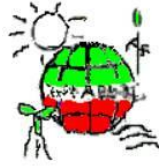


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طاقة الشمال

North Lebanon Alternative Power

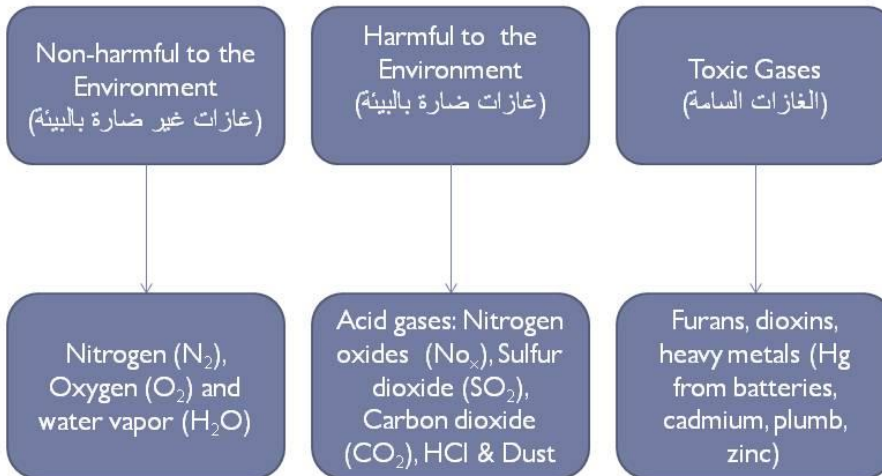
Incineration Emissions Control Systems & Heavy Metals Recycling

Done by: Eng. Alaa Zakaria
Date: 27/8/2019

1

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Emissions Components (مكونات الانبعاثات)



▶ 2

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DIRECTIVE 2000/76/EC OF THE EUROPEAN
PARLIAMENT AND OF THE COUNCIL
(المعايير الأوروبية لكمية الانبعاثات المسموحة لكل غاز)

Polluting substance	Air emission limit values (ELV), mg/m ^{3 a)}		
	daily average values (ELV _{24hrs})	half-hourly average values	
		100% (ELV _{30minA})	97% (ELV _{30minB})
Total dust	10	30	10
Total organic carbon (TOC)	10	20	10
HCl	10	60	10
HF	1	4	2
SO ₂	50	200	50
NO _x (as NO ₂)	200	400	200
CO	50	100	
Cd + Tl	total 0.05 ^{b)}		
Hg	0.05 ^{b)}		
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	total 0.5 ^{b)}		
PCDD/Fs	0.1 ngTEQ/m ^{3 c)}		



^{a)} related to the conditions: the pressure of 101.3 kPa, the temperature of 273.15 K, dry gas, 11% O₂

^{b)} the sample period of a minimum 30 minutes and a maximum of 8 hours

^{c)} the sample period of a minimum 6 hours and a maximum of 8 hours

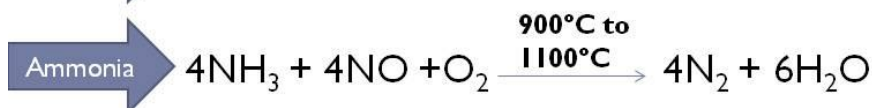
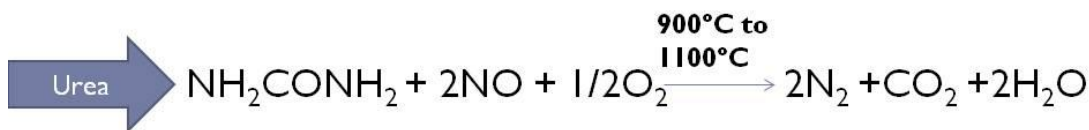
▶ 3

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Techniques for the Reduction of pollutant gases (تقنيات لخفض الغازات الملوثة)

I. Nitrogen Oxides (NO_x) Reduction Techniques:

a. Selective Non-catalytic reduction process:



b. Selective Catalytic reduction process:

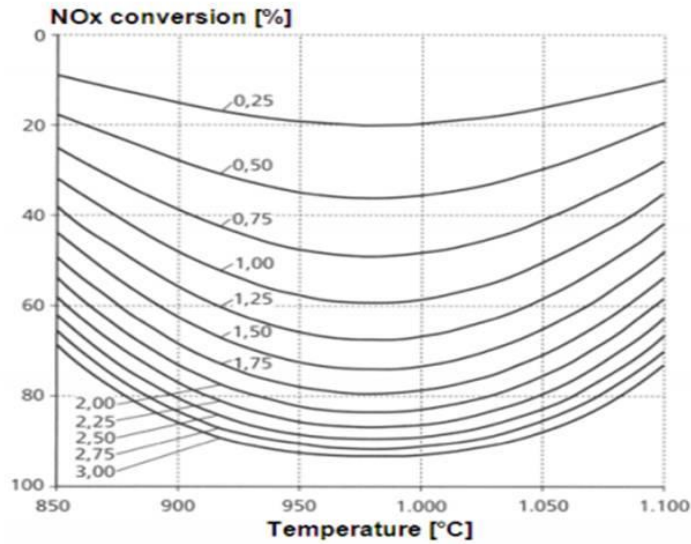


▶ 4

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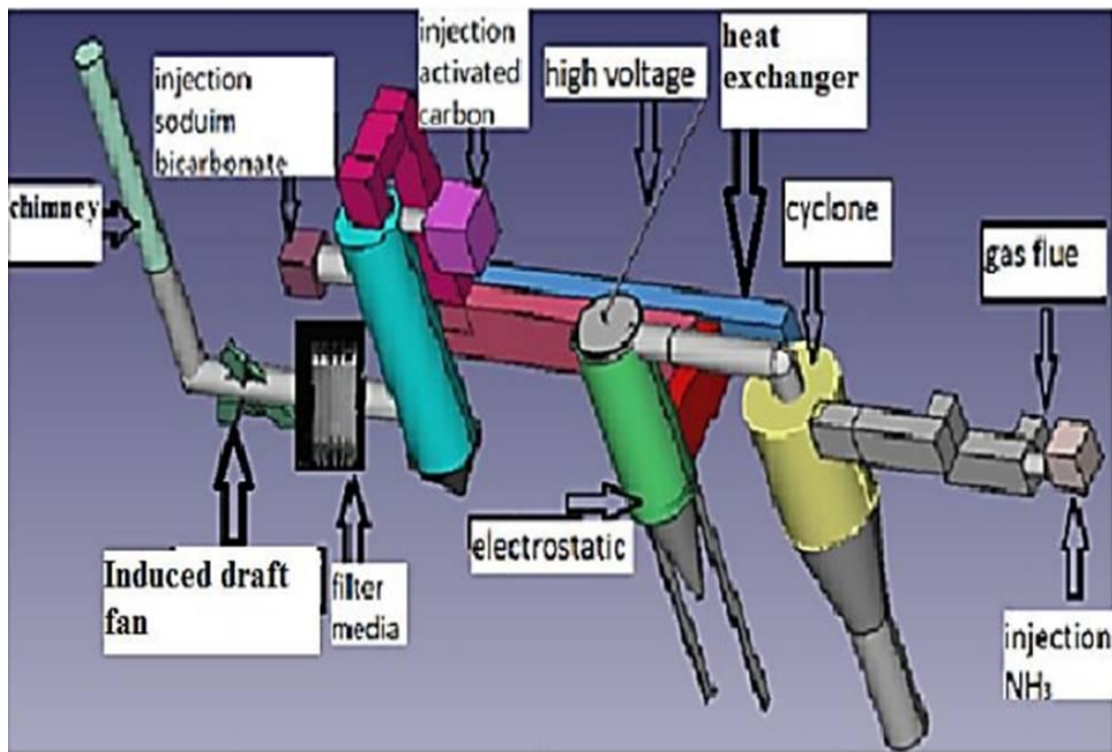
Techniques for the Reduction of pollutant gases (تقنيات لخفض الغازات الملوثة)

- ▶ Used option: Reduction of NO_x with Ammonia



▶ 5

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▶ 6

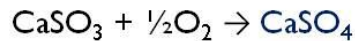
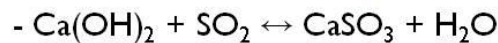
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Techniques for the Reduction of pollutant gases (تقنيات لخفض الغازات الملوثة)

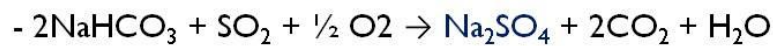
2. Acid Gas (HCl, HF & SO₂) Treatment Technologies:

❖ Bag filters with reagent injection:

→ Calcium Hydroxide: Ca(OH)₂



→ Sodium Bicarbonate: NaHCO₃:



▶ 7

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Techniques for the Reduction of pollutant gases (تقنيات لخفض الغازات الملوثة)

- ▶ Residence time: > 1 second
- ▶ Flue gas temperature: 135 ~ 815°C
- ▶ Temp. of conveying air: <60°C
- ▶ Stoichiometry: 1.5 to 3 times additive WRT. Acid gases
- ▶ Sorbent particle size: finer particles result in better performance



▶ 8

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Techniques for the Reduction of pollutant gases (تقنيات لخفض الغازات الملوثة)

Table I: Dry Injection of Sodium Bicarbonate for HCl and SO₂ Removal at Various Waste Incinerators

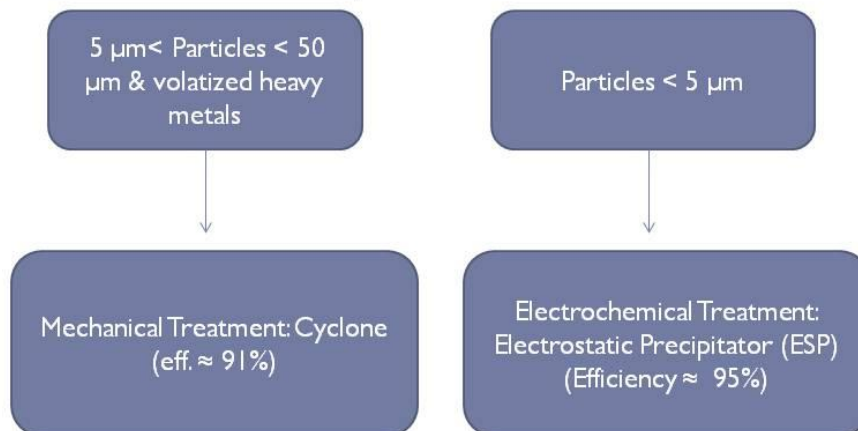
Plant	Waste	Capacity (tons/y)	Removal Rate (%)	
			SO ₂	HCl
UVE Metz (France)	Municipal Waste	90,000	> 98	> 98
Sotrenor Veolia Group (France)	Hazardous Industrial Waste	100,000	> 99	> 99
Burgo Mantova (Italy)	Hazardous Industrial Waste	60,000	> 97	> 95
Müllheizkraftwer, Kassel (Germany)	Municipal Waste	90,000	> 90	> 99
AHKW Geiselbullach (Germany)	Municipal Waste	50,000	> 80	> 95
Oshima (Japan)	Municipal Waste	40,000	> 96	> 99

▶ 9

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Techniques for the Reduction of pollutant gases (تقنيات لخفض الغازات الملوثة)

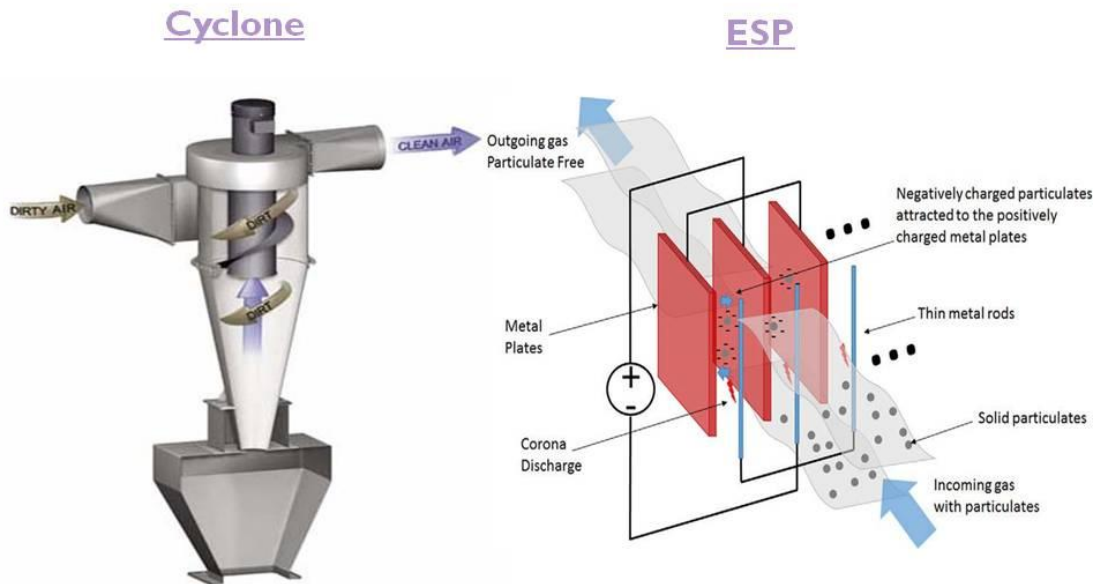
3. Treatment of Dust:



▶ 10

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Techniques for the Reduction of pollutant gases (تقنيات لخفض الغازات الملوثة)



▶ 11

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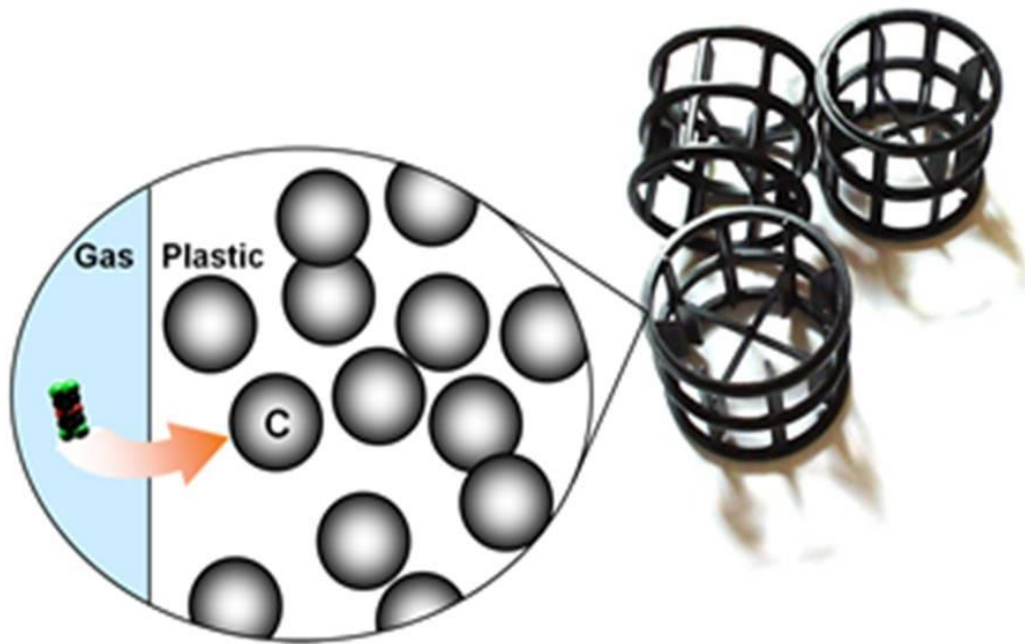
Techniques for the Reduction of poisonous gases (تقنيات الحد من الغازات السامة)

▶ Removal of Dioxin & Furans: Adiox

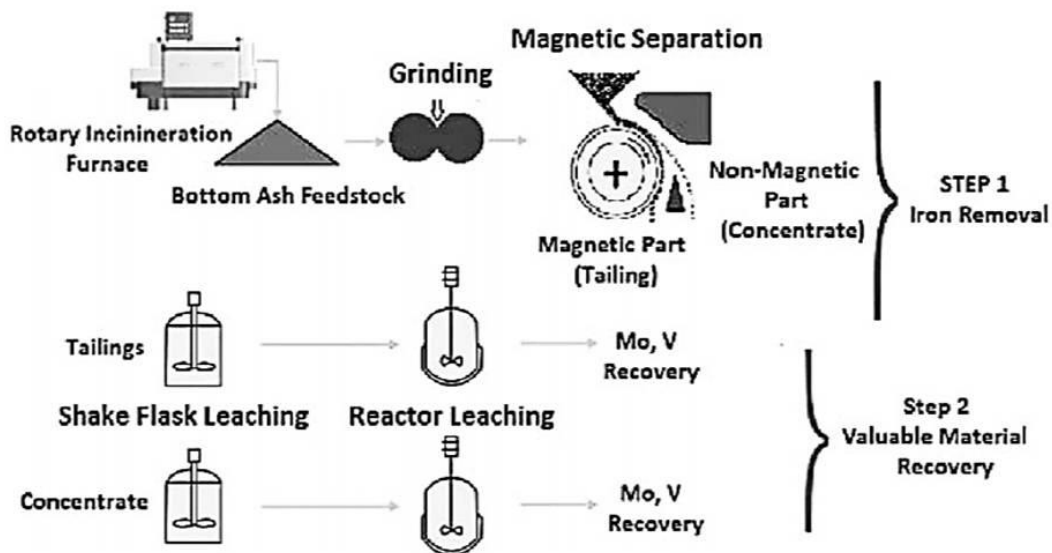
- Consists of polypropylene doped with carbon particles
- Effective, safe and economical technology for scrubbing dioxins from gases.
- Incinerated after use, leading to the destruction and removal of dioxins from the ecosystem.
- Can be installed with a scrubber or other type of equipment in a flue gas cleaning system

▶ 12

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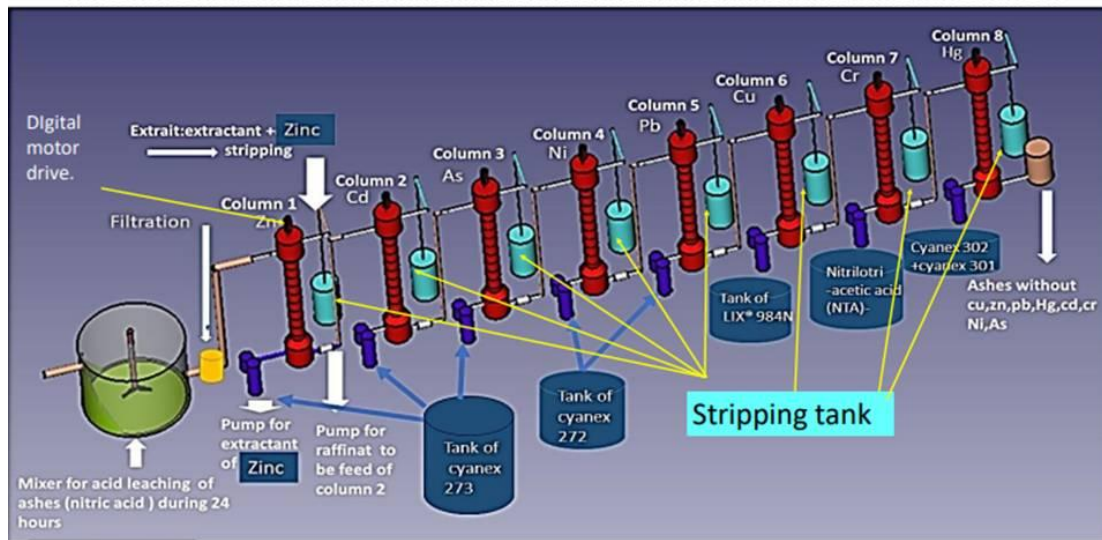


Heavy Metals Recycling Unit (وحدة إعادة تدوير المعادن الثقيلة)



Heavy Metals Recycling Unit

(وحدة إعادة تدوير المعادن الثقيلة)



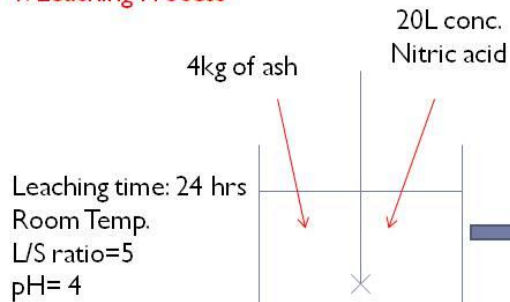
▶ 15

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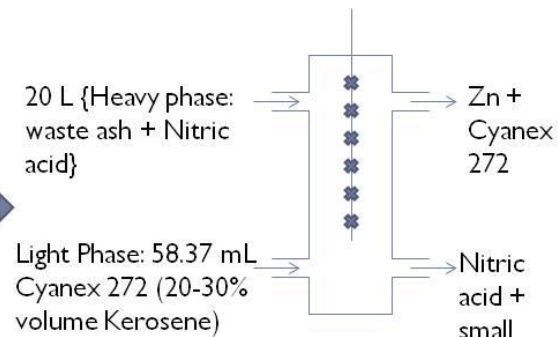
Zinc Recovery

(استعادة الزنك)

1. Leaching Process



2. Extraction Process



4. Metal Production

Zn Metal

3. Stripping Process

Zn Stripping by Sulfuric acid (H_2SO_4)

▶ 16

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 طاقة الشمال

Sensors & their Prices

(أجهزة الاستشعار وأسعارها)



Seite 4/6

Preisinformation PI_190826_TEMO-WI Lebanon_CEMS Ilef

Pos	Artikel/Bezeichnung	Menge	Einh.	Preis	Netto EUR
	Gasmeter™ CEMS Ilef FTIR-Messsystem mit Rädern statt Sockel <i>EIGNUNGSGEPRÜFTES MESSSYSTEM</i>				
1	TTCEMS_Ilef_10 Automatische Messeinrichtung CEMS Ilef für die kontinuierliche Emissionsüberwachung	1	St.	95.494,00	95.494,00



Seite 3/5

Preisinformation PI_19mmtt_Kunde_CMM

Pos	Artikel/Bezeichnung	Menge	Einh.	Preis	Netto EUR
	Gasmeter™ CMM Quecksilber-Messsystem <i>EIGNUNGSGEPRÜFTES MESSSYSTEM</i>				
1	TTCMMSYS-002 Gasmeter CMM - Messschrank mit Rädern für die kontinuierliche Messung des Gesamt-Quecksilber-Gehaltes in Rauchgasen	1	St.	68.508,00	68.508,00

▶ 17

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Power (www.nlap-lb.com) طاقة الشمال

EN 15267 - - Type Approval & Certification of AMS

(موافقة على الصنف وإصدار الشهادات لنظام الرصد الآلي)

❖ Content:

1. EN 15267-1:2009: General Principle
2. EN 15267-2:2009: Initial assessment of the AMS manufacturer's QM system and post certification surveillance of the manufacturing process
3. EN 15267-3:2007: Performance criteria & test procedures for AMS for monitoring emissions from stationary sources
4. EN 15267-4: Performance criteria & test procedures for measuring ambient air quality

▶ 18

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EN 15267 – Part 1: General Scope (الجزء الأول: النطاق العام)

EN 15267 – Part 1:

1. It specifies the general principles for the products certification of AMS for monitoring emissions from stationary sources and ambient air quality.
2. Steps:
 - a- Performance testing of an AMS
 - b- Initial assessment of the AMS manufacturer's quality management system
 - c- Certification
 - d- Surveillance

EN 15267 – Part 1: General Scope (الجزء الأول: النطاق العام)

3. Roles & responsibilities during certification:

- Manufacturers of AMS should establish, maintain & operate a quality management system according to EN 15267-2
- Test laboratory should hold accreditation for type approval testing according to EN ISO/IEC 17025
- Relevant body:
 - needs accreditation to EN 4501 I if the relevant body is a certification body
 - verifies evidence, that manufacturer has an EN 15267-2 conform QMS
 - adds the AMS to official register

EN 15267 – Part 2: QM System & Audit Scope (الجزء الثاني: نظام مراقبة الجودة ونطاق التدقيق)

❖ Specifies the requirements for:

1. The QM system of the manufacturer
 2. The initial assessment of the AMS manufacturer
 3. Ongoing surveillance to ensure that the AMS fulfills the minimum requirements of the approval test procedure, also after soft- or hardware modifications.
- ❖ The manufacturer must keep records and evaluations on any modification of the certified AMS.

▶ 21

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EN 15267 – Part 3: Minimum Requirements & Test Procedures for CEMS (الجزء الثالث: الحد الأدنى من المتطلبات وإجراءات الاختبار لنظام الانبعاثات المستمرة)

❖ Defines the performance criteria & test procedures for AMS that:

1. Measure gases and particulate matter in respective flow of the waste gas from stationary sources.
- ❖ This European Standard supports the requirements of particular EU Directives
- ❖ It provides the detailed procedures covering the QAL1 requirements of EN 14181
- ❖ It provides input data for QAL3 procedure described in EN 14181

▶ 22

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EN 15267 part 4: Minimum requirements and test procedures for CAMS

(الجزء الرابع: الحد الأدنى من المتطلبات وإجراءات الاختبار لنظام المراقبة الآلي)

- ❖ Not available !!!
- ❖ was planned to define the performance criteria & test procedures for AMS for ambient air quality for both gases and PM.

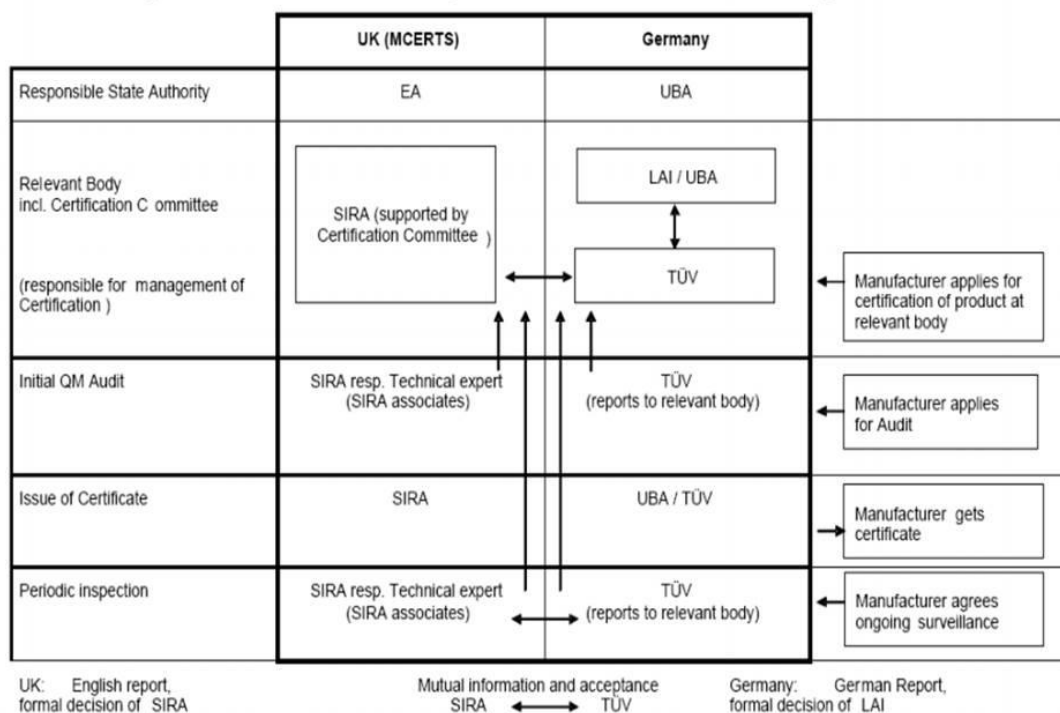
I. Norm (Chapter)	I. Gas
I. EN 14211:2005 (Chp.8)	I. NO _x
I. EN 14212:2005 (Chp.8)	I. SO ₂
I. EN 14625:2005 (Chp.8)	I. O ₃
I. EN 14626:2005 (Chp.8)	I. CO
I. EN 14662-3:2005 (Chp.8)	I. C ₆ H ₆

EN 15267 part 4: Minimum requirements and test procedures for CAMS

(الجزء الرابع: الحد الأدنى من المتطلبات وإجراءات الاختبار لنظام المراقبة الآلي)

Norm	PM
VDI 4202 Sheet 1	Performance Criteria
VDI 4203 Sheet 3	Test Procedures
EN 12341:1998	PM ₁₀
EN 14907:2005	PM _{2.5}
EN 14662-3:2005 (Chp.8)	C ₆ H ₆

Comparison of German and British system of Product Certification according to EN 15267



▶ 25

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 طاقة البديل

Zinc Recovery (Bottom & Fly Ash)	Equipment & Chemicals Needed	Quantity (for 1 sample)	Prices
Equipment Needed	Grinding Machine for grinding bottom ash	1	
	Vacuum Filtration (for separating ash from water)	1	
	Agitation Leaching Tank	1	
	Rotating Discs Column (RDS)	1	
	GASMET CEM Sensors System	1	95,554EU
	GASMET CMM Sensors System	1	68,508EU
	Dioxin Monitoring System	1	
Chemicals Needed	Distilled Water for washing fly ash	1 liter	
	Nitric Acid for Leaching of heavy metals	20 liters	\$25/liter
	Cyanex 272 (83411-71-6) for extraction of Zn	300mL	
	Kerosene for extraction of Zn	1200mL	
	Sulfuric acid for stripping of Zn		\$10 to \$12/liter

References

(المراجع)

- ▶ <https://eurlex.europa.edu/legalcontent/EN/TXT/PDF/?uri=CELEX:02000L0076-20081211&from=EN>
- ▶ https://www.ms-umwelt.de/wp-content/uploads/downloads/denox/en/SNCR-Best_Available_Technology_for_NOx_Reduction_in_Waste_To_Energy_Plants.pdf
- ▶ <http://www.thermopedia.com/content/752/>
- ▶ <http://aecenar.com/index.php/downloads/send/3-meae-institute/504-nlap-wedc-report-2-2018-pdf>
- ▶ <http://aecenar.com/index.php/downloads/send/3-meae-institute/359-281016masterthesismayssakamareddine-temo-ipp>
- ▶ <http://www.gmab.se/dioxin-removal/>
- ▶ <https://www.gasmet.com/products/category/emission-monitoring-systems/continuous-emissions-monitoring-system-cems-ii-e/>
- ▶ <https://www.gasmet.com/products/category/emission-monitoring-systems/continuous-mercury-monitoring-system-cmm/>