derogations from BAT
- MCPD could result in problems of scale – thousands of existing plant requiring permitting and emission measurements in the same time period
- Environmental regulations will continue to tighten through BREF and Directive review provisions

ANY QUESTIONS?

Stephen.Griffiths@uniper.energy

Uniper disclaimer:

This presentation may contain forward-looking statements based on current assumptions and forecasts made by Uniper SE management and other information currently available to Uniper. Various known and unknown risks, uncertainties and other factors could lead to material differences between the actual future results, financial situation, development or performance of the company and the estimates given here. Uniper SE does not intend, and does not assume any liability whatsoever, to update these forward-looking statements or to conform them to future events or developments.

