AECENAR
TECDA
Association for Economical and Technological Cooperation in the Euro-Asian and North-African Region

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

Environmental Impact Assessment for an academic mobile municipal waste incinerator

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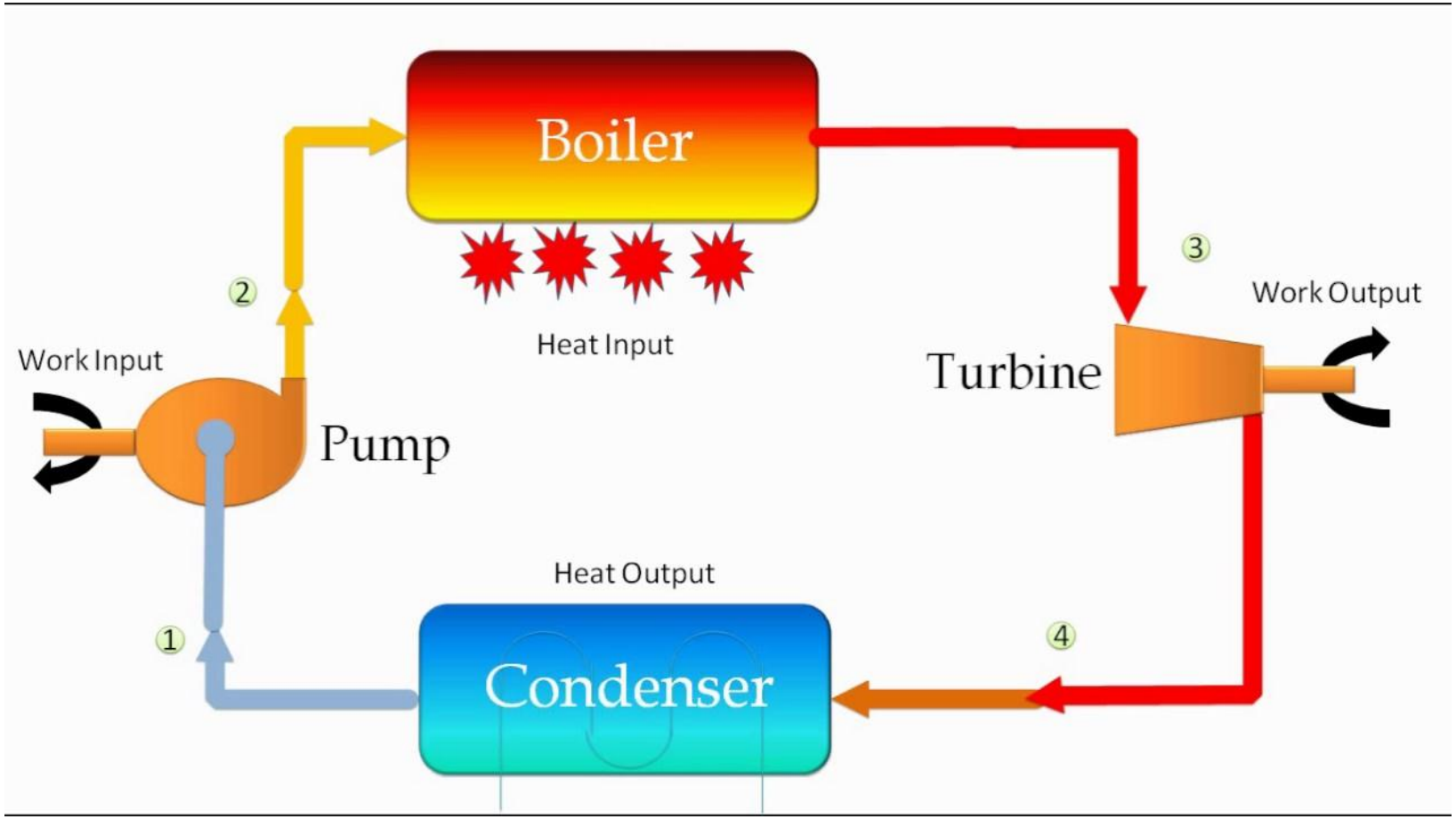
Waste Treatment

ELKURDI Hiyam @NLAP Sept 2022

The cycle in a thermal power plant



Our mobile waste to energy power plant

- a big challenge is the enviroment impact assessment and that is why this is the main topic of the presentation.

What is an enviromental impact assesment

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.

APPENDIX D
ENVIRONMENTAL INFORMATION REQUIREMENTS SET OUT IN ANNEX IV OF DIRECTIVE 97/11/EC

Article 5(1) of Directive 97/11/EC requires the Developer to provide to the Competent Authority the information set out below in so much as the information is relevant to the given stage of the consent procedure and to the specific characteristics of the project and of the environmental features likely to be affected, and the developer may reasonably be required to compile the information having regard *inter alia* to current knowledge and methods of assessment.

Environmental Information Requirements for EIA

1. Description of the project, including in particular:
   - a description of the physical characteristics of the whole project and the land-use requirements during the construction and operational phases,
   - a description of the main characteristics of the production processes, for instance, nature and quantity of the materials used,
   - an estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc.) resulting from the operation of the proposed project.

2. An outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects.

3. A description of the aspects of the environment likely to be significantly affected by the proposed project, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors.

4. A description of the likely significant effects of the proposed project on the environment resulting from:
   - the existence of the project,
   - the use of natural resources,
   - the emission of pollutants, the creation of nuisances and the elimination of waste,

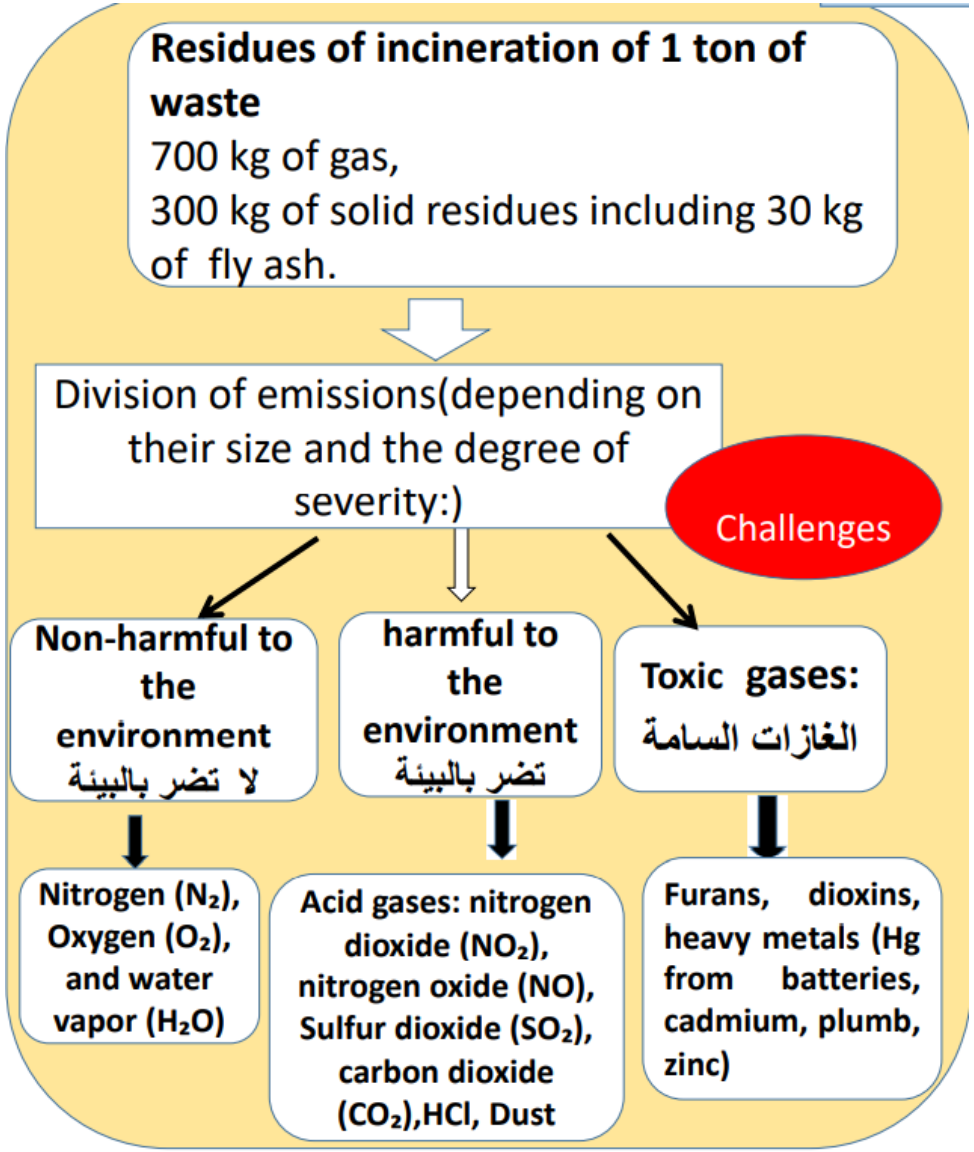
   and the description by the developer of the forecasting methods used to assess the effects on the environment.

5. A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.

6. A non-technical summary of the information provided under the above headings.

7. An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the developer in compiling the required information.

What needs to be considered in our case



The maximum allowed concentrations

parameter	half-hour mean value	European Directive 2000/76 / EC of 04/12/2000 and French Decrees of 20/09/2002 and 03/08/2010	refectural stopped operating permit Flamoval of 17/06/2009	
Total dust		1-20	10	3
Hydrochloric acid (HCl)		1-50	10	7
Hydrofluoric acid (HF)		10	1	0.7
Sulphur dioxide (SO_2)		1-150	50	15
Carbon monoxide(CO)		5-100	50	30
total organic carbon (COT)		1-20	10	8
Mercury (Hg)		0.001-0.03	0.05	0.04
Cadmium + Thallium (Cd + Tl)		-	0.05	0.04
Other heavy metals (Sb + As + Pb + Cr + Cu + Co + Mn + Ni + V)		-	0.5	0.4
Oxides of Nitrogen (NOx)		40-300	200	50
Ammonia (NH_3)		-	30	10
Dioxins and furans		0.01-0.1	0.1	-

The removal of the NOx gazes

1.Techniques for the reduction of nitrogen oxide(تقنيات للحد من أكسيد النيتروجين)

-Thermal NOx: When burning a portion of the nitrogen in the air is oxidized to nitrogen oxides. This reaction occurs only significantly at temperatures above 1300 ° C. The reaction rate depends exponentially on the temperature and is directly proportional to the oxygen content

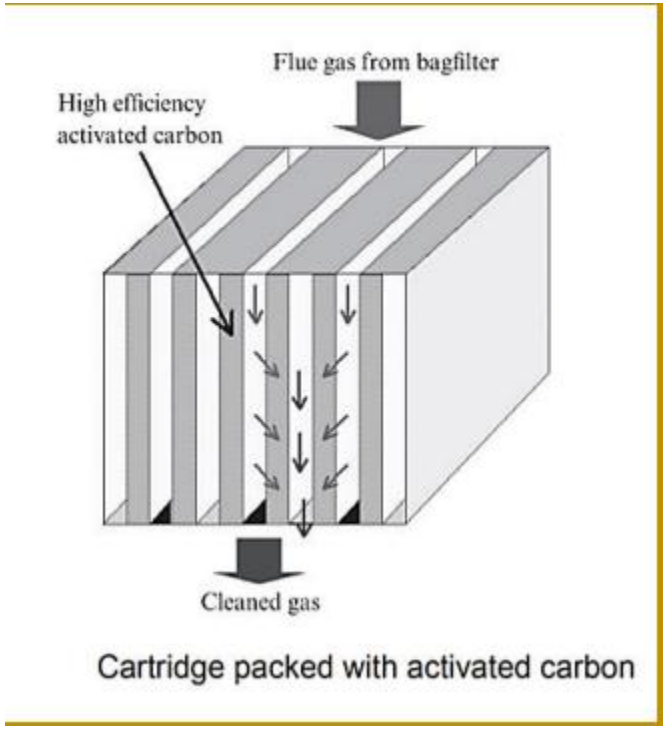
-Fuel NOx: when burning a portion of the nitrogen contained in the fuel is oxidized to nitrogen oxides.

PROCESS OF REDUCING NON-SELECTIVE CATALYTIC (SNCR):

the reducing agent (typically ammonia or urea) is injected into the furnace and reacts with nitrogen oxides. The reactions occur at temperatures between 850 and 1000 ° C, with higher reaction rates and lower in this range.

Selective Catalytic Reduction (SCR) is a catalytic process during which ammonia mixed with air (the reduction agent) is added to the exhaust gas and passes through a catalyst, usually a sieve (e.g. Platinum, rhodium, TiO_2, zeolites). When passing through the catalyst, ammonia reacts with NOx to give nitrogen and water vapor.

The treatment of the furan and dioxine



3.Acid gas treatment technologies(HF, HCl and SO_2)تقنيات معالجة الغاز الحمضي

- Treatment by $Ca(OH)_2$:

$Ca(OH)_2 + 2HCl \leftrightarrows CaCl_2 + 2H_2O$

$Ca(OH)_2 + 2HF \leftrightarrows CaF_2 + 2H_2O$

$Ca(OH)_2 + SO_2 \leftrightarrows CaSO_3 + H_2O$

$CaSO_3 + 1/2\ O_2 \rightarrow CaSO_4$

- Treatment by $NaHCO_3$:

$NaHCO_3 + HCl \leftrightarrows NaCl + CO_2 + H_2O$

$NaHCO_3 + HF \leftrightarrows NaF + CO_2 + H_2O$

$2NaHCO_3 + SO_2 + 1/2O_2 \rightarrow Na_2SO_4 + 2CO_2 + H_2O$

On-site realization

On-site realization

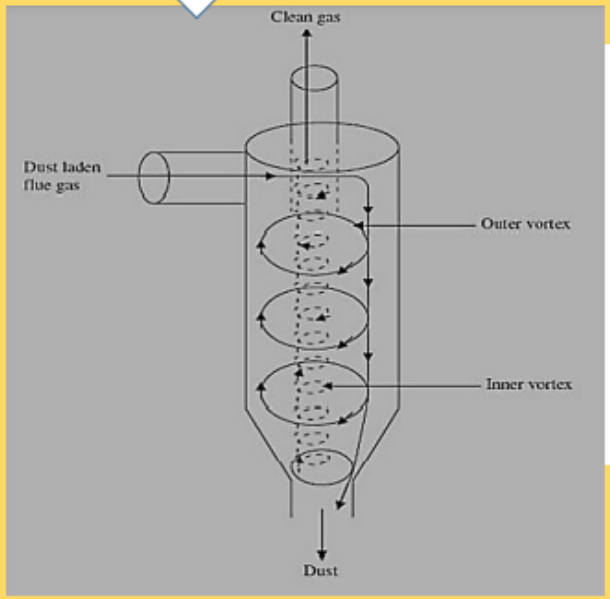
4.Treatment of dust (علاج الغبار)

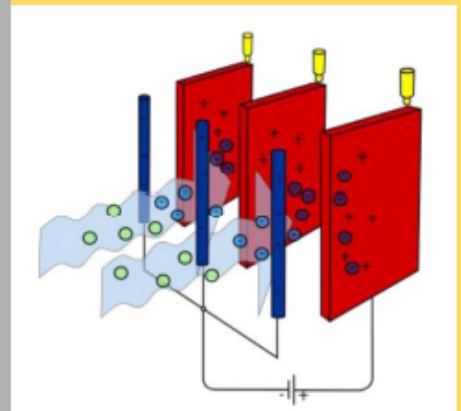
Particles between 5 & 50 micron and volatized heavy metals

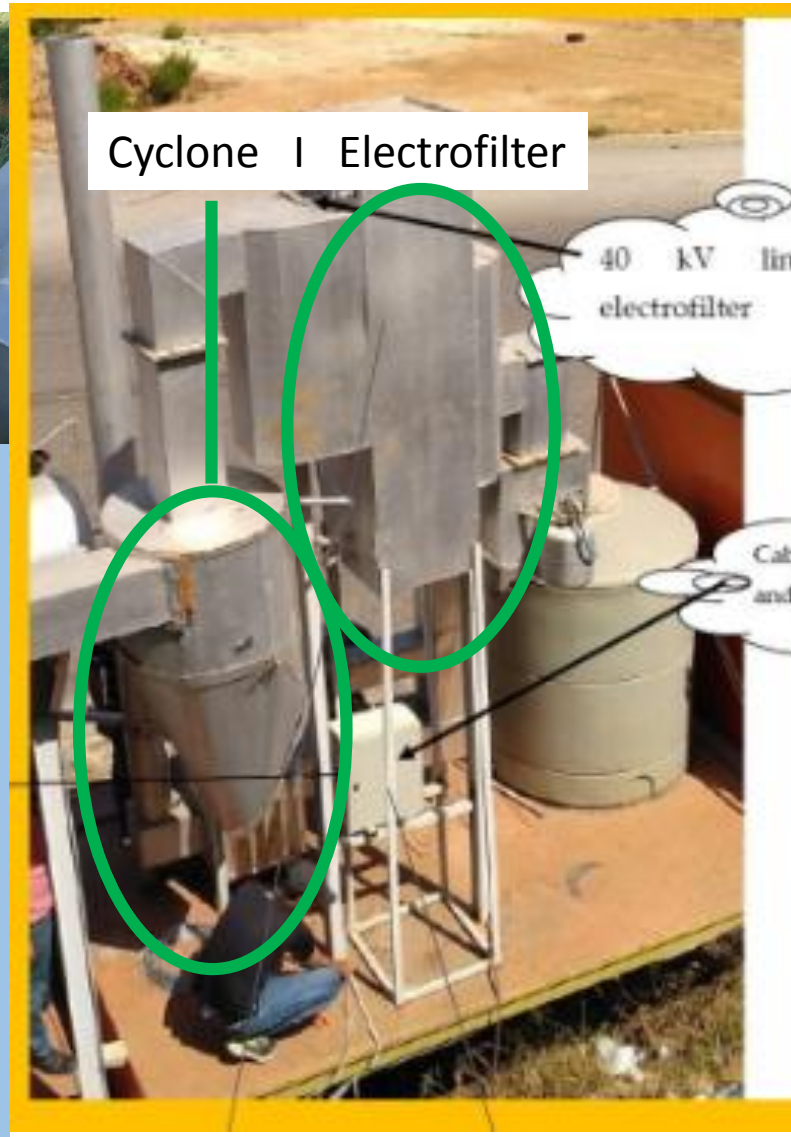
Less than 5 micron

Mechanical treatment :
العلاج الميكانيكي
Cyclone(efficiency:91%)

Electrical treatment :
العلاج الكهربائي
The electrostatic precipitator (ESP)(efficiency:95%)







Mesurement

to make sure that the allowed concentrations are not exceeded, measurement techniques have to be applied:

- laser absorption and
- the filter weight measurement

laser absorption

5.Continuous Emission Monitoring (CEM)

A series of sensors will be implemented to assure a continuous emission monitoring of different gas formed in the flue gas without the Dioxins and furans that measured by GC(gas chromatographic); Sensors of:CO,CO_2,NO,NO_2, SO_2,SO,HCl,heavy metals.

On-site realization

Experiment at the power plant

All this was actually done to prove that the power plant at the right is environmentally friendly. This power plant converts waste to electrical energy by heat treatment. The flue gas goes throw several filters. After the last filter the measurements are taken. At the right you see the results of the first real experiment at the power plant.

This experiment was done to see which problems we have at the outdoor experiment to solve them.
During the measurement the gas was environmentally friendly concerning the CO.
But we have to repeat this measurement to ensure
The results and with better conditions.

:Problems
High ambient temperature
Difficulty to compare: with and without gas
Challenge to fix the Laser

Results: Power plant

```
Reading sensor...
Time taken: 59
50
0
[32.15, 30.49, 32.96, 30.84, 33.75, 32.37, 32.91, 31.97, 33.13, 32.81, 32.17, 31.75, 32.74, 33.27, 33.04, 32
[34.20, 32.56, 33.24, 32.17, 33.80, 33.06, 33.24, 33.17, 34.32, 33.80, 33.69, 33.10, 33.14, 33.60, 33.51, 32
[34.34, 34.13, 33.51, 33.17, 33.64, 34.03, 34.36, 33.53, 34.02, 34.65, 34.18, 33.98, 34.06, 33.45, 33.92, 33
[34.87, 33.90, 33.09, 33.57, 34.95, 34.18, 34.00, 33.59, 34.27, 33.55, 34.11, 34.35, 34.40, 34.35, 34.09, 33
Tmax:34.95°C
deltaT:0.39°C
deltaTmax:0.47°C
The CO dosis is environmentally friendly
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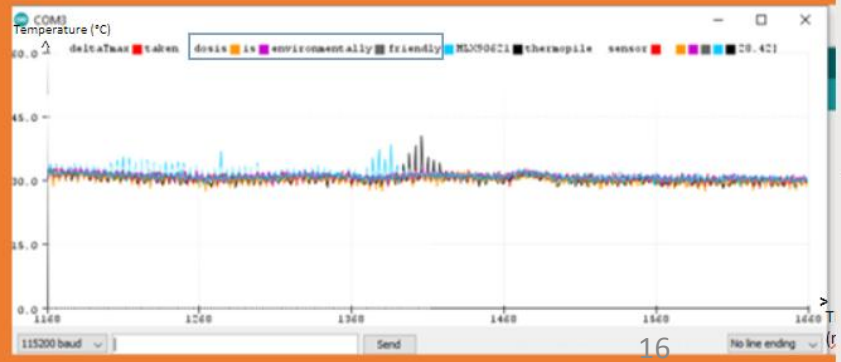


Mariam Mourad@INT/AECENAR 2020

The filter weight measurement

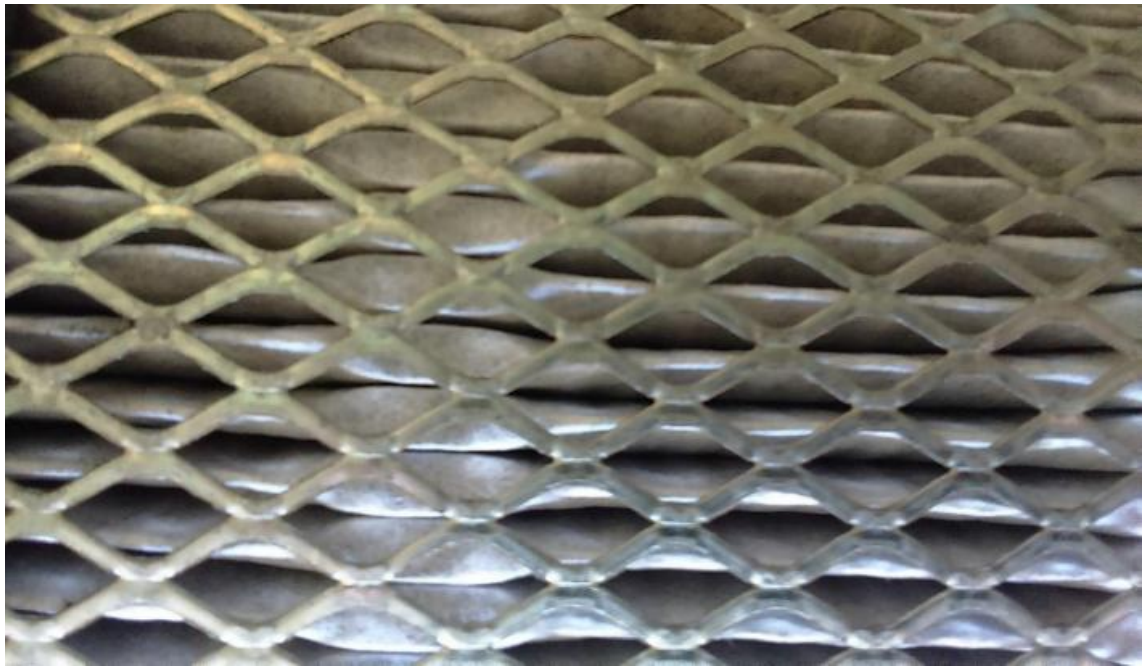
Mass of filter before treatment =1300 g

mass after treatment =1364 the total mass of particulate =1364-1300=64 g

375 m^3/h correspond to 64 g

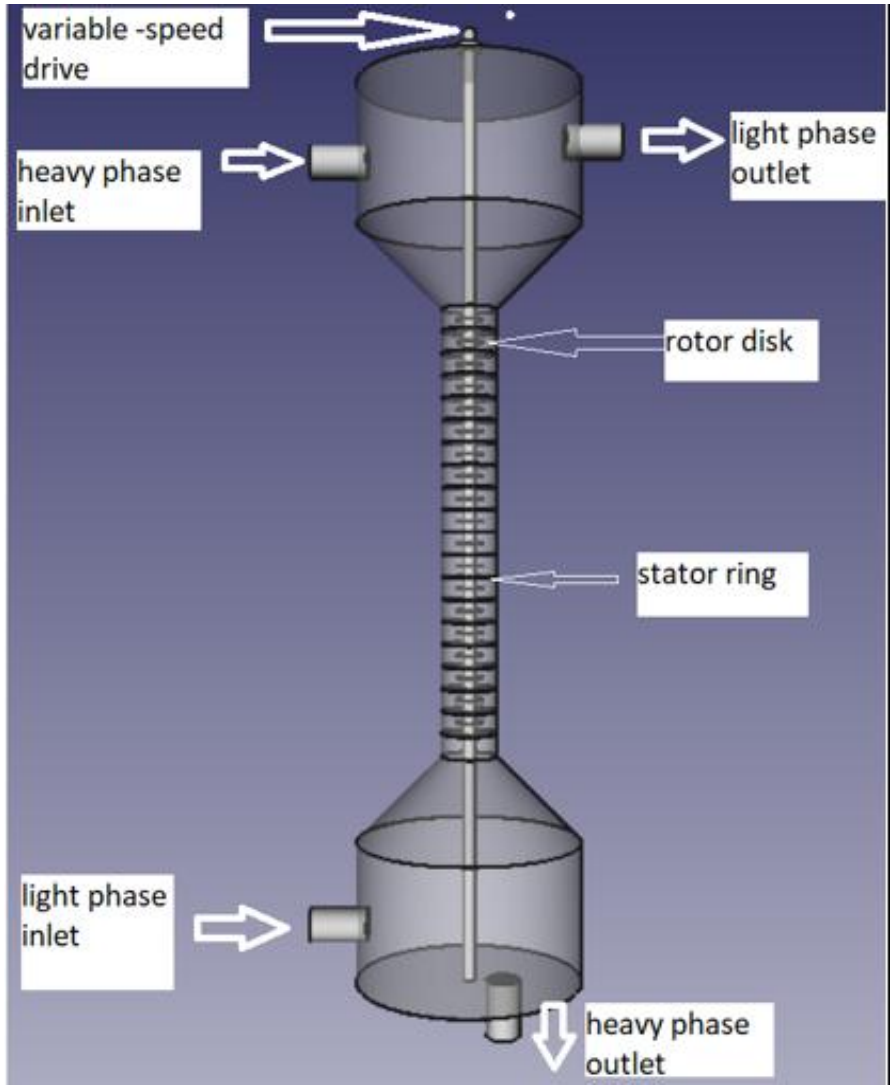
Thus 170 mg / m^3 <200 mg/ m^3 confirm to Lebanese standard (annex D) positive results

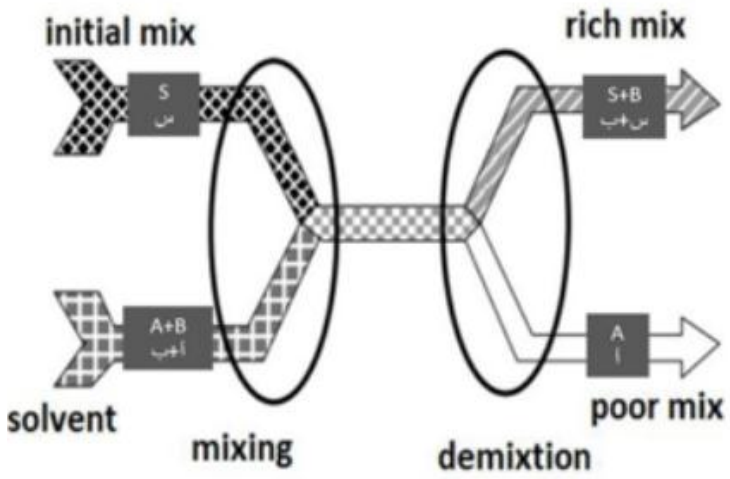
Color of media before treatment



Filter media after treatment

The ashes recycling





Realization

The mobile powerplant

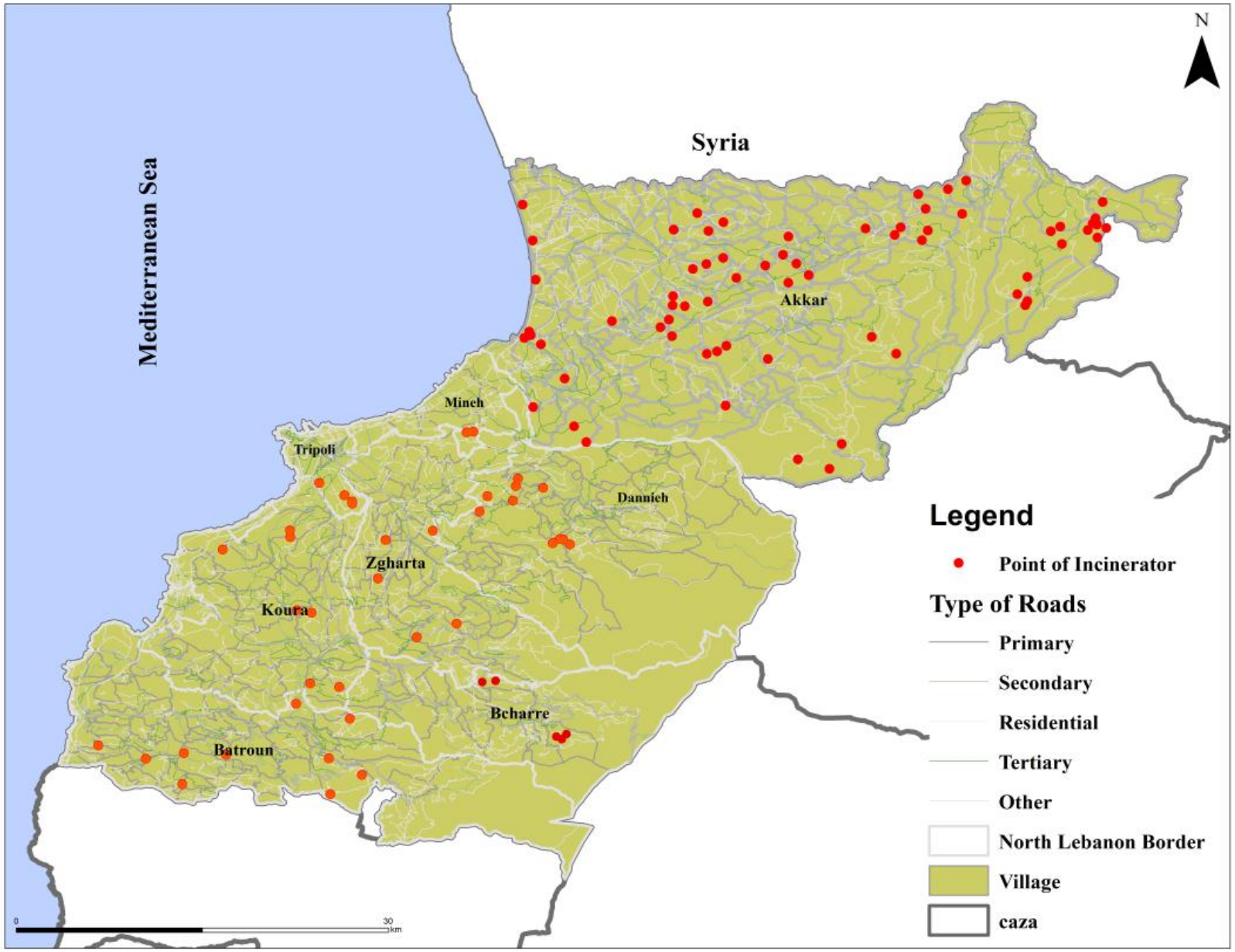
- الارتفاع = 620 cm
- الطول = 1400cm
- العرض = 280 cm

ألان لننظر إلى :
محطة نظام حرق النفايات المتحركة
mobile NLAP-IPP unit

Additional condition in lebanese law

- Constrain is according to lebanes law that the incenerator has to be at least 1 km distance to any public building or private house .

Overview of all suitable places for waste incinerators in North Lebanon



The different locations in which the mobile power plant was

Rasn hach

Rayhaniye Camp

Beqaa Sefrin

Masjid El Salam – El Mina

With contribution of :

- Hiyam Elkurdi (cand. M.Sc. Environmental Science and Spatial Planing
- the suitable places for waste incinerators in North Lebanon

- Abdullah Kassem (M.Sc in Electrical Physics)
- The rocess control system

- Jihad Bachir (Mechanical engineer)
- Test engineer and designer

- Maysaa Kamareddine (M.Sc in physique energetique)
- the filter systeme

- Mariam Mourad (M.Sc in fundamental physics)
- the laser absorbtion mesurement of the polluent gases

- Ali Dib (B.Sc in physics)
- On-site director