



Domestic waste management at Cacharí City

A. S. A. Carella

Delegación de Cacharí. Argentina

Abstract

Cacharí is a small town of 3000 inhabitants where, up until 1998, 400 cubic metres of domestic wastes were dumped in a place close to the town. It led to the pollution of the town's underground water, its soil and atmosphere and, when burned, the whole town was covered with smoke. In order to ameliorate such effects, work to rectify the problems started between teachers and pupils of all the town schools.

A NGO (URECA) was created and held responsible for giving out information about the importance of classifying household trash as organic and inorganic. The town authorities built a special place where two workers are in charge of classifying the trash that can be sold (paper, glass, plastic and so on). Other town workers produce the composting which is used to enrich the soil.

The joint work between the URECA and the town government has already given excellent results.

1 Introduction

Cacharí is a small town located in the center of Buenos Aires Province, in the Azul County, Argentina. It is 250 km southwest of Buenos Aires City, the Argentina's federal capital. It holds about 3000 inhabitants, and its commercial activity stems from the agricultural and livestock primary production.

The domestic solid waste has been estimated as 700 kg/person/day, and its final fate used to be a dump located 400 meters from the town. Proliferation of rodents, unpleasant odors, smoke from burnings and groundwater contamination, were among the major inconveniences that people had to live with daily.

Another problem was of wanderers trying to pickup something valuable in the residuals and, even more dangerous, getting pieces of food out of the garbage either for themselves or to be given to their breeding animals. The residuals were collected daily by two trucks, and there was no attempt to classify them. Inhabitants showed little interest in preserving clean streets and concerns were



only aroused when the wind brought smoke and offensive odors to the town. Much scrap (agricultural machines and appliances) were found in backyards, which again brought about many rodents.

Started by municipal officials, students and teachers, an NGO named URECA (Unión de Reciclado Ecológico Cachari) was established in order to promote a better handling of the domestic wastes and, in general, aimed at improving the quality of the residents' life.

At the onset 20 teachers joined the effort, to which students later got engaged to add up to 150 members. Discrete groups of teachers and students were formed to face the various task which were carefully planned in advance. One group is responsible for making the public aware of their work and the problems faced by going to the media (TV, radio, newspapers, magazines, etc.). Another group is in charge of printing material related to the URECA initiative and a third group looks out for support of any kind (economical, technical, sympathy). A teacher takes up the overall coordination.

Those groups, along with technicians and local government officials, planned four major action guidelines.

2 Project stages

2.1 Residual treatment scheme definition

The first step was to determine the residuals flow in the city, i.e., the movements and paths of residuals in the urban domain. Three large flows were identified: domestic residuals, commercial residuals, and residual stored in backyards (later to be dumped unsafely in bulk).

Residents were encouraged to carry out the separation of organic and inorganic residuals of their own waste in high-density polyethylene bags (green and red, respectively).

The loads of organic residuals arriving at the treatment plant are transformed to compost by worms, whereas the inorganic residuals are classified and later sold for recycling. The residuals unsuitable for any use are to be disposed in a monitored sanitary landfill (not yet built).

Merchants were talked into the separating of their residuals, and to inform the municipal garbage collectors of the time they were to take the bags for picking. That way, the municipal workers adjust their schedule and avoid those residuals to be collected by wanderers, who may not give use them in a proper manner.

As for the residuals stored in backyards, again the strategy was to convince residents that they should take them out on pre-arranged days and times to be picked up by the municipal workers. Such an action virtually eliminated the existence of spurious, potentially dangerous dumps along country roads.

All of the above actions were the result of an aggressive diffusion campaign by the teachers and students of URECA.

2.2 Diffusion campaigns

The diffusion campaign made use of all media available in the town, giving a clear explanation of what was expected from residents (in-home separation of organic and inorganic wastes), about the advantages of eliminating the existing dump, and the possibility of residuals recycling. Many talks were given by specialists and the audience was invited to debate the ideas and to resolve their doubts and questions.

Printed material was distributed (Figure 1), explaining the selective separation, its easiness and advantages, and the name URECA chosen by the students for the project.

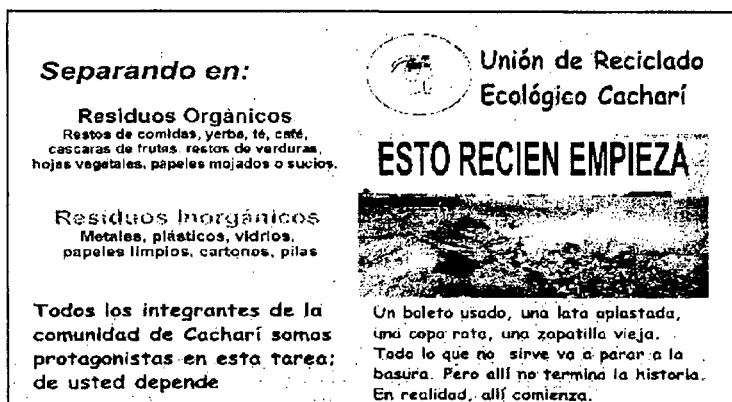


Figure 1: URECA's printed material

The project content was also made known in schools, with the idea of gaining students to be part of the NGO. The students carried out a poll to know the status before starting the project, to test the interest by residents, and to retrieve other valuable information.

In order to facilitate the in-house residuals separation, merchants were asked to stock and sell preferentially green and red bags. In the near future, two "green points" in the city will be available. Those are meant to be places to dispose off batteries, paper, and aluminum cans, and where information about the project will be given.

Nowadays, the campaign continues, driven by the students who go to TV and radio programs, write articles for magazines, accept interviews in newspapers, etc.

2.3 Complementary activities

Aside from what has been described, the municipal government and URECA develop actions aimed at keeping the interests of the students and the overall population alive.

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The southern boundary of the *Aedes aegyptys*, the dengue transmitter mosquito, is about 400 km to the north of Cacharí, which is not far enough away to considerer that the city is safe from the disease. Although there has not been an outbreak of dengue in Argentina, the mosquito has been detected. That warned URECA to the need of monitoring every water-carrier container that may bear the mosquito's larvae. Those larvae are collected by URECA members, properly trained on their capture, and taken to a specialized institution where they are examined.

URECA and the local government are building and setting receptacles at every street corner for people to dispose of papers. To date, there were no such receptacles, neither in the streets nor in public buildings.

Another task was the gathering and disposing of batteries. That implied persuading the people to separate the batteries out of the residuals and taking them to plastic containers in commercial shops and public buildings. After that, municipal workers collect the containers and take them to the plant to be treated as follows: calcium oxide and cement are added to avoid leachates; then they are transferred to two plastic bags (110 microns) and sealed into a cement block. Such blocks are assumed to isolate the batteries for about 50 years.

URECA also carried out campaigns among merchants to minimize the number of PEHD complimentary plastic bags given out, and to resort to red and green bags so that people could use them for the initial separation of residuals at home. The ONG organizes frequent recreational activities (meetings, walks, bike rides, etc.) as a way to incorporate followers in the difficult task of changing the population habits. URECA keeps contact via e-mail with ONGs in Argentina and other countries.

2.3.1 The next complementary activity

Shortly, the students will begin the setup of Californian worms hatcheries at the local schools. This will drive the students to project their own experience with the worms and to learn the worm's behavior.

2.4 Treatment plant construction

The Cacharí municipal government gave the use of a piece of land of 60 by 250 meters, located at 700 meters from the town, to carry out all tasks related to the residuals treatment. After cleaning up the land and leveling it, trees were planted around the perimeter and in inner spots.

The plant itself consists of a warehouse (7 by 18,50 meters), restrooms, a small office, ten boxes to store inorganic wastes, the composting beds, toxic material boxes (not yet built), and the worm hatchery. The warehouse is the place where the separation and classification of residuals are done. It has machinery to facilitate the work. Inasmuch as the place is continuously washed, the floor has a drainage system. The restrooms are equipped with two toilets, a shower, lavatories, and dressing rooms. General control and attention to the public are centered in the office (3 by 3 meters). The boxes store the wastes already classified, and some of them have a roof to avoid the wetting of paper,

cardboard, and pieces of cloth. Non-roofed boxes contain glass, plastic, etc., which do not lose their characteristics if wet. A place for litter and a sector for hazardous or pathogenic residues will be built aside the warehouse in the future. The composting sector will be in front of the warehouse, with enough space to allow its proper maintenance. Provision has been made to drill monitoring wells to control the quality of the underground leachate.

3 Treatment plant operation

One of the early tasks was to assess the Cachari's people habits in terms of their consumption. It was concluded that the residues were 740 grams/person/day, which adds up to 2200 kg per day for the whole town.

It emerged from the poll that 69% of the residues were organic, the rest being inorganic, pathogenic, etc. Two former wanderers were hired to select and classify the inorganic residues at the treatment plant, while municipal workers were in charge of composting and dealing with the organic residues. All workers wear gloves and protecting masks, and are frequently clinically checked at a local hospital to make sure that their health is not affected.

Two trucks collect the residuals and take them to the plant. They are dumped inside the warehouse, where two workers separate inorganic from organic matter (the colored bags help them), and classify the various residues. The organic fraction will be taken to the back of the plant, where it will first get crushed for size homogeneity and hence to accelerate the aerobic degradation. It will then be taken to the composting beds where fungi and bacteria start the natural degradation process. Those beds will be made out of cement, with lateral downsloping, to allow drainage of the leachate still contained. Such a leachate will be collected by lateral drains and flow towards a reception chamber. Such a leakproof chamber will hold liquids which, after chemical analysis, will be taken to a near treatment plant. It may be anticipated that the amount of liquid per ton on residuals will not be significant. In the near future, it has been proposed to analyze the leachate looking for dangerous dissolved metals (lead, mercury) or other potentially risky substances. After 50 days of resting, the Californian worms are incorporated, which consume the organics and excrete nutrients enriched in minerals and bacteria needed in agricultural soils.

Until the lack of metals can be checked, the product is used for floriculture. The students use this processed product to demonstrate the final fate of their residues to the town's people. They distribute 500 grams bags among the residents, along with explanatory leaflets. It has been estimated that the price of such compost in the local market may be in the order of \$ 1 per kilogram.

Once the red bags (inorganics) are separated, the workers open them and the classification stage starts. Cardboard and paper are set aside and pressed on for selling. The pressing is manual until the municipal government assigns funds to buy a hydraulic press. This material is stored under cover to avoid wetting, and is easily sold because of the many buyers in the area. Glass is separated according to colored bottles of commercial value, and crushed glass. It is also sold to regional buyers, although its price has gone down because most of the glass

comes from imports. Metal cans are pressed and packed for later selling. Clothes in good condition are taken to institutions, where they are mended and distributed according to the requests received by municipal social workers. Plastic residues are difficult to sell because of their heterogeneity and low value, so they actually represent a problem in terms of disposing of them. Nowadays, Pete, PVC, and PEHD are sold in Buenos Aires City. Batteries from domestic uses are treated as explained above.

Inasmuch as the people distinguish two types of residues (organic and inorganic), the red bags usually carry pathogenic materials (diapers, syringes, medicines, etc.). The pathogenic qualification has to do with their potential to transmit diseases or to cause contamination. That material cannot be recycled, so in the future they will be treated as ruled by the provincial environmental agency (most probably, establishing agreements with dedicated treatment plants). If a careful technical-economical analysis indicates so, an idea has grown of buying a special furnace for pathogenic residues to serve the regional needs.

Another problem to be solved is that of the pruning leftovers. Two alternatives are being thought of: buying a crushing machine, and making use of the residues from the annual municipal pruning (aspen trees, willows, ash trees, plane trees, etc.) for setting up a small trees nursery to fulfill the municipal annual forestation campaign. The nursery location would be in the treatment plant, in order to make good use of the worm-produced fertilizer. Other minor plants collected (weeds, herbs, etc.) may be used for composting purposes.

3.1 Small sanitary landfill

Recycling of residues has not fully developed in Argentina, and the few treatment plants are far away, which translates to high transportation costs. Therefore, large amounts of residues are generated, which cannot be recycled and for which a final safe fate has to be imagined.

A small sanitary landfill has been established, with a 1000-microns impermeable membrane at the bottom, to dump the residues of no use which are produced by the plant – previously compacted. Because of relatively high groundwater levels in the area, it has to be a rather shallow excavation so that the bottom is no closer than 70 centimeters from the groundwater level. The membrane is wrapped up along the perimeter of the landfill, to ensure that the leachate remains inside. The excavation and other labor will be by municipal workers, and only the membrane installation will be hired out. The filling up will start by dumping the residues in the most elevated area, so that the liquid substances drain to the lowest sectors and are pumped towards a reception chamber. No machinery is needed because the residues get there already compacted. Heavy machines will only be needed to cover the residues with soil and to compact it. Those sectors of the landfill already used are planned to be covered by an impermeable film to diminish the amount of rainfall infiltrating the residues. The mean annual rain in Cacharí is about 760 mm, much of which concentrates in the autumn, thereby representing a potential risk of infiltration.



4 Conclusions

It should be said that the whole project is not finished yet, and that the eventual changes in attitude have not been 100 per cent effective. The actual dump site is not definitely closed, there are people who do not do the in-house residues separation and they keep throwing away material in bulk, etc. However, positive changes have been observed in young people.

It should also be pointed out that the joint effort by teachers, students and local municipal officers towards a common objective, pays no attention to differences in political views or social status. The URECA's teachers and students do their work in their spare time, which shows a high degree of commitment with the project. The senior students give talks to their younger fellows, which causes more positive impact because the instructions come from their peers instead that from the teachers. Professionals, merchants, and most of the Cachari people have given their support to the project, which is a good indicator of its future sustainability. The local government has been able to optimize their work of picking up residuals, both in terms of personnel as well as economically. Trucks and municipal machinery no longer work in a disorderly manner, but they head out to work with a fixed schedule and have plenty of time for other work.

In summary, a community has been brought together by a project where all are protagonists are working for the same objectives.