GUIDE FOR THE IMPLEMENTATION, MONITORING AND EVALUATION OF BIO-WASTE SOURCE SEPARATION AND COMPOSTING SCHEMES

Separation at source and Composting of food residues

ATHENS-BIOWASTE
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Athens Bio-waste
Guide for the implementation, monitoring and evaluation of bio-waste source separation and composting schemes
The Guide for the Implementation, Monitoring and Evaluation of Bio-waste Source Separation and Composting Schemes, was developed in the framework of the European co-funded programme LIFE-Environment "Integrated Bio-waste Management in Greece - The Case Study of Athens" with the participation of the National Technical University of Athens, the Solid Waste Management Authority of Attica (E.D.S.N.A), EPTA - Consulting Environmental Engineers and the Municipalities of Athens and Kifissia.

The guide was developed using the results of the pilot bio-waste separation at source in the Municipality of Athens and the Municipality of Kifissia. It was applied in selected areas, covering a population of more than 3,000 inhabitants in each municipality. These areas were:
In Athens: Kypriadou, Gazi.
In Kifissia: Kato Kifissia, Nea Kifissia, Kastri, Ekali (and it was extended to Strofili and Kefalari).

The pilot project began in 2013 and continues to be implemented in the two municipalities. The material collected, is transferred to the Mechanical Biological Treatment Plant of Athens (A. Liossia).

The Guide is an essential tool for the municipalities, which intend to implement their bio-waste separation at source (SaS) scheme. It includes step-by-step directions on how a municipality can design, implement and monitor a (SaS) system.
1 INTRODUCTION

According to the Framework Directive 2008/98 the biological wastes (bio-waste) are defined as:

*the biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and related wastes from food processing plants,*

In article 22 of the Framework Directive it is mentioned that Member States take appropriate measures, where appropriate and in accordance with Articles 4 and 13, to encourage:

a) the separate collection of biological waste, in view of the composting and digestion of the bio-waste,

b) the treatment of bio-waste in a way that ensures a high level of environmental protection,

c) the use of environmentally safe materials produced from bio-waste.

The separation at source of bio-waste is being implemented for decades in several European Countries and is considered as one of the most basic tools for the diversion of biodegradable waste from landfills. This guide is intended for countries which are at the beginning and aim to establish an organized collection and treatment network for bio-waste.
2 DESIGN OF THE SEPARATION AT SOURCE SCHEME

2.1 BASIC PARAMETERS

1. **Ensuring availability of a treatment unit for the collected bio-waste**

Before the start of the design of a SaS system, the Municipality should have secured that the region is serviced by a municipal bio-waste treatment plant (composting or anaerobic digestion).

2. **Selection of the areas involved**

An entire municipality or only one district / region can be selected with the aim progressively to extend the system. Also, specific waste producers can be selected, e.g. large tourist facilities.

→ **Advantages**: Based on the results of implementation in the pilot area, errors can be avoided and prevented and the system can be optimized prior to its extension to the whole municipality.

3. **Number of households within the region's limits**

In order to estimate the number of households within the region, municipal data and records concerning active electricity bills can be used. Alternatively, data from the Official Statistical Authority can be used.

4. **Number of store and businesses within the region's limits**

For estimating the number of commercial stores, hotels and other large producers (supermarkets, farmers markets) within the region where the same methodology as with households can be applied.

5. **Selection of materials to SaS**

The separation at source system can include garden waste either as a combination with food residues or separately. The disadvantage of the common collection is the requirement of greater capacity bins and the seasonal garden waste production.

In the case where common collection of food residues and green waste is chosen the following must be evaluated and taken into account:

- Proportion of residences with garden
- The production of green waste shows fluctuations with the larger quantities from spring to autumn.
It is recommended that SaS for garden waste be carried out separately from food residues.
2.2 SYSTEM SELECTION FOR SAS

2.2.1 DOOR TO DOOR

In a door to door collection system, every building has its own bin, distributed by the Municipality, with a size of usually 30-360 lt. This method is mainly suitable for houses or residences with yard, so that it is possible to place a collection bin in an exterior private space. The use of this method can be also used for blocks of flats, provided there space for the placement of the bin.

The residents receive from the Municipality a waste collection programme, where the exact days and time of collection are listed. During those days the owners place the bins in the curb in front of the building. Next, when the collection vehicle has gone, the bin is moved again inside at the owner’s responsibility.

This collection method leads to high percentages of participation and high quality of the material collected since a feeling of responsibility is generated in the citizen. Also, the crew of the collection body has the possibility to perform sample optical checks and make recommendations to the owners of the bins, where it is found that there is systematic disposal of materials (e.g. packaging materials), which are not an objective of the programme.
Choose the door-door system if one of the following criteria applies:

- The main feature of the Municipality are houses with yards (more than 60% of the buildings).
- The door-door system is already implemented successfully in the Municipality.

2.2.2 CENTRAL BINS

This collection system is based on a dense network of bins, at a relatively small distance from every household. The citizen carries the separated bio-waste to the bins, where they are collected. The difference with the door-door system is that these bins are common and serve the area where they are placed.

For the siting of the bins it is recommended to take into consideration the existing network of bins for mixed and recyclable waste (e.g. blue bins network). This practice helps towards an easy adaptation of the users avoiding reactions or complains for their siting, since the existing locations of the bins have already been configured in the people's minds as waste disposal sites.

In any case, the final selection of siting should be done by the Municipality's Cleansing Department, taking into account space adequacy, users serviced, possible nuisances and ease of accessibility for the rubbish truck.

This method is suitable for areas with a high density of building and restricted space for use of private bins in every house/building. The disadvantage is that there is no direct connection between the bin and some households and thus the feeling of personal responsibility is not generated and higher percentages of impurities are observed as well as lower participation.

Also, frequent washing of the bins is required by the Municipality's Cleansing Department.
2.3 SELECTION AND SUPPLY OF EQUIPMENT

This Section outlines the process of selection and supply of the required equipment (bins, biodegradable sacks, collection truck, etc.) for the implementation of the SaS system.

2.3.1 BIODEGRADABLE BAGS

A bag is defined as biodegradable when it meets the specifications of the standards EN 13432 "Packaging - Requirements for the recoverable packaging through composting and biodegradation - Testing programme and evaluation criteria for the final acceptance of each packaging" and EN 14995.

In practice it is a type of bag which biodegrades and is composted 100% within a period of months at the most. Thus it can be put directly into the biological treatment process, without the need to be removed as with common plastic bags, offering at the same time high durability to liquid and organic waste.

The basic requirements for biodegradable bags are the following:

- The size should be compatible with the kitchen bin, in which it will be used
- Thickness should be about 20 μm for sacks ~10 lt and 35 μm for sacks ~50 lt, so they can withstand the weight of food waste

The advantages in the use of biodegradable sacks are:

- Increased participation in the SaS programme, especially at its start
- Reduction in leachate and odours in the bin and the collection vehicle
- Reduction in the frequency of bin washing

Its basic disadvantage is the high cost. This cost is expected be reduced significantly when many Municipalities implement collection programmes and a market is created for this product.

The practices followed in relation to their distribution and use are the following:

1. Free provision by the Municipality during the whole duration of the programme
2. Free provision only during the initial stages of the programme. Then citizens will have to buy them from supermarkets and other stores.
3. Optional use at the citizen's expense from the start of the programme or alternatively use of a paper bag

In relation to the required quantities of biodegradable sacks the following are recommended:

- Athens Bio-waste
  Guide for the implementation, monitoring and evaluation of bio-waste source separation and composting schemes
• Supply of biodegradable sacks, to last for at least for three months per household
• On average at least 6 bags/week are required per household and 8 bags/week per store-business.

In a question put to the participants in the Municipality of Kifissia, as to how they evaluate the biodegradable bag, 89% answered that they were satisfied from its use and only 38% stated that they had used alternative storing means, such as paper bag or plastic bag.
Together with the distribution of biodegradable sacks there must be a briefing of the citizens on the alternatives in case a) the initial quantity runs out or b) the Municipality does not supply biodegradable sacks at all.

**Alternative solutions**

- **Use of paper bag**
  Corresponding to paper bags used for groceries

- **Use of newspaper**
  Wrapping of food residues with a newspaper and then disposal in the kitchen bin

- **Purchase of biodegradable sacks**
  Purchase of biodegradable sacks from supermarkets, grocery stores etc. The Municipality must arrange that sacks be available in stores within the regions participating in the SaS

**2.3.2 COLLECTION BINS**

**2.3.2.1 Kitchen bin**

Regardless of the selection at source system (door to door or central bins) every household must be provided with a small selection at source bin, which is placed in the kitchen. Free supply of kitchen bins by the Municipality helps significantly in enabling citizens to participate in the SaS programme and it is recommended for all cases.

The number of kitchen bins is estimated on the basis of the number of households and stores/businesses of the SaS application area.

Kitchen bins usually have a capacity of 7-10 lt and can additionally have vent holes. In the case of the vented bins aeration of the material is allowed, provided biodegradable bags are used. This aeration leads to the reduction of odours and humidity from the material.
In case the supply of biodegradable bags is discontinued by the Municipality, the supply of vented bins with holes must be avoided.

The kitchen bin must have adequate width so that a dish can be emptied and suitable depth so that its washing is possible.

2.3.2.2 External collection bins (door to door)

The external collection bins in a door to door system usually have two wheels and a capacity of up to 360 lt.
The following table shows the bin type and the proposed capacity, depending on the households served per building in a **door-door system**:

<table>
<thead>
<tr>
<th>Households per Building</th>
<th>Required capacity (lt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35-40</td>
</tr>
<tr>
<td>2</td>
<td>35-40 x 2</td>
</tr>
<tr>
<td>4-6</td>
<td>120</td>
</tr>
<tr>
<td>7-12</td>
<td>240</td>
</tr>
<tr>
<td>&gt;12</td>
<td>360</td>
</tr>
</tbody>
</table>

→ Bins between 35-50 lt must have a safety lock so that in case of overturn (e.g. cats) there is no dispersion of their content.

→ **Bin stickers**
The dimensions should be as large as possible. Indicatively some specifications are mentioned below:

- 30 x 35 for two-wheel bins
- Four colours
- Mold, cutter, rounded edges
- Screen printing
- White PVC sticker
- Indelible inks with the use of varnish of 4-5 year duration
- For outdoors use

### 2.3.2.3 Outdoor collection bins (central bins)
The outdoor collection bins, which are accessible 24 hours by the citizens/businesses, are proposed to be two-wheeled ones (e.g. from 260-360 lt) due to the high specific weight of food residues) and to have brown color.
However, in special cases such as e.g. in the Municipality of Athens metal four-wheel bins can be used, which are manufactured for capacities of 660lt and above. With the metal bins:

- Theft is hindered as well as their removal by unauthorised personnel
- They provide the possibility of placing holes on the cover to avoid the insertion of bulky materials
- They present durability to arsny

For the stickers all that was mentioned in the previous Section is applied, while the dimensions of the over 360 lt bins must be at least 48x65cm (width x height).

> For the calculation of the number of central bins, the locations must be taken into account, where bins for MSW and recyclable materials have been placed.

### 2.3.3 BIO-WASTE COLLECTION-TRANSPORT VEHICLE

Vehicles must be suitable for the collection of bio-waste, their transport and unloading in the processing plant.

The vehicles should be selected as follows:

- They should have adequate capacity, in order to collect all bio-waste from the target area in a single route.
- They should be watertight and preferably closed (open vehicles should not be excluded).
- They should be equipped with a bin lifting mechanism.
- They should be suitable for manual unloading of the bins, particularly when the door to door system is implemented.
- They should carry the logo of the separation at source scheme.
- Depending on the building density of the serviced area, they should be particularly maneuverable in order to be used in narrow streets also.
In order to reduce capital costs, the possibility of using an existing municipal collection vehicle should be examined first.

Usually the vehicles considered as suitable for this case are those of the press and mill type of 4-12m$^3$. Higher capacities should be avoided particularly during the first period of implementation of the SaS system.

→ Due to the high specific weight of bio-waste (about 500 kg/m$^3$), the vehicle driver must ensure that there is no vehicle overloading.

→ Bio-waste must be transported daily to the processing plant if possible and not remain in the vehicle after collection because of the generation of odours. However the distance to the WTP could be a limiting factor.

2.4 DISTRIBUTION OF BINS

The distribution of bins/biodegradable sacks is a turning point in a separation at source programme. During the distribution days, the citizens can come in direct contact with the Municipality staff, be briefed and ask for clarifications regarding the programme.

Next, the personnel requirements for the distribution of bins are presented:

- **Organization and staffing of distribution crews consisting of:**
  - About two (2) persons/team, which will visit households and brief about the ongoing bin distribution.
  - Each team must be accompanied by the Municipality crew (one driver and one worker), which will carry the bins. For this purpose a small open vehicle/truck can be used.

- **Each distribution crew must be equipped with the following:**
A frequently asked questions (FAQ) form
An information form, so that there is a single and standardised information flow from every crew to the citizens.
A map of the route which will be followed.
A list for data recording of the households/stores, which will take the bin and participate in the programme.

The distribution team participants must be fully trained and briefed as to the purpose and objectives of the programme, so that they can provide the maximum possible information to the citizens.
Also, a uniform appearance is important for the creation of a positive image. It is indicatively mentioned that in the Municipality of Athens vests were used bearing the Athens Bio-waste logo.

→ The distribution team and the crew should be in continuous visual and telephone contact in order to achieve fast bin distribution after a household has agreed to receive a bin.

→ The bin distribution must be carried out preferably during the weekends, in order to ensure the presence of most of the residents. Also, for the same reason extended holiday seasons should be avoided.

![Image 6: Use of LIFE vests during the bin distribution in Kifissia](image)
2.5 FREQUENCY AND COLLECTION PROGRAMME

The determination of the collection frequency for food residues depends on factors such as:

- produced quantities (e.g. peak periods)
- collection frequency of mixed MSW
- climatic conditions (summer or winter period)
- the separation at source system

Based on the results of the pilot programme, the collection in the door to door system was 2-3 times a week. In the contrary in the central bin system, the collection rate was 1-2 per week during the winter with a possible increase of the collection rate to at least twice a week during the summer months.

Generally, in all the areas of the pilot programme there were no suggestions/complains from the residents about the collection frequency increase.

Next are presented the results of the questionnaire which was addressed to the residents of the areas where the door to door system was implemented.

<table>
<thead>
<tr>
<th>Question</th>
<th>SATISFACTORY</th>
<th>FAIR</th>
<th>NOT SATISFACTORY</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you rate collection frequency?</td>
<td>80%</td>
<td>19%</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Would you prefer more frequent collection?</td>
<td></td>
<td></td>
<td></td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>Are you satisfied with the collection programme?</td>
<td></td>
<td></td>
<td></td>
<td>95%</td>
<td>5%</td>
</tr>
</tbody>
</table>

The questionnaire results show that in general terms a 2-3 times per week collection rate was acceptable by the participating residents.

→ It is suggested to implement collection twice a week on average (this applies to Mediterranean countries). Depending on the season and on residents' suggestions, the collection rate can
increase or decrease either to cover waste production peaks or to make the programme more efficient.

→ The collection personnel must always be the same, in order to be suitably briefed about the objectives of the programme and to be able to provide clarifications and directions to the residents.
2.6 PARTICIPATING AND SERVED HOUSEHOLDS

After the completion of the bin distribution only part of the households will receive a kitchen bin and will participate in the programme. For this reason, it is important to have a briefing kiosk in every district for a few days, particularly for those who were absent during the distribution days.

The total number of households, which received a bin are defined as served households and their percentage to the total number of households depends on various factors such as e.g. the efficiency of the awareness campaign or the bin distribution programme.

The experience of the pilot programme showed that the served households are between 45%-80% of the total number of households.

Regardless of the number of served households it is expected during the programme, that only a percentage of these households will actually participate in the programme. As participating households are defined those which participate in the programme at least once within a pre-defined period of time, which usually includes 3 days of collection.

On the basis of the evaluation results of the pilot programme, it was shown that at least 45% of the served households or 20%-35% of the total number of households participated in the programme one year after the bin distribution.

The percentage of the participating households is high immediately after the bin distribution and it shows descending course when no awareness activities are carried out. (Section 3.6).
2.7 Collection Times

The estimate of the collection time is essential, in order to estimate the required number of collection routes.

For the door to door system, the following table presents analytically the collection times per Route as a function of the type of bins and the participating households, on the basis of the pilot Athens Bio-waste results. These times may vary in areas with other characteristics:

<table>
<thead>
<tr>
<th>Type of Bins Collected</th>
<th>Net collection time</th>
<th>Participating Households</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Route 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 lt</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Route 2</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>Route 3</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Route 4</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>Route 5</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Route 6</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Bins Collected</th>
<th>Net collection time</th>
<th>Participating Households</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Route 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 lt</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Route 2</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>Route 3</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Route 4</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>Route 5</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Route 6</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

*Unloading with the use of lifting mechanism

In Route 1 e.g. 4 10lt bins, 25 35lt bins and 1 50lt bin were collected. The households corresponding to the above bins were 43.

According to the data of the above table it is shown that on average 0.84 min or otherwise 50sec are required for servicing each household which participates in the door to door system.

Therefore, the total net collection time can be calculated approximately as follows:

\[ X = Y \times \text{Estimated Participation Percentage} \times 0.84 \text{ minutes/household} \]
Where:

Y: the total number of kitchen bins of capacity ~10 lt which will be distributed. The number of bins equals the serviced households.

**Estimated Participation Percentage (%)** The percentage of households, which are expected to participate actively in the system one year after the start of the SaS system. The value of 45% can be used.

0.84 minutes/household: Specific coefficient of the net collection time per household.

At this point it must be mentioned that if the participating households within a route are increased the time for servicing each household will be reduced. According to the estimates of the Municipality's Cleansing Department within the same time period and route 50% more households can be serviced provided they place their bin during the specified collection days.

Therefore the above expression is modified as follows:

\[
X = Y \times \text{Estimated Participation Percentage (\%)} \times 0.56 \text{ minutes/household}
\]

For the central bins system, the following table presents analytically the collection times per Route as a function of the number of the collected four-wheel bins:

<table>
<thead>
<tr>
<th>Route</th>
<th>Number of four-wheel Bins</th>
<th>Net collection time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>27 minutes</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>29 minutes</td>
</tr>
<tr>
<td>3</td>
<td>39</td>
<td>46 minutes</td>
</tr>
<tr>
<td>4</td>
<td>39</td>
<td>39 minutes</td>
</tr>
<tr>
<td>5</td>
<td>39</td>
<td>45 minutes</td>
</tr>
<tr>
<td>6</td>
<td>35</td>
<td>45 minutes</td>
</tr>
<tr>
<td>7</td>
<td>42</td>
<td>55 minutes</td>
</tr>
<tr>
<td>8</td>
<td>43</td>
<td>47 minutes</td>
</tr>
<tr>
<td>9</td>
<td>37</td>
<td>37 minutes</td>
</tr>
<tr>
<td>10</td>
<td>44</td>
<td>43 minutes</td>
</tr>
<tr>
<td>11</td>
<td>50</td>
<td>53 minutes</td>
</tr>
<tr>
<td>12</td>
<td>49</td>
<td>49 minutes</td>
</tr>
</tbody>
</table>

According to the data of the above table it is shown that on average about 1 minute is required for the unloading of each bin.
Therefore, the total net collection time can be calculated as follows:

\[ X = Y \times 1 \text{ minute/bin} \]

Where:

\( Y \): the total number of central bins which will be placed.

\( 1 \text{ minute/household} \): Specific coefficient of the net collection time per central bin.

Finally, in both systems the movement time between collection districts must be counted as well as the time for the delivery of the collected bio-waste to the processing plant.
3 AWARENESS CAMPAIGN

3.1 INTRODUCTION

The basic objective of the awareness campaign is to inform households and stores about the separation at source scheme in order to ensure their participation.

At the same time, it targets the briefing bodies such as schools, mass media and local clubs.

3.2 PHASES OF BRIEFING CAMPAIGN

The briefing-awareness campaign is divided into three (3) phases, with the intermediate and the central being the starting moment of the separation at source.
Figure 1: Phases of Briefing-Awareness Campaign

<table>
<thead>
<tr>
<th>Phase</th>
<th>Objective</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHASE 1: BRIEFING</td>
<td>First contact and briefing about the SaS system implementation.</td>
<td>1 month prior to SaS start</td>
</tr>
<tr>
<td>PHASE 2: ACTIVATION</td>
<td>Activation of citizens about the start of the separation at source and their analytical guidance for the proper use of the equipment.</td>
<td>during the bin distribution</td>
</tr>
<tr>
<td>PHASE 3: REMINDER</td>
<td>Continuous awareness of the citizens about the benefits of the SaS and encouragement for the continuation of their participation.</td>
<td>Continuous after the start of the SaS</td>
</tr>
</tbody>
</table>
### 3.3 HORIZONTAL ACTIONS

#### 3.3.1 CAMPAIGN RESPONSIBLE

The organization and coordination of the briefing-awareness campaign should be assigned to a dedicated person. An indication of the necessary man-days is given in the next table:

<table>
<thead>
<tr>
<th>Phase of SaS</th>
<th>Time Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 6 months prior to the SaS launch</td>
<td>1 day a week</td>
<td>System preparation – planning</td>
</tr>
<tr>
<td>1 month prior to the SaS launch</td>
<td>3 days a week</td>
<td>Launch of A’ phase of the campaign</td>
</tr>
<tr>
<td>During distribution</td>
<td>5 days a week</td>
<td>Launch of B’ phase of the campaign</td>
</tr>
<tr>
<td>During SaS implementation</td>
<td>2 days a week</td>
<td>Launch of C’ phase of the campaign</td>
</tr>
</tbody>
</table>

#### 3.3.2 CENTRAL CAMPAIGN MESSAGE

The development of the central message and of the identity of the awareness campaign is the first step towards the implementation of all remaining communication actions.

**Logo**

The logo for the separation at source of the Municipality of Athens and Kifissia was selected between a series of alternative proposals, with the objective to be simple in use and to communicate directly and efficiently the recycling-composting of food residues.

![Logo](image)

**Central Campaign Message**

The central campaign message *Food Residues Composting* was selected to promote the meaning of composting but also to be understandable by most citizens. The expression *food residues* has been considered as more suitable to communicate the campaign message than the official term *bio-waste*.

![Central Campaign Message](image)
**Campaign Banner**
The campaign banner has been developed to allow its insertion in web pages and internet media. Some snapshots are presented below:

![Image 7: Banner of the briefing campaign project](image)

### 3.3.3 CONTACT OFFICE - CONTACT LINE

The creation of a citizens' contact and briefing office is necessary for the continuous and direct contact of citizens with the competent services of their Municipality. For this purpose, the existing contact telephones of the Cleansing Service of the Municipality can be used, but one person must be fully trained to answer on a daily basis. All requests must be recorded on a special form.

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From the experience of Athens Bio-waste, the contact office received almost daily phone calls with requests for new bins (e.g. in areas not serviced), for bin substitution (in case of theft), for free supply of bags from the Municipality, etc.

3.3.4 Athens Bio-waste Web Page

Updating of the Municipality's web page with information about the SaS system is recommended since it provides the opportunity to residents to be informed on all the actions planned for their district. It is recommended to include thematic actions, such as: Who can participate? How can he/she participate? Why participate?

Image 8: Excerpt from the Kifissia Municipality webpage
3.3.5 Social Media

The use of social media, such as Facebook, Twitter etc. is necessary for the wide dissemination of initiatives, especially among young people. The dissemination of information from user to user makes briefing quick, immediate and effective.

Image 9: Excerpt from Facebook page of the Athens Bio-waste project

3.3.6 Collection Vehicle Branding

The bio-waste collection vehicle is a daily reminder to the people in the pilot region and it confirms in some way their effort for separation at source. The creation of a model with the central message of the briefing-awareness campaign and the branding of the vehicle are highly recommended.
Also, the bins must have a uniform image and fit into the more general picture of the briefing campaign. For this purpose the design of a special sticker for outdoor bins must be designed.

The stickers designed for the two Municipalities in the Athens Bio-waste project are the following:
3.4 BRIEFING ACTIONS (PRIOR TO THE SAS LAUNCH)

The 1st phase of the campaign aims to the first contact and briefing of the residents/stores in the target areas.

3.4.1 BROCHURE - POSTER

The brochure is the most important tool in order to inform about the planned actions. The minimum contents of the brochure are the following:
- Methods and equipment for the implementation of the programme
- Definition of bio-waste and the items which can be collected separately
- General - summary information about the Municipality's initiative
- Contact data
It is also recommended to use one side of the brochure as a poster, so that it can be used with a dual purpose.

For the estimate of the quantities of the brochure to be published, the following must be taken into account:

- The total number of the households served
- Number of schools and other public buildings
- Extra amount for distribution in municipal events, etc.
→ As the number of copies increases the price per brochure decreases.

→ If possible the brochures should not include specific dates or names of persons so that they can be used even if those change in the future.

3.4.2 SAS Launch Letter

The distribution of the brochure in combination with a form letter from the Mayor or Vice-Mayor to the residents is deemed as the most direct and efficient mean for briefing and encouraging the residents to participate in the SaS. In this way, a direct and 'personal' approach of the residents is achieved by the local government representatives, which creates to the residents a feeling of responsibility for the improvement of the quality of life in their district.

Also, the objective of the form letter is to inform about specific actions or activities of the Municipality in the frame of the programme, which are not included in the brochure. Indicatively, are mentioned:

- The exact date of bin distribution and the collection launch
- The bin distribution method (door-door, distribution hours, etc.)
- The collection programme for every region
- Scheduled events to inform residents.

3.4.3 Update of the Municipal Council and Officials

It is important in this phase to have an analytical update of the competent officials of all the Municipality as well as of the Municipal Council, in order for the procedure which will be followed for achieving the SaS objectives to be fully understood.

3.4.4 Press Release & Press Conference for the Launch of the Programme

The form letter to the citizens, can be used as a press release, for briefing the local media and bodies. The press conference in areas with large population is appropriate for a wider briefing. The Campaign Official must compile a list of all local bodies and Media in order to send regular updates and press releases.
3.5 ACTIONS OF ACTIVATION - GUIDANCE (DURING BIN DISTRIBUTION)

The 2nd phase of the campaign which is connected in time with the bin distribution, aims at activating the citizens for the launch of the separation at source. This phase lasts a short period of time and it targets residents and stores of the serviced areas.

3.5.1 NOTICES

A week before the launch of the bin distribution, notices should be posted, which will inform residents of the upcoming launch of the separation at source. The notices will be mainly posted in blocks of flats in order to achieve a simultaneous update and reminder to all residents.

![Notice in a block of flats of the Municipality of Athens](image14.jpg)

3.5.2 BIN INSTRUCTION MANUAL

The objective of this manual is to accompany the bins which will be delivered to the residents of the pilot areas and inform them in detail on the method of their use. It is appropriate that this manual should be in the households and businesses in a conspicuous place, in case some information is needed. The manual should include the following information:

- Instructions for the use of both kitchen and outdoor bins
- Instructions for the use of biodegradable bags
- Biodegradable items that can be placed in the bin
- Contact information
The manual could be substituted with a letter, but since a commercial printing is done the cost is proportional.

3.5.3 INFORMATION KIOSK

During the bin distribution, some residents might be absent or there might not be enough time for analytical briefing and guidance. From the Athens Bio-waste experience, conducting events in central locations of the Municipality (pre-arranged day and hour) is not very effective because of low participation. For this reason it is suggested that a mobile kiosk be installed in every neighborhood for a few days.
In the kiosk, which should be coated with the central message of the campaign, information about the programme should be provided, printed information brochures should be handed out to all those who have not received it and above all personal briefing should be carried out.

3.6 ACTIONS OF REMINDER - AWARENESS (DURING IMPLEMENTATION)

The 3rd phase of the campaign concerns the continuous awareness of the residents and the action planning should be determined by the monitoring and evaluation system.

3.6.1 INFORMATION KIOSK

A reminder action of the pilot system is the residents update through the mobile booth-stand in various neighborhoods at regular intervals (one every semester).

It is important in this phase to record problems, complaints etc. Also, with the production of the first compost material, this can be distributed for free in small sample sacks.

3.6.2 REMINDER LETTERS

It is proposed to send relevant letters every six months or at least annually.

These letters should serve a dual purpose:

- update about the course of the system and its results
- encourage the continuation of the efforts already under way by the residents
Consequently, they should at least include the following:

- Actions which have taken place since the last letter, such as collected quantities, maps with the participating locations, system expansion, equipment replacement, answers to complaints, problem solving, etc.
- Actions planned for the next quarter, such as planned events, etc.

Letters should be signed by the municipality officials.

Also, in combination with the letters, a questionnaire could be sent for monitoring the separation at source system and the update - awareness campaign.

3.6.3 SCHOOL ACTIVITIES

Actions for awareness on environmental and recycling issues in schools should be carried out at least once per year. There are a significant number of actions that could be implemented effectively in schools with relatively low cost from the Municipalities themselves in collaboration with the teachers of the schools. Indicatively some examples are mentioned below.

NURSERIES - KINDERGARTEN

- Distribution of brochures to children, presentation of information in very simple words and emphasis that the brochure must be given to the parents.
- Forms with standard exercises
- Games in the classroom
PRIMARIES

- Distribution of brochures to children, presentation of its information
- Active participation of the pupils to the separation at source scheme. Every pupil will bring from home one or two peels of fruits or leaves and together with their teacher they will reject them into the small brown food residue bin which will be provided by the Municipality.
- Organization of painting competition for the A'-D' classes. Each student chooses one of the following indicative subjects:
  - «The route of bio-waste»
  - «The hidden in the blue bin fruits and the garbage policeman looking for them to put them in the brown bin»
  - «The lost tomato and the way to the brown bin»
  - «The banana is in danger of falling into the green bin and the food residues campaign to save it and put it in the brown bin».
- Project on the subject of bio-waste composting and separation at source for the classes (E'-F'). Possible project topics:
  - «What is bio-waste? Activities at home which produce bio-waste»
  - «Food residues composting. How can I participate in my Municipality?»
- Survey (B’ – F’). Each pupil does research at home and in his immediate environment about the SaS programme, filling out questionnaires. The aggregated results are analysed in the classroom and passed on to the Municipality.

GYMNASIUM - HIGH SCHOOL

- Distribution of brochure to children, presentation of its information
Optional project on the topic of bio-waste composting and separation at source. Possible project topics:
- «The separation at source scheme and food residue composting»
- «Advantages of composting»
- Projection of relevant video about bio-waste composting

3.6.4 PRESS RELEASES - INFORMATION LETTERS

Press releases will be sent throughout the implementation of SaS in combination with reminders that will be distributed to residents. Particular emphasis should be given to sending press releases to local newspapers and websites. At the same time an information letter should be sent to selected local bodies of each Municipality.

3.6.5 PARTICIPATION TO LOCAL EVENTS

Given the limited budget for information actions, it is important that they can be incorporated into scheduled Municipal events. This will be considered on a case basis at regular intervals. Examples include the Environment Day and related events implemented by a Municipality.

Image 17: Athens Bio-waste booth during the 2012 Semi-Marathon
Image 18: Athens Bio-waste booth during the flower fair in Kifissia, 2012
4 BIO-WASTE TREATMENT

The first step before the launch of a separation at source scheme is to ensure the availability of a biological treatment unit.

In the case of the pilot programme, the collected bio-waste is transferred to the Mechanical Biological Treatment Plant of Athens, where they are treated separately from mixed waste in a composting channel.

4.1 QUALITY OF INCOMING MATERIALS

To enable the treatment of bio-waste these should present specific characteristics and be compatible with the available treatment equipment. The presence of impurities in the collected bio-waste hinder the effectiveness of treatment and affects negatively the quality of the compost produced and consequently its marketability and utilization. Therefore the proper separation at source of food residues and the reduction of impurities result in better and more correct treatment of the material.

The concentration of contaminants in bio-waste is directly related to the SaS system which is applied to serviced areas. In areas where a door-door collection system is applied bio-waste is largely free of impurities compared with central bins systems. This differentiation in the recovery efficiency is based mainly on the fact that with the door-to-door method individualization and responsibility of the user is achieved.

In the the Municipality of Kifissia where the door-door system is implemented, it is observed consistently a very high purity of the collected bio-waste which ranges to over 98%* levels. Due to the good quality of bio-waste it is possible to treat them directly in the composting plant.

---

1 Without considering plastic bags
In the case of Municipality of Athens where the bio-waste SaS programme is implemented using central bins, the impurities amount to 5-6%. It should be noted that in the case of Kypriadou it has been observed that there a need for further purification of certain collected loads before they are treated in the composting plant. This is due to the need to remove foreign materials which may cause wear and damage to the machinery of the composting unit (e.g. stirring system).

In commercial areas such as that of Gazi in the Municipality of Athens where the SaS programme is implemented using a central bin system, the biggest challenge is presented regarding the presence of impurities in collected bio-waste. This material systematically presents many impurities of all types but mainly from packaging materials. The collected material from the serviced area of Gazi always requires further separation before being led for treatment in order to remove foreign materials e.g. debris, cables, bulky waste, which may cause problems in the operation of the composting plant.
4.2 BIO-WASTE TREATMENT TECHNOLOGIES

The main technologies for the treatment of bio-waste are composting and anaerobic digestion, which are summarized.

4.2.1 COMPOSTING

Composting is the controlled aerobic, biological, oxidizing process of degradation and stabilization of organic materials which occurs under conditions which lead to the development of temperatures of the thermophilic range (region). Consequently composting is a specialized form of waste biostabilisation in which the moisture and aeration conditions are such as to ensure the rapid development of controlled high temperatures favorable for growth and prevalence of thermophilic microorganisms. It is about i.e. a controlled bio-oxidizing process in which:

- It concerns heterogeneous organic materials in solid state
- It goes through an initial degradation phase during which temperatures are developed in the thermophilic region and phytotoxic substances are temporarily produced, and
- It leads to a stabilisation state, the final product of which is characterized as "mature compost"

4.2.2 ANAEROBIC DIGESTION

- The term "anaerobic digestion" refers to the controlled biological degradation of organic waste under conditions of lack of oxygen (anaerobic) and leads to the production of biogas (a mixture of CH₄ and CO₂ which may be used as fuel for the cogeneration of electricity and heat) and of a residue (digestate). Anaerobic digestion involves biological processes which can be classified into four distinct phases:

  • Hydrolysis of polymeric organic compounds (fats, proteins, polysaccharides) with the aid of enzymes that are released by hydrolytical bacteria and are converted to water soluble products
• **Fermentation** of the above solvent products and their conversion into a variety of intermediate products, such as short organic acids, alcohols, carbon dioxide, hydrogen and ammonia.

• **Oxeogenesis**, i.e. production of acetic acid, carbon dioxide and hydrogen from the products of the previous stage by means of mandatory oxeogenic bacteria. At this stage, carbon dioxide is the main component of biogas. (pH: 4.5 to 6.5).

• **Methanogenesis**, in which the products of the previous phase are converted into methane and carbon dioxide from the methanogenic bacteria. (pH: 6.8 to 7.2).

### 4.3 QUALITY OF COMPOST

The determination of the quality of the final solid material resulting from the biological treatment processes of the collected bio-waste (composting, anaerobic digestion) is an important element which renders possible its classification as compost and its potential safe disposal. Therefore, the quality control of the material generated determines the acceptance and the evolution of treatment methods for bio-waste and the development of the compost market.

In particular for bio-waste, the European Commission issued a relevant report on common declassification criteria when these are subject to biological treatment. The required quality specifications of the finished product, as provided in the aforementioned report, are expected to be the content of relevant Regulation which should be jointly pursued by the Member States of the EU.

The required quality characteristics of the final product include examination of the content in organic matter, the stabilization level, the presence of pathogens, pests and weeds, the impurity content and the concentration of heavy metals and organic pollutants. In particular, the limit values set for each of the above mentioned parameters are presented in the following table.

<table>
<thead>
<tr>
<th>Quality Criteria</th>
<th>Parameter</th>
<th>Limit Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compost</td>
<td>Content in organic matter</td>
<td>Minimum limit 15% of dry matter (d.m.) in the final product after the biological treatment of bio-waste and prior to its mixing with other materials.</td>
</tr>
<tr>
<td>Inorganic pollutants - Heavy metals</td>
<td>Cadmium, Cd</td>
<td>1.5 mg/kg d.m.</td>
</tr>
<tr>
<td></td>
<td>Chromium, Cr</td>
<td>100 mg/kg d.m.</td>
</tr>
<tr>
<td></td>
<td>Copper, Cu</td>
<td>200 mg/kg d.m.</td>
</tr>
<tr>
<td></td>
<td>mercury, Hg</td>
<td>1 mg/kg d.m.</td>
</tr>
</tbody>
</table>

---

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### Quality Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel, Ni</td>
<td>50 mg/kg d.m.</td>
</tr>
<tr>
<td>Lead, Pb</td>
<td>120 mg/kg d.m.</td>
</tr>
<tr>
<td>Zinc, Zn</td>
<td>600 mg/kg d.m.</td>
</tr>
</tbody>
</table>

**Organic pollutants**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polycyclic Aromatic Hydrocarbons (PAH₁₆)</td>
<td>6 mg/kg d.m.</td>
</tr>
</tbody>
</table>

**Sanitary specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of pathogens</td>
<td>Absence in a 25 g sample</td>
</tr>
<tr>
<td>E.Coli</td>
<td>Maximum content 1000 CFU/g of fresh material</td>
</tr>
<tr>
<td>Development of plant pests and weeds</td>
<td>Maximum allowable limit up to 2 parasites per liter of compost</td>
</tr>
</tbody>
</table>

**Unwanted ingredients and properties**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impurities in plastic, glass and metal</td>
<td>Maximum permissible limit of impurities (glass, metal and plastic) up to 0.5% by weight of dry matter material after sieving at 2mm.</td>
</tr>
</tbody>
</table>

**Material stabilisation**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compost</td>
<td>- Respirometric index with maximum permissible value of 25 mmol O₂/kg organic matter/h. or -Minimum Rottegrad III, IV or V (Self-heating control of the material with limit a temperature increase up to 30°C of ambient temperature).</td>
</tr>
<tr>
<td>Solid residue of anaerobic digestion</td>
<td>- Respirometric index with maximum permissible value of 50 mmol O₂/kg organic matter/h. or -Maximum content in organic acids equal to 1500 mg/l or -Maximum biogas production equal to 0.25 l/g volatile solids</td>
</tr>
</tbody>
</table>

---

Organic matter

Organic matter is an important parameter for assessing the quality of the compost because it is a key building block of organisms and soil. Organic matter is a source of food for soil fauna, it contributes to biodiversity by acting as a reservoir of nutrients such as nitrogen, phosphorus, etc. while at the same time it is the main factor in fertility and soil productivity. Organic substance protects the soil from the loss of nutrients due to leaching, while nutrients are gradually and balanced recovered by the soil solution through which the root system feeds. Therefore, the content of the compost in organic matter is particularly important since it can significantly improve the physicochemical properties of soils. In the declassification criteria the minimum required
content of compost in organic matter is 15% d.m. in the final product after the biological treatment of bio-waste and prior to its mixing with other materials. This is to prevent the dilution of the composting / anaerobic products with inorganic components (e.g. sand, soil).

→ Indicative values of organic matter from the compost resulting from the composting of bio-waste in the Municipalities of Athens and Kifissia is equal to 67.27 ± 8.77% d.m.

Sanitary specifications
The presence of pathogenic microorganisms in the compost and the development of parasitic organisms are a limiting factor in its disposal to the ground. The significance of the above control parameters in compost lies in the potential risk of their exposure and transmission to the plants, animals and humans during its disposal to the ground. According to the bio-waste declassification criteria the absence of Salmonella spp is required in 25gr of fresh material, while as a maximum limit of presence of Escherichia coli are defined 1000 CFU gr-1. In addition, there is an upper limit in the growth of parasites and weed when using compost equal to 2 parasites per liter of compost. Indicatively, the microbiological testing on different samples of compost from bio-waste in the pilot areas of the Municipalities of Athens and Kifissia, is in agreement with the requirements for sanitization of the material. The measurement of the presence of pathogenic microorganisms and the development of parasites should be linked with the operational conditions concerning the treatment of bio-waste such as temperature-time conditions².

→ Indicatively, the microbiological testing on different samples of compost from bio-waste in the pilot areas of the Municipalities of Athens and Kifissia, is in agreement with the requirements for sanitisation of the material with the absence of Salmonella spp at 25gr of fresh material and 40 CFU gr¹ for Escherichia Coli.

Impurities
The impurities relate to the total amount of foreign materials contained in the final product namely glass, metal and plastic. The presence of glass (4-mm to 13-mm) presents a risk to humans and animals when exposed without precautions or through direct ingestion. The metal impurities can also cause serious problems, while they are at the same time a possible source of trace elements that interact with the ground. Hard plastic in large quantities may affect the physical properties of the soil during compost disposal (e.g. soil staining, heat retention). In general the presence of impurities in soils, due to the use of compost, leads to the deterioration and reduction of the value

² The degree by which pathogenic microorganisms are inactivated has been determined on the basis of the thermal necrosis. Therefore, maintaining a high temperature is regarded as the most reliable method, if not the only one, which can be determined and adjusted during the biological treatment of bio-waste. For this reason, the time-temperature conditions are the most common control parameter of elimination / inactivation of pathogenic microorganisms in the compost. In each pathogenic microorganism there is a threshold value of temperature above which the microorganism is no longer viable. The conditions proposed for composting of bio-waste are (a) 65°C or more for at least 5 days, or (b) 60°C or more for at least 7 days, or (c) 55°C or more for at least 14 days. Correspondingly during the anaerobic digestion of bio-waste, maintaining 55°C for at least 24 hours with a hydraulic retention time of at least 20 days is a sufficient condition for ensuring sanitisation of the final solid product.
of land, and may adversely affect the demand for material since the presence of impurities is the only immediately visible contaminant in the final product. The declassification criteria of bio-waste regarding impurities provide a maximum cumulative rate in glass, metal and plastic (material of size less than 2mm) equal to 0.5% measured in dry mass material. It is worth noting that in the case of the final processed material derived from the bio-waste of the pre-pilot areas of the Municipalities of Athens and Kifissia the present criterion is not fulfilled showing a percentage of impurities (>2mm) equal to 2.0% d.m. (mainly glass impurities). In this case, the high content of impurities in the final product is due to the absence of any pretreatment in the collected bio-waste (e.g. removal of non-biodegradable organic materials) before its entry to the composting plant.

Therefore, in the biological treatment plants which receive bio-waste with a high rate of impurities due to incorrect practice of SaS in the serviced areas (e.g. SaS implementation in commercial areas such as Gazi - see. Section 4.1) further separation is deemed necessary e.g. by mechanical separation or separation by hand, in order to increase the purity of the entering material to levels that meet the criterion of impurities in the final product. In contrast, in cases such as the pilot SaS implementation in the Municipality of Kifissia where a very high purity is registered of the entering material, it is possible to have direct treatment of bio-waste without further separation.

Finally, it is worth noting that compost from mixed bio-waste produced currently Mechanical Biological Treatment does not meet the impurities requirements set out by the bio-waste declassification criteria despite having a thorough mechanical selection to the entering load (mixed waste). Therefore, it is concluded that the separation of bio-waste through appropriate SaS programmes is considered a prerequisite for achieving the desired limits on the level of impurities.

Levels of impurities in (a) bio-waste compost (European countries and Athens Bio-waste pilot programme) (b) mixed compost (EMAK) and the maximum permissible limit of impurities in compost set by the E.U.

<table>
<thead>
<tr>
<th>Country</th>
<th>% dry matter</th>
<th>E.U. Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>France (1)</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>France (2)</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
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<td></td>
</tr>
<tr>
<td>Belgium</td>
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<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Germany (1)</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Germany (2)</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Germany (3)</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Athens Bio-waste Pilot application</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>EMAK mixed compost</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>E.U. Limits</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>

**Heavy metal concentration**

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The presence of high concentrations of heavy metals in compost and soil may develop suitable conditions for their penetration through the root system of plants, into their edible fruit and thus bio-accumulate in animal and human tissues which could lead to poisoning as well as carcinogenesis and mutations due to their cumulative effect. The heavy metals for which a check of their concentration is carried out in the resulting solid products which result from the bio-waste biological treatment methods, are Cadmium (Cd), Chromium (Cr), Lead (Pb), Copper (Cu), Nickel (Ni), Zinc (Zn) and mercury (Hg).

The particularity of heavy metals in relation to the other control parameters lies in the fact that they have a greater impact on the environment and on the health of animals and humans, while they are not degraded during the biological treatment of bio-waste, but in the contrary an increase in their concentration is seen in the final product in relation to the entering bio-waste. Therefore, the concentration of heavy metals and therefore the quality of the final product is directly linked to the characteristics of the entering material. Observing the following table it is seen that the concentration of heavy metals in compost, which comes from bio-waste in SaS implementation areas in Europe as well as in the pilot areas of the Municipalities of Athens and Kifissia, is in most cases below the maximum permitted limits in all components examined. In contrast, the compost produced from mixed waste (case of EMAK Ano LioSSia) shows significantly higher concentrations of heavy metals, which in several cases (e.g. copper, mercury and lead) exceed the maximum permitted limits which have been set on the basis of bio-waste declassification criteria. The highest concentrations of heavy metals in the mixed compost are due to the encumbrance and contamination of bio-waste during their retention with the rest of the waste prior to their mechanical selection. Therefore, it is concluded that the bio-waste SaS is a basic prerequisite for the achievement of the declassification criteria regarding the concentration of heavy metals.

Concentration of heavy metals in (a) bio-waste compost (European countries and Athens Bio-waste pilot programme) (b) mixed compost (EMAK) and maximum permissible concentrations of heavy metals in compost set by the E.U.

<table>
<thead>
<tr>
<th>Type of Compost</th>
<th>Country</th>
<th>Cd</th>
<th>Cr_{tot}</th>
<th>Cu</th>
<th>Hg</th>
<th>Ni</th>
<th>Pb</th>
<th>Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compost from bio-waste in E.U. countries</td>
<td>Ireland</td>
<td>0.8</td>
<td>65</td>
<td>100</td>
<td>0.3</td>
<td>39</td>
<td>100</td>
<td>266</td>
</tr>
<tr>
<td></td>
<td>Netherlands</td>
<td>0.6</td>
<td>27</td>
<td>55</td>
<td>0.15</td>
<td>13</td>
<td>79</td>
<td>217</td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
<td>0.9</td>
<td>37</td>
<td>99</td>
<td>0.24</td>
<td>22</td>
<td>164</td>
<td>282</td>
</tr>
<tr>
<td></td>
<td>Austria</td>
<td>0.8</td>
<td>40</td>
<td>88</td>
<td>0.28</td>
<td>27</td>
<td>41</td>
<td>324</td>
</tr>
<tr>
<td></td>
<td>Spain</td>
<td>0.6</td>
<td>57</td>
<td>169</td>
<td>0.6</td>
<td>31</td>
<td>83</td>
<td>359</td>
</tr>
<tr>
<td></td>
<td>Belgium</td>
<td>1.3</td>
<td>46</td>
<td>59</td>
<td>0.2</td>
<td>18</td>
<td>103</td>
<td>317</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>0.8</td>
<td>-</td>
<td>135</td>
<td>0.5</td>
<td>33</td>
<td>79</td>
<td>312</td>
</tr>
<tr>
<td></td>
<td>Germany (1)</td>
<td>0.6</td>
<td>37</td>
<td>70</td>
<td>0.17</td>
<td>24</td>
<td>57</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>Germany (2)</td>
<td>0.7</td>
<td>36</td>
<td>75</td>
<td>0.2</td>
<td>25</td>
<td>62</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>Germany (3)</td>
<td>0.7</td>
<td>37</td>
<td>78</td>
<td>0.17</td>
<td>25</td>
<td>55</td>
<td>246</td>
</tr>
<tr>
<td></td>
<td>France (1)</td>
<td>0.9</td>
<td>39</td>
<td>107</td>
<td>0.38</td>
<td>25</td>
<td>92</td>
<td>332</td>
</tr>
<tr>
<td></td>
<td>France (2)</td>
<td>0.6</td>
<td>41</td>
<td>86</td>
<td>0.19</td>
<td>24</td>
<td>66</td>
<td>236</td>
</tr>
<tr>
<td>Compost from bio-waste from the SaS pilot implementation in the Municipalities of Athens and</td>
<td>0.43</td>
<td>14.58</td>
<td>113.36</td>
<td>0.22</td>
<td>16.89</td>
<td>90.47</td>
<td>261.59</td>
<td></td>
</tr>
</tbody>
</table>

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Guide for the implementation, monitoring and evaluation of bio-waste source separation and composting schemes
Organic pollutants

Organic pollutants are a new evaluation criterion of the quality of the final material resulting from the bio-waste biological treatment methods. This criterion has been set given the concern that has occurred due to possible high concentrations of organic pollutants in compost and/or solid residues of anaerobic digestion. Organic pollutants may occur in agricultural products grown near industrial zones where incinerators operate or metallurgical and petrochemical activities are applied. According to the bio-waste declassification criteria polycyclic aromatic hydrocarbons (PAHs) are contained in organic pollutants with an upper concentration limit in the final product equal to 6 mg/kg d.m.

Material stabilisation

The biological stabilisation of the final product is intended to control its maturity until the completion of the required biological processes relating to the treatment of bio-waste.
5 MONITORING - EVALUATION

Monitoring of the separation at source system is an essential process since it allows the Municipality to evaluate the results and take corrective actions.

5.1.1 COLLECTED QUANTITIES

<table>
<thead>
<tr>
<th>Indicator target</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Collected quantities of bio-waste, are the most important indicator in the implementation of a SaS system since it shows whether the system proceeds successfully or not.</td>
<td></td>
</tr>
</tbody>
</table>

Measurement – Indicator Recording

Information about the collected quantities can be obtained from the treatment plant. It is recommended to record data per route (Route).

Also aggregate data should be kept per month and per region (provided different routes are run).

The percentage of separate collection of bio-waste, is calculated as
follows:

<table>
<thead>
<tr>
<th>COLLECTED BIO − WASTE QUANTITIES (−impurities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL ESTIMATED BIO − WASTE QUANTITIES (IN THE MUNICIPALITY)</td>
</tr>
</tbody>
</table>

To estimate the total estimated quantities of bio-waste produced in a region, data from qualitative analyzes should be used.

### Indications – Handling Measures

- **Reduction of quantities per month**
  - It is checked whether the reduction is due to a period of low food residue production, due to a non-touristic season or due to other possible causes.
  - If after 6 months a systematic reduction is observed, awareness measures should be applied.
  - If after these measures have been applied (e.g. 1-2 months later) no increase in the quantity is observed, the 'system effectiveness and satisfaction of citizens' is examined.

### 5.1.2 MATERIAL PURITY

#### Indicator target

The purity of the collected waste, i.e. the absence of impurities (e.g. plastic, metal, etc.) indicates the degree of public awareness and the effectiveness of the SaS system organized by the Municipality. It is a decisive factor for the treatment of the material, as the processing plants may not accept material with a high impurity rate e.g. above 10% b.w.

#### Type of Impurities

The impurities in the bio-waste SaS are divided into 2 categories:

- Impurities due to excessive use of plastic bags by the citizens, which occurs when the available free biodegradable bags have been exhausted.
- Other impurities (e.g. packaging) by incorrect selection at source, which occurs when the citizen is not briefed correctly.

#### Method of estimation – purity recording

There are two methods to estimate impurities:

- Empirically, through visual inspection and with the help of evaluation scale. The empirical estimation can be done either during unloading of the material at the processing plant or individually in each bin.

  A indicative evaluation scale of the impurities:
### Classification of impurities

<table>
<thead>
<tr>
<th>No impurities</th>
<th>Only one material e.g. bag</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Few impurities but with SaS indication</td>
</tr>
<tr>
<td>Many impurities</td>
<td>the material is similar to mixed waste</td>
</tr>
</tbody>
</table>

- By sampling in the plant and analyzing the qualitative composition of the collected bio-waste (in cooperation with the operator of the plant).

### Measurement requirements

- The technical staff of the processing plant should be suitably trained and provide constant information to the Municipality about the percentage of impurities of the collected bio-waste (ideally for each Route). For the staff training it will be required to conduct sampling and qualitative analysis of samples during the initial runs.
- A bin supervisor must be assigned, who will conduct regular bin checks and record (on a qualitative scale) the material purity (it concerns central bin systems).
- In door to door systems a monitoring programme should be prepared.

### Indications – Handling Measures

#### High impurity percentage mainly in plastic bags

- Plastic bags appear when the biodegradable bags distributed to citizens in the initial phase of the SaS system have been exhausted.
- Since this creates technical problems in the operation of the treatment plant, the Municipality should:
  - provide free extra biodegradable bags, which is often considered quite difficult because of the high cost.
  - to implement a specific awareness campaign to avoid the use of plastic bags, encouraging other ways of wrapping materials (e.g. paper grocery bags, newspapers).

#### High impurity

This indicates that some participating citizens have not been briefed.
<table>
<thead>
<tr>
<th>Percentage with mixed materials and packaging</th>
<th>properly. In central bin systems, people may confuse the colours of bins (e.g. blue bin for waste packaging, brown bin for bio-waste, etc.).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In Central bin systems</strong></td>
<td>▪ The bin supervisor is informed by the plant about the high impurities and carries out a visual check on the bins of the origin of waste.</td>
</tr>
<tr>
<td></td>
<td>▪ If bins are observed with bags other than those of food residues, a sticker is placed on the upper side of the bin (to make it more obvious that the bin concerns only food residues)</td>
</tr>
<tr>
<td></td>
<td>▪ He/she distributes a special letter to the neighbourhood with emphasis on the purity of the material.</td>
</tr>
<tr>
<td></td>
<td>▪ If the bins mainly serve stores, he/she contacts the person in charge.</td>
</tr>
<tr>
<td></td>
<td>▪ He/she checks a few days later and if the situation has not improved he/she transfers the bin to a different spot or removes it.</td>
</tr>
<tr>
<td><strong>In Door-door systems</strong></td>
<td>▪ Collection workers are informed, so they visually check the bins before collection.</td>
</tr>
<tr>
<td></td>
<td>▪ If impure material is observed systematically originating from a house, necessary recommendations are given.</td>
</tr>
</tbody>
</table>

### 5.1.3 Participating Households

<table>
<thead>
<tr>
<th>Indicator target</th>
<th>This indicator shows how many households participate in one area, i.e. the percentage of the population participating in the SaS of food residues. It is of crucial importance, if the Municipality wishes to increase the collection quantities, i.e. to increase the diversion of bio-waste from the landfill.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of estimation – purity recording</td>
<td>In door-door systems: ▪ If a particular district of the Municipality (e.g. Municipal section) participates, then statistical data about the local</td>
</tr>
</tbody>
</table>
population and the number of households can be obtained by the respective statistical agency. Also, data is used for all the branches of hygiene, hotels, etc., located within the Municipality.

→ TOTAL POPULATION, TOTAL HOUSEHOLDS
→ TOTAL COMPANIES

- For the population served, the data from list created during the distribution of bins is used. The list includes among others households and firms, which have received bins and their addresses.

→ POPULATION SERVED, HOUSEHOLDS SERVED
→ COMPANIES SERVED

- For the counting of the participating households in an area, at least two consecutive measurements are carried out from which the result will be:
  - The number of households that participated at least once, i.e. those which have at least once taken the bin out
    → PARTICIPATING HOUSEHOLDS
  - The number of companies that participated at least once, i.e. those which have at least once taken the bin out
    → PARTICIPATING COMPANIES

- Participation is calculated as follows:

\[
\% \text{ PARTICIPATION OF SERVED HOUSEHOLDS} = \frac{\text{PARTICIPATING HOUSEHOLDS}}{\text{SERVED HOUSEHOLDS}}
\]

\[
\% \text{ PARTICIPATION OF SERVED COMPANIES} = \frac{\text{PARTICIPATING COMPANIES}}{\text{SERVED COMPANIES}}
\]

\[
\% \text{ TOTAL HOUSEHOLD PARTICIPATION} = \frac{\text{PARTICIPATING HOUSEHOLDS}}{\text{TOTAL HOUSEHOLDS}}
\]

\[
\% \text{ TOTAL COMPANY PARTICIPATION} = \frac{\text{PARTICIPATING COMPANIES}}{\text{TOTAL COMPANIES}}
\]

In the central bin systems:

- If a particular district of the Municipality (e.g. Municipal section) participates, then statistical data about the local population and the number of households can be obtained by
the respective statistical agency.

- TOTAL POPULATION, TOTAL HOUSEHOLDS
- TOTAL COMPANIES

- For the population served, the data from list created during the distribution of bins is used. The list includes among others households and firms, which have received bins and their addresses.
  - POPULATION SERVED, HOUSEHOLDS SERVED
  - COMPANIES SERVED

- It is considered that the participating households separate 4 of bio-waste kg/week.

- PARTICIPATING HOUSEHOLDS are calculated as follows:

\[
\% \text{ HOUSEHOLD PARTICIPATION} = \frac{\text{TOTAL COLLECTED QUANTITIES PER WEEK}}{4 \text{ KG} \times \text{TOTAL HOUSEHOLDS}}
\]

- PERCENTAGE OF SERVED HOUSEHOLDS PARTICIPATING

\[
\% \text{ PARTICIPATION OF SERVED HOUSEHOLDS} = \frac{\text{PARTICIPATING HOUSEHOLDS}}{\text{SERVED HOUSEHOLDS}}
\]

- PERCENTAGE OF TOTAL HOUSEHOLDS PARTICIPATING

\[
\% \text{ TOTAL HOUSEHOLD PARTICIPATION} = \frac{\text{PARTICIPATING HOUSEHOLDS}}{\text{TOTAL HOUSEHOLDS}}
\]

| Other relevant indicators | The indicators which are normalized to households, are considered more reliable than the corresponding per resident. However, from the average value of the number of persons per household all the indicators may be deduced to residents. |
| Indications – Handling Measures | When the participation proportion of the households served is low (e.g. <40%), this means that although citizens have taken a bin, they are not aware enough to start SaS. In this case, contact by phone should be made (data is available due to the distribution of bins) to examine the reasons for non-participation. Also, provision of information / awareness at schools should be established to motivate parents. Motivation, e.g. reduction of offset fees could be a way to encourage participation. |
The percentage of total households participating is low

When the participation percentage of households is low (e.g. <10%), this means that people have either received a bin and they are not participating (see above), or they have not received a kitchen bin because they did not want to participate. If the participation of served households is relatively high, then emphasis must be given to households that have not received a bin. A new launching campaign should be organized for SaS and delivery of bins.

→ With increasing participation rate, the SaS system becomes more effective and efficient since more quantities of bio-waste can be collected in the same route.

→ Even if a costly briefing - awareness campaign is implemented, there will always be households which do not participate. Changing the behaviour towards issues of recycling and separation at source (changing daily habits) requires a lot of time and constant briefings, while only provision of incentives could be immediate and effective. For example, the policy of 'Pay as you throw - PAYT' for mixed waste could directly lead people to separate their waste in order to reduce their annual expenditure.

5.1.4 Effectiveness of Awareness Campaign

| Indicator target | Every briefing and awareness campaign should be monitored and evaluated in order to optimize the use of communication actions. The basic measurement that should be sought from the evaluation process is the extent to which the objectives of the project are achieved, i.e. the quantities collected. However, indicators should be recorded - which track the degree of implementation of the communication actions (e.g. number of leaflets distributed). |
| Method of qualitative estimation | Indicators are relatively easy to quantify, and assess, but they are not representative as to the degree of achievement of the final objective (separate collection and treatment of bio-waste). |

For example, the distribution of 1,000 brochures covering the whole of a pilot area is an important indicator, but it does not mean that all recipients eventually have received the brochure, have read it and have shown awareness.

An index should be created of people and bodies who have been briefed and it must be constantly supplemented together with each action of awareness.

Where there is a way to record contact information, this should be completed

- Name
- Number of persons per household
Frequency
- Indices of action implementation should be recorded continuously by the SaS Project Official in order to be evaluated according to the other indicators/indices analyzed above.

**Indicative indicator examples**
- Number of calls, request recording (complaint, application for a bin, information, etc.)
- Number of visits to the Municipality's web site
- Number of 'likes' in the facebook site
- Estimation of number of brochures distributed per area
- Estimation of number of form letters distributed per area
- Number of events staged and number of participants
- Number of press releases/interviews, Number of invitations/press releases that were sent, Number of references in the press
- Number of households – businesses briefed
- Estimation of number of visitors in the briefing kiosks
- Number of schools and pupils that participated in school activities

### 5.1.5 SYSTEM EFFECTIVENESS & CITIZEN'S SATISFACTION

**Indicator Target**
In a SaS system, citizens or businesses may not participate or to stop participating, because they may not be satisfied with the services provided by the Municipality. It is a quality indicator and measures the satisfaction of citizens regarding the SaS system implemented in their area.

**Method of qualitative estimation**
It can be estimated using the following questionnaires:
- By distributing printed questionnaires door to door through the collection crews. The answer may be sent by fax or directly to the Municipality.
- Sending email to Citizens who have received a bin (utilizing the record kept with their contact details)
- Through telephone contact with Citizens who have received a bin
- Through schools, using a questionnaire which all pupils will receive
- Through the Municipality's web site or the social network media
- Through the analysis of requests/complaints received through the Municipality's contact line
This research is of particular value in the first years of operation of the SaS system, where the Municipality is trying to identify the problems and to improve its services. The questionnaire should be implemented at least once a year for the first few years and there must be a possibility to complete it through the online media.

Example of research conducted in the Municipality of Kifissia in the first semester of implementation of the SaS system

Through research, the indications about the problems are clear, in which case the Municipality is in a position to know and deal with the problem properly. There should also be an examination of the percentage of the unsatisfied citizens even if it is small.

5.1.6 System Efficiency

Indicator target

Even if the SaS system operates successfully as far as the participation or citizen satisfaction is concerned, the Municipality should always consider the parameters of system optimization in order to reduce their operational costs and consequently reduce the offset fees paid by the citizens.

Method of estimation

The most basic indicator is the Annual Operating Cost of the SaS system (with increasing collection quantities, the cost per ton is reduced) but also the Total Operating Cost of the department. The cost should be measured on an annual basis.

Possible ways of optimisation

- Optimisation of routes
- Change of the frequency of collection of mixed waste, when the participation rate is relatively high
- Use of a transfer station for bio-waste in order to reduce travel to the processing plant
- Utilisation of the bio-waste collection workers in other services (if there is time available)
6 SEPARATION AT SOURCE COST DATA

6.1 INVESTMENT COST

The cost of the initial investment for the installation of a separation at source system includes the following individual expenses:

- cost of bin supply
- cost of purchase of a special refuse truck (provided no existing truck is used for collection)
- cost of purchase of biodegradable sacks
- cost of awareness campaign (during initial phase and first year) including consumables for school events

**Indicative unit prices** (excluding VAT), which are representative of the Greek market, are presented in the following table:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost of Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Σώλια</strong></td>
<td></td>
</tr>
<tr>
<td>Plastic Bins 10 lt</td>
<td>6- 10,00 €</td>
</tr>
<tr>
<td>Plastic Bins 35-40 lt</td>
<td>19,00 €</td>
</tr>
<tr>
<td>Plastic Bins 50 lt on wheels</td>
<td>20,00 – 34,00 €</td>
</tr>
<tr>
<td>Plastic Bins 120 lt on wheels</td>
<td>25,00 €</td>
</tr>
<tr>
<td>Plastic Bins 240 lt on wheels</td>
<td>38,00 €</td>
</tr>
<tr>
<td>Plastic Bins 360 lt on wheels</td>
<td>65,00 €</td>
</tr>
<tr>
<td>Metal Bins 660 lt</td>
<td>335 €</td>
</tr>
<tr>
<td>Metal Bins 1100 lt</td>
<td>335 €</td>
</tr>
<tr>
<td><strong>Βιοδιαλυτικές σάκοι</strong></td>
<td></td>
</tr>
<tr>
<td>Biodegradable sacks 10 lt</td>
<td>0,085-0,135 €</td>
</tr>
<tr>
<td>Biodegradable sacks 50 lt</td>
<td>0,245-0,475 €</td>
</tr>
<tr>
<td><strong>Vehicles</strong></td>
<td></td>
</tr>
<tr>
<td>Garbage truck of the press type 4 m³</td>
<td>60,000 €</td>
</tr>
<tr>
<td>Garbage truck of the press type 6 m³</td>
<td>70,000 €</td>
</tr>
<tr>
<td>Garbage truck of the press type 8 m³</td>
<td>110,000 €</td>
</tr>
<tr>
<td>Garbage truck of the press type 10 m³</td>
<td>120,000 €</td>
</tr>
<tr>
<td>Garbage truck of the press type 12 m³</td>
<td>115,000 €</td>
</tr>
<tr>
<td>Garbage truck of the mill type 4 m³</td>
<td>100,000 €</td>
</tr>
<tr>
<td>Garbage truck of the mill type 6 m³</td>
<td>110,000 €</td>
</tr>
<tr>
<td>Garbage truck of the mill type 8 m³</td>
<td>115,000 €</td>
</tr>
<tr>
<td>Garbage truck of the mill type 10 m³</td>
<td>125,000 €</td>
</tr>
<tr>
<td>Garbage truck of the mill type 12 m³</td>
<td>130,000 €</td>
</tr>
</tbody>
</table>
The following charts show the distribution of investment costs in relation to the population served, as indicated by the Software for the Cost and Footprint CO₂eq Assessment from the separation at source of bio-waste.

**Figure 2:** Distribution of investment cost in a door-door system

**Figure 3:** Distribution of investment cost in a central bin system
In a door-to-door system, purchase costs of collection bins is higher than that in a system of central bins. Similarly, in both systems, the investment cost can be reduced if existing collection vehicles are used or if no kitchen bins and biodegradable bags are purchased. In all cases, the investment cost per resident is substantially reduced with an increase of the area of SaS implementation.

**Figure 4: Investment cost comparison between door to door system and central bin system (examples)**

Note: For the design of the SaS system and its installation Municipality staff will be required in order to coordinate the planning activities, the technical specifications of the equipment, the awareness campaign, the supply and distribution of bins. Also, during the phase of bin distribution special Municipality crews or volunteers will be required.
6.2 OPERATING COST

The operating cost of a separation at source system includes the following main individual costs:

- cost of collection personnel
- fuel cost
- cost of maintenance, insurance and operating of vehicles
- cost of bin replacement (5% yearly)
- cost of awareness campaign
- cost of support personnel (Responsible for SaS and for awareness campaign, bin supervisor)
- cost of purchase of new biodegradable bins (not appropriate due to high cost)

Required personnel

The staff, who will be employed in the collection of bio-waste is an important factor in the operating costs and the effectiveness of the program.

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Number of personnel</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection personnel</td>
<td>1 Driver και 1-2 collection workers per vehicle</td>
<td>The number of employees (1 or 2 per vehicle) depends on the number of bins to be emptied on a route but also on the building layout characteristics of the area and the siting of bins (in the case of two workers it should be possible to have simultaneous collection e.g. from opposite sides of a street).</td>
</tr>
<tr>
<td>Support personnel</td>
<td>1 Responsible for SaS and the awareness campaign</td>
<td>for the organization and monitoring of the system at all levels (collection, awareness, other organizational issues) as well as for the implementation of the awareness programme</td>
</tr>
<tr>
<td>Bin supervisor</td>
<td>1 Part-time bin supervisor</td>
<td>he/she will monitor the purity of the material in the bins by performing visual inspections and making recommendations where necessary.</td>
</tr>
</tbody>
</table>
The following figures show the breakdown of the operating costs, as shown by examples\(^3\) through the *Software of Estimation of the Cost and of the Footprint CO\(_2\)eq. from the separation at source of bio-waste.*

---

\(^3\) Note: these cases arise with different assumptions
It is obvious that the cost of collection staff is the biggest cost in operating a bio-waste SaS system, next follow the fuel and maintenance costs, insurance and operation of vehicles. For this reason, it is important to optimize the collection route (frequency, workers per collection route, employing workers in other tasks) as well as the selection of the appropriate vehicle (capacity, energy consumption, emissions).

By comparison, the operating cost of a door-to-door system is clearly higher than the corresponding system of central bins, since in the first case the citizens are served per household or per residence. This is more distinct in areas with a larger population.
7 ACTION PLAN

This section presents a concise action plan with the minimum required actions and staff for a Municipality, which installs for the first time a separation at source system.

## STEP 1

**Ensuring availability of a treatment plant for bio-waste**

- Is there a treatment plant for bio-waste treatment?
- Treatment plant location
- Is there sufficient treatment capacity?
- Will there be use of a transfer station (WTS)?

**Implementation region of the SaS programme**

- Will the whole of the Municipality be covered?
- Is there a pilot region which will be initially selected and then extended?
- Recording of the number of stores - businesses (large producers in the implementation area)

**Software of Estimation of Cost and CO2eq. Footprint from the separation at source bio-waste**

- Ask for the software in the email software@bio-waste.gr
- Run the software and you will be guided into Step 2.

## STEP 2

**Planning of the separation at source programme**

### 12 months prior to launch

- Selection of either door to door or central bin system
- Estimation of bins/biodegradable sacks required
- Evaluation of present fleet sufficiency or need for garbage truck purchase
- Drafting of specifications for the required equipment

**Planning of the awareness programme**

### 12 months prior to launch

- **Horizontal Actions**
  - Creation of a campaign central message
  - Creation of a communications Office - Contact line
  - Creation of the programme website
  - Creation of a social media page
- **Actions prior to SaS launch**
  - Creation of a briefing brochure - poster
  - Drafting of letter for the SaS launch
- **Actions during bin distribution**
  - Creation of notices
  - Creation of bin use manual

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65 Athens Bio-waste
Guide for the implementation, monitoring and evaluation of bio-waste source separation and composting schemes
- Information booth (kiosk) design
- Actions during implementation
- School event planning - Consumables

**STEP 3**

<table>
<thead>
<tr>
<th>Procurement of Tenders</th>
<th>6 months prior to launch</th>
</tr>
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<tbody>
<tr>
<td>Issue of tender documents &amp; tender procedure</td>
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<table>
<thead>
<tr>
<th>Receipt of supplies</th>
<th>2 months prior to launch</th>
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<tbody>
<tr>
<td>Receipt of collection equipment</td>
<td></td>
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<tr>
<td>Receipt of awareness material</td>
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**STEP 4**

<table>
<thead>
<tr>
<th>Implementation of horizontal briefing actions</th>
<th>1 month prior to launch</th>
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<tr>
<td>Implementation of briefing actions</td>
<td>1 month prior to launch</td>
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<thead>
<tr>
<th>Brochure - poster</th>
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<tr>
<td>SaS launching letter</td>
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<tr>
<td>Briefing of the Municipality board &amp; Municipality officials</td>
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<tr>
<td>Press release &amp; press conference for the launch of the programme</td>
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**STEP 5**

<table>
<thead>
<tr>
<th>Bin distribution (see 2.4)</th>
<th>1 week prior to launch</th>
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<tbody>
<tr>
<td>Organisation and staffing of distribution crews</td>
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<td>Recording of number of households which have received a bin</td>
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<table>
<thead>
<tr>
<th>Implementation of actions of activation - guidance (see. 3.5)</th>
<th>1 month prior to launch</th>
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<tbody>
<tr>
<td>Brochure distribution - poster</td>
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<tr>
<td>Distribution of SaS launching letter</td>
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<td>Briefing of the Municipality board &amp; Municipality officials</td>
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<td>Press release &amp; press conference</td>
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**STEP 6**

<table>
<thead>
<tr>
<th>Implementation of the monitoring/ evaluation programme</th>
<th>from the launch and after</th>
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<tbody>
<tr>
<td>Collected quantities</td>
<td></td>
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<tr>
<td>Material purity</td>
<td></td>
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<tr>
<td>Participating households</td>
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<tr>
<td>Effectiveness of the awareness campaign</td>
<td></td>
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<tr>
<td>Effectiveness of the system and residents’ satisfaction</td>
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<tr>
<td>Efficiency of the system</td>
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<table>
<thead>
<tr>
<th>Implementation of reminder - awareness actions (see 3.6)</th>
<th>From the launch and after</th>
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<tbody>
<tr>
<td>Information booth</td>
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<td>Reminder letters</td>
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<td>School Activities</td>
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<td>Press releases - Information letters</td>
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<td>Participation in local events</td>
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