Waste Management Program at the Universidad Tecnologica de Leon

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Abstract: In Mexico a lot of educational institutions send their waste to places of final disposal, which generates a negative impact to the environment; especially when these places are not adequate and they do not comply with the current environmental legislation. This is why at the Universidad Tecnologica de Leon (UTL) it has been implemented a System of Environmental Management; where 83% of the negative impact (environmental aspects) is related to waste generation. This resulted in the creation and put into practice of a Waste Management Program.

Different actions have taken place to make the program work. For example, creating a plan for, the handling of valued waste, design and set forth of the infrastructure for the primary separation of waste, environmental education and promotion to the university's community about the adequate handling of the waste, among other things.

Also, one basic part of the program is the creation of indicators: in 2008, 2009, and 2010 the daily total generation of waste, *per capita* generation, the amount recovered in the storage center for its sale and eventual recycling as the waste used to elaborate natural fertilizer (compost). Therefore, in this article are shown the results obtained from the creation and implementing of the Management Waste Program of the UTL, which can be used as testimony and model to continue bettering the handling of waste inside educational institutions.

Keywords: Waste management, valued waste, composition of the waste, university campus.

INTRODUCTION

All activities inside the university campus cause in certain degree a negative impact to the environment. One of these impacts is the generation of waste. It is important that all educational institutions, mainly universities, to implement actions to not only support the caring of the environment, but also to contribute to the overall formation of the students. So they, the students can be more prepared for challenges in the near future.

In Mexico there are universities that have waste management programs, some of these examples are: UAM (Universidad Autonoma Metropolitana), UNAM (Universidad Nacional Autonoma de Mexico), Tecnologico de Monterrey (just some of their campus), Universidad Autonoma del Estado de Morelos, Universidad de Guadalajara, Universidad Autonoma de Baja California, Universidad Autonoma de San Luis Potosi, Instituto Tecnologico Autonomo de Mexico, Escuela de Estudios Superiores de Zaragoza. In Guanajuato, ITESI (Instituto Tecnologico Superior de Irapuato, which has an ISO 14001 certification), Universidad de Guanajuato, Universidad Iberoamericana de Leon, and Tecnologico de Monterrey Campus Leon (both are starting their programs), and Universidad Tecnologica de Leon.

In the Universidad Tecnologica de Leon (UTL) there has always been a concern for addressing and minimizing this negative impact. We have been the main promoters of this change: teachers and students of the Environmental Technology degree. In 2008, it has been said that the UTL was the only educational institution in Leon, Guanajuato (Mexico) which was closest to the concept of "a green university" [1].

Although the degree of Environmental Technology opened in 1998, and since then a lot of actions have been taken to protect the environment, it was not until 2006 that nine students did their evaluations to create a system of environmental management inside the university (named: SGA-UTL), with the purpose of formalizing and integrating the efforts done in the past and formulating significant and non-significant environmental aspects; taking as reference the ISO 14001.

Out of the 18 environmental aspects that were identified for the SGA-UTL, approximately 83% correspond to the impact caused by the UTL in the area of waste [2, 3]. So, to follow-up and respond to the SGA-UTL, in 2008 started in a formal way, the WASTE MANAGEMENT PROGRAM in conjunction with the operation of a storage center, which helps with the collection, storage, and separation of the waste. The inorganic waste recovered is sold for later recycling and the organic waste is used to elaborate natural fertilizer (compost).

Just in 2008 the UTL generated 55.77 tons of waste (on average 0.2 tons per day), with this we can compare ourselves to other universities in Mexico; for example, in the Universidad Autonoma de Baja California (Mexicali I campus) one ton is generated a day [4], in Universidad Iberoamericana de Leon 0.16 tons are generated a day [5], in Universidad Autonoma Metropolitana 1.55 tons are generated a day [6, 7], this generation depends on many

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factors, mainly on the number of people inside the institution, later on we will discuss the generation *per capita* for a more accurate conclusion of this information.

As we can see, not much information exists about the generation of waste inside Mexican universities (*per capita*, total waste generation, composition of waste, etc.) [4], although some universities have their waste management program. Therefore, the main objective of this essay is to show the results obtained from at least 3 years at the UTL, to establish as precedent and testimony to continue bettering the handling of waste inside educational institutions in Mexico.

BACKGROUND AND FIELD OF STUDY

The *Universidad Tecnológica de Leon* is located in Leon, Guanajuato Mexico, and it was founded in 1995 [8]. In present time it offers around 10 degrees for TSU (University Superior Technician, level 5B, a level before Engineering). Among these degrees we have Environmental Technology. Besides this, an academic program exists in the afternoons to obtain the degree of Engineering. To offer the model 70-30 (70% practice and 30% theory) a lot of specialized labs exist to be used by the students; three terms exist per year: January-April, May-August, and September-December. Today, around 3,486 people are in the university, among which are students, teachers and administrative personnel, see Table **1**.

The waste management program started in 2007, with the storage center called Universitary Collecting Centre (UCC) or CUPA (Spanish acronym). Since then, the program offers service to the entire university by gathering, storing and separating waste. Three categories exist for the waste generated in the university: organic (green container), not organic (blue container), and garbage (black container). Not organic waste was sold for later recycling, the organic waste are used to produce natural fertilizer, and garbage is sent for final disposal at the sanitary landfill (see Fig. **1**).

The whole university community (students, professors, and administrative personnel) deposit waste in each containers, then the collecting is made (just organic and inorganic waste are taken to UCC).

MATERIALS AND METHODOLOGY

To satisfy the needs of the university in regards to the handling of waste, a diagnose was made through a quantification of the waste, with the purpose of determining the indicators of generation and designing a waste management program according to the results obtained by the study. To complement the information obtained by the program, the following methodological steps took place:

Table 1. Diverse Sector Population at Universidad Tecnologica de Leon in 2009 and 2010

	2009	2010
Students	1513	2834
Full time Professors	117	131
Administrative[1]	117	130
Half time Professors	274	391
Special projects	1	0
Service[2]	N.D.	N.D.

[1]Includes personnel in labs and information center.
[2]Includes Cafeteria service, cleaning and surveillance, which are external companies – constantly rotating, but only represent less than 2% of the population.

1. Special Waste Handling Plan

The sources of waste generation were determined to make a qualitative analysis (separation indicators) and afterwards a quantitative analysis (as mentioned in point 2), through the establishment of each source, the kinds of waste were established from its generation to its sale; the specific needs and determining of responsibilities of certain aspects such as: the generation, containment, internal collection, storage, primary and secondary separation, the original plan written by Lopez in 2008 [9], and continuing with actualization through indicators of the section 3 (indicators calculation).

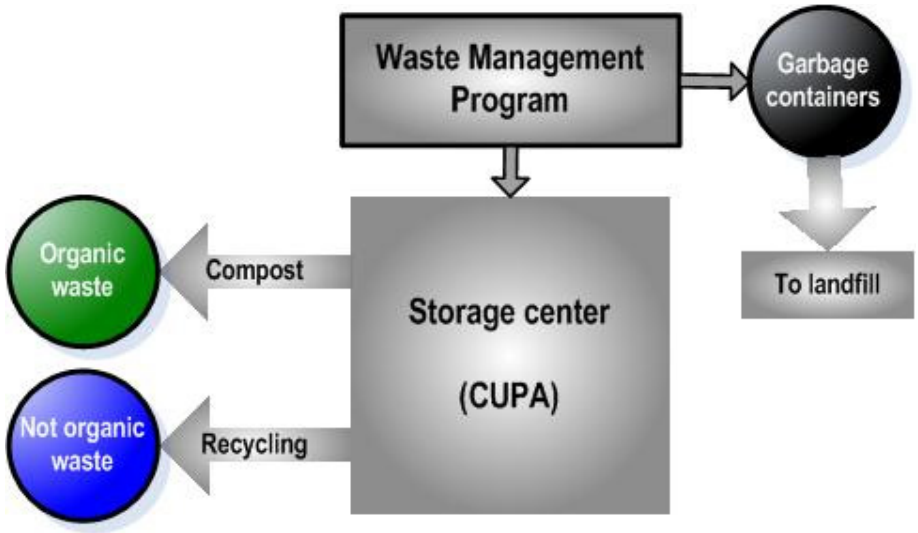

Fig. (1). Operation diagram of the storage center and destination of the waste.

2. Quantitative Analysis

Three analysis were made: one from June 2 to June 6 of 2008, another from June 22 to July 18 of 2009, and the last one from February 15 to March 6 of 2010, excluding Sundays; to quantify the production of waste from each source (the samples correspond to two terms from the university: January-April and May-August). Once collected, the samples were classified by source of generation, their physical properties were measured and determined (such as their density and volume), as also their composition.

3. Indicators Calculation

The indicators were determined from the sampling done in the quantitative description, to evaluate the efficiency of the plan, such as: total generation, *per capita* generation, percentage of waste recovered and kilograms of waste sent to the sanitary landfill, kilograms sent to recycling. Also, the different factors that vary waste generation inside the campus were analyzed, some of which are: holidays, professional practice, graduations, cultural events and others that are detailed further along.

Some of the data and indicators were obtained through the measuring of waste that entered the storage center (UCC), where the control of these measures is done through an electronic log:

- Waste subject to appreciation such as: PET, HDPE, cardboard, metal, aluminum, paper, and glass were collected, quantified and stored in UCC for later sale.
- With the organic waste, these were collected from the cafeteria, gardens and some of the waste containers in the university to elaborate natural fertilizer (compost).
- The waste that do not have a recuperation potential or that cannot be used as natural fertilizer were deposited in garbage containers, where they are taken to the sanitary landfill. The measurements of this waste are used to create an operational performance indicator [10]: total of waste sent for final disposal (kilograms sent to the sanitary landfill).

4. Containment Infrastructure Proposal

According to the needs detected in each of the sources of generation as a result of the previous sampling, some proposals were made for the acquisition and distribution for the containment infrastructure for each of the buildings; including the capacity evaluation (m^3 – cubic meters) of the general garbage containers (where they are stored until the local authorities take them to the landfill).

5. Environmental Education

An educational campaign was put into action for the entire university's community about the appropriate separation of the waste in the different containers inside the university with the intention of increasing the separation indicators and collecting of appreciable waste; and therefore, reducing the amount of waste that are sent to final disposal.

RESULT AND DISCUSSION

1. Special Waste Handling Plan

This handling plan includes, among other things: a qualitative analysis of waste and the different flow diagrams of the methods established for waste handling.

1.1. Qualitative Analysis

From the revision made, 16 sources of generation were identified inside the university, which are shown on Table **2**.

Table 2. Waste Generation Sources Related to Specific Activities

Source of Generation	Activities
Buildings (A, B, C, D, E, F)	Classes, administrative offices
Cafeteria	Catering
Laboratories (A, B, C)	Specialized education by degree
Link Center	Conferences, administrative work and publicity
Information Center	Book lending, magazines, etc.
Gardens	Fun and recreation
Football field and basketball courts	Fun and recreation
Maintenance	Facility and equipment maintenance
Construction areas and remodeling	Construction activities

Note: all buildings have two floors, except the Information Center and Cafeteria.
Source: Modified and upgraded since [9].

Table 3. Waste Classification in the Universidad Tecnologica de Leon

Inorganic		Garbage		Organic
Paper and newspapers	Books and notebooks	Metalized wrappings (cookies, potato chips)	Brochures	Cookies
Marker boxes	Aluminum	Paper wrappings	Plastic	Fruit
Folders	Invitations	Plastic sheets	Gum	Food scrap
Magazines	Paper	Plastic bags and tetra pack (juice, milk)	Compact Discs	Garden waste
Leaflet	Pieces of paper	Spoons		
Manuals	Soda bottles	Pens		
Calendars	Water bottles	Diapers		
Carton boxes	Yoghurt bottles	Toilet paper		
Pen boxes	Glass	Fruit containers		

Once identified the sources of waste generation, a qualitative description was made from each obtaining different results. Table **3** shows waste that is deposited in each of the containers according to their classification inside the university (organic, inorganic and garbage). It is important to clarify that carton, office paper (books and notebooks), mixed paper (magazines and invitations), newspapers, etc, are considered as inorganic because each are subject to sale and recycling (that is the internal classification corresponding to the different containers).

Even though people know in which container goes what kind of waste (due to environmental education), sometimes they do not deposit the garbage in its correct place. The results of a qualitative separation are shown below in Table **4**; this sample was taken in 2008.

1.2. Flows Diagrams of Waste Handling

Five flow diagrams were created according to the handling of each appreciable waste, which include: newspaper, office paper, mixed paper, organic waste and carton, there also exist flow diagrams that include the handling of dangerous waste such as: electronic appliances, serigraphy waste, electronic devices, fluorescent lamps, used batteries and waste from the different labs. Each procedure shows the specific needs and assignation of responsibilities for the handling of each waste. All the flow diagrams are available for the university's community through our quality website: http://calidad.utleon.edu.mx/access/index.php, and form part of the environmental aspects of SGA-UTL.

2. Quantitative Analysis

The results obtained from the sampling are shown in Table **5** (divided by sources of generation), including average weight, obtained in 2008, 2009 and 2010 with their respective standard deviation. In all the data we can observe that the greatest generation of waste is produced by activities from the Cafeteria, and the least generation of waste is variable depending the year.

The volume and density measurements are shown in Table **6**, where we can observe that the cafeteria is one of the highest in regards to volume and density, given that its composition is from organic waste (food) and Styrofoam.

Table 4. Qualitative Description of the Waste Containers

Source	Container		
	Organic	*Inorganic*	*Garbage*
Building A	S	S	R
Building B	R	I	I
Building C	S	I	I
Building D	I	S	S
Building E	N.D.	N.D.	N.D.
Building F	UN	R	UN
Lab A	S	S	R
Lab B	S	S	R
Lab C	S	I	I
Cafeteria	I	I	S
Link Center (CVD)	R	S	S
Information Center	S	I	I

UN = Unacceptable (separation between 0-25%).
I = Insufficient (separation between 26-49%).
R =Regular (separation between 50-75%).
S = Sufficient (separation between 76%-99%).
E = Excellent (separation to 100%).
N.D. = No data, because in 2008, the building wasn't in use, yet.

Table 5. Average Weight of Waste (Organic, Inorganic and Garbage) for Each Source of Generation

Year	2008		2009		2010	
Source	*Weight (kg/Day)*	*Standard Deviation*	*Weight (kg/Day)*	*Standard Deviation*	*Weight (kg/Day)*	*Standard Deviation*
Building A	12.89	*5.76*	12.70	*12.76*	9.0	*7.3*
Building B	19.22	*6.86*	20.44	*10.86*	23.94	*14.85*
Building C	13.60	*13.47*	9.77	*5.83*	37.57	*18.00*
Building D	25.67	*9.15*	2.86	*2.77*	5.83	*1.05*
Building E[1]	-	-	9.26	*8.10*	4.91	*4.35*
Building F	13.37	*7.07*	4.76	*3.83*	7.79	*7.25*
Cafeteria	64.91	*11.04*	25.01	*14.87*	47.24	*24.41*
CVD	12.27	*11.87*	4.28	*2.17*	6.31	*7.51*
Information Center	12.18	*5.18*	5.75	*4.95*	4.98	*2.55*
Lab. A	11.44	*10.94*	3.33	*2.47*	6.66	*6.01*
Lab. B	8.13	*5.53*	2.62	*2.59*	4.35	*3.83*
Lab. C	8.01	*5.18*	5.32	*5.56*	8.41	*4.79*
Paper containers[2]	-	-	17.67	*12.19*	3.09	*3.05*
Garden waste[3]	-	-	184.00	-	-	-

[1]In construction during 2008.
[2]In 2008 there aren't measurements of the paper containers.
[3]In 2009 the garden waste could just be sampled, the average of generation was obtained through one month of measuring.

Table 6. Average Volume and Density of Waste (Organic, Inorganic and Garbage) by Each Generation Source

Año	2008		2009		2010	
Source	Volume (m^3)	Density (kg/m^3)	Volume (m^3)	Density (kg/m^3)	Volume (m^3)	Density (kg/m^3)
Building A	0.22	57.31	0.66	56.71	0.24	38.39
Building B	0.50	40.97	1.81	45.11	0.33	71.48
Building C	0.23	57.28	0.70	48.22	0.71	53.29
Building D	0.38	67.83	0.33	64.51	0.15	38.20
Building E	-	-	0.62	44.11	0.09	52.26
Building F	0.11	123.50	0.48	29.25	0.17	44.95
Cafeteria	0.57	114.68	0.34	50.81	0.48	98.05
CVD	0.16	78.38	0.10	46.48	0.16	38.34
Information Center	0.16	74.90	0.09	92.44	0.14	36.84
Lab. A	0.16	69.51	0.19	42.17	0.17	39.12
Lab. B	0.16	52.36	0.08	38.42	0.07	59.21
Lab. C	0.14	55.45	0.13	35.99	0.19	44.71
Paper containers.	-	-	0.20	72.91	-	-
Garden waste.	-	-	2.35	313. 64	-	-

In Table **7** it can be observed the composition of the waste generated inside the university, having as the greatest generation of waste the organic matter (composed mainly by the cafeteria waste) and toilet paper, in this composition are excluded the garden waste due to that its generation is seasonal (spring, summer, autumn and winter).

3. Indicators Calculation

The total average generation of waste in 2008 was 202.065 kg/day, with a standard deviation of 92.055 and a *per capita* generation of 0.08 kg/person a day, with a population of approximately 2,525 people. In that year the storage center recuperated the 25.6% of the total waste generated in the university, which represents 48% of the recoverable waste, as shown in (Fig. **2**).

In 2009, the total average generation of waste was 147.47 kg/day and the *per capita* generation was 0.05 kg/person a day, and the percentage of recovered waste in the storage center was 29.76%, it is important to mention that the goal for the SGA-UTL was 25%, so from that moment on we started improving the environmental education program for the university community, although this number was good, the percentage of appreciable waste decreased from 46% in 2008 to 34.1% in 2009.

Finally, in 2010 the total average of generation went from 220.01 kg/day and a *per capita* generation 0.063 kg/person a day, and yet we cannot compare with 2008 and 2009 given that 2010 is still in progress while this article is being written and we don't have the results for all the year.

During work days in the university in 2008, 2009, and 2010 (present) [11, 12], the measurements were made of the appreciable waste that entered the storage center. (Fig. **3**) shows the amount of waste that entered the storage center for appreciation, since January until December [13].

Table 7. Percentage by Weight

Waste	*2008*	*2009*	*2010*
Organic matter	33.97%	23.45%	29.80%
Toilet paper	21.35%	18.00%	15.38%
Carton	8.18%	5.33%	4.10%
PET	8.10%	5.46%	5.00%
LDPE	3.12%	3.70%	4.00%
Markers	2.89%	-	0.03%
Glass	2.88%	2.77%	9.00%
File paper	2.59%	4.52%	3.04%
Styrofoam	2.08%	2.03%	4.00%
HDPE	2.04%	1.89%	2.00%
Polypropylene	1.98%	1.24%	6.00%
Tetrapack	1.93%	1.71%	1.69%
Waxed paper	1.73%	1.07%	-
Napkins	1.32%	6.77%	-
Mixed paper	1.07%	4.96%	1.50%
Aluminum	1.02%	0.82%	1.40%
Waxed carton	0.84%	0.35%	-
Newspaper	0.80%	0.43%	0.13%
Metal	0.64%	0.96%	1.00%
Garden waste	0.51%	0.39%	-
Construction waste	-	6.14%	-
Electronic waste	-	3.39%	-
Wrappings	-	1.40%	3.00%
Oil	-	-	1.00%
PVC	-	-	1.00%
Fine waste	0.73%	3.11%	6.12%
Other*	0.23%	0.12%	0.81%

* Includes: sponge, dust, mop, clothes, cotton, gauze, batteries, porcelain, CDs, soap, cord, tow, wood.

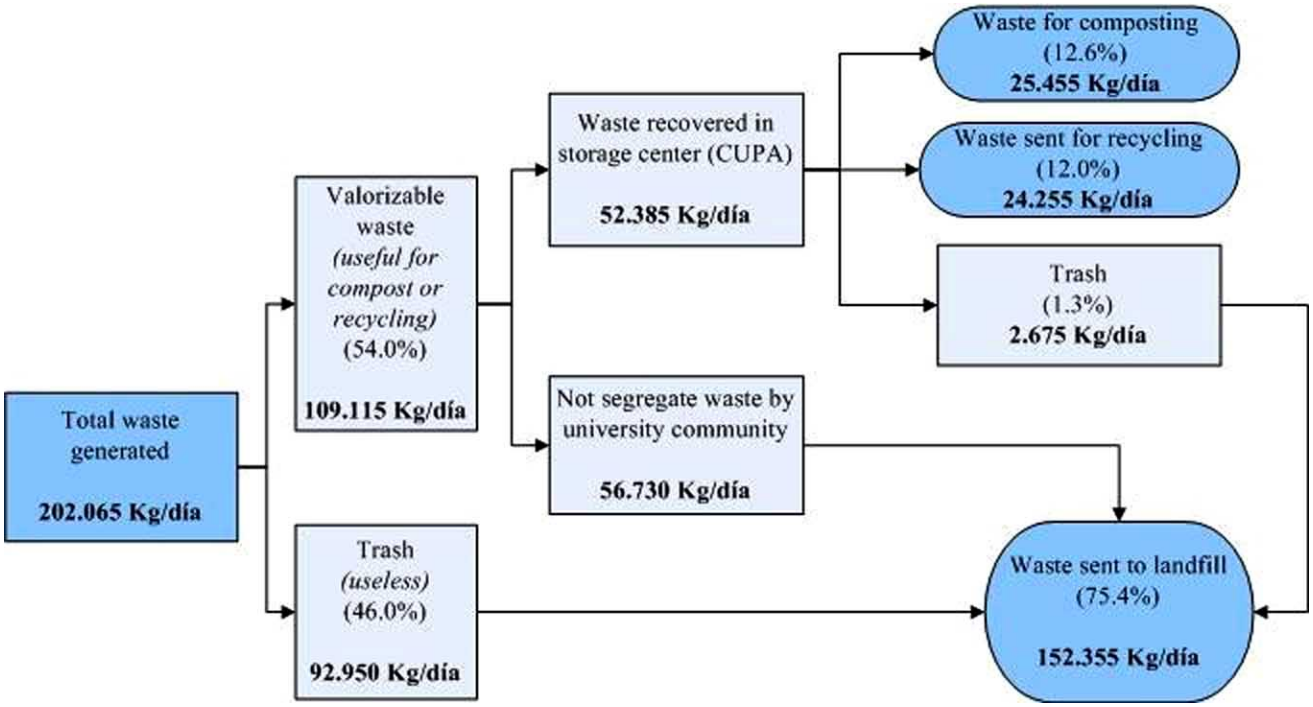

Fig. (2). Balance generation, recuperation and no recuperation of waste in 2008.

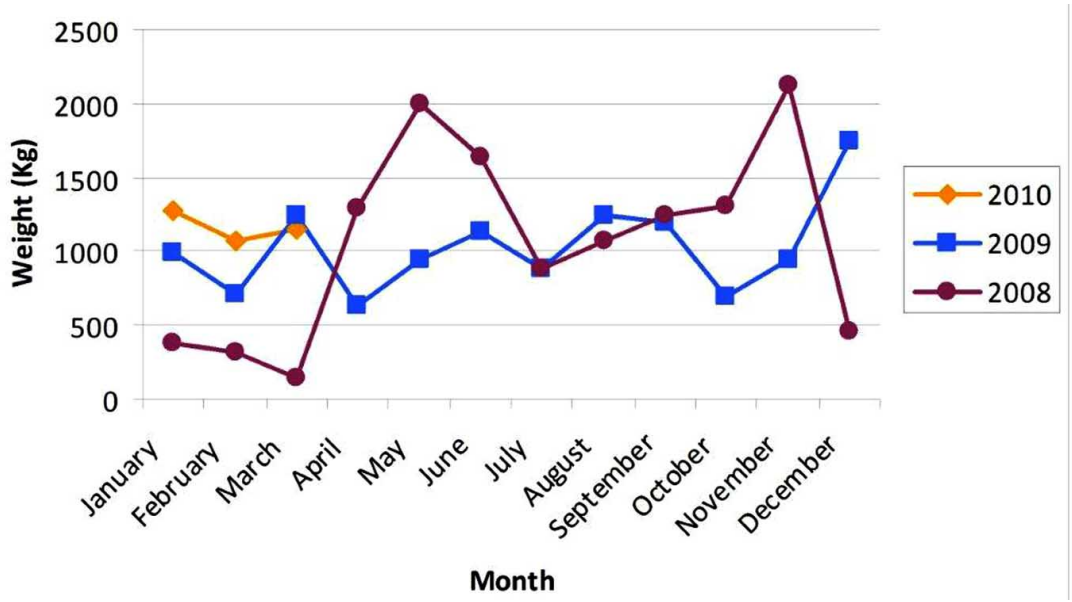

Fig. (3). Amount of recoverable waste that entered the storage center for their recuperation in 2008, 2009, and partially in 2010.

In 2008, the total amount of waste recovered in the storage center was 14.52 tons, in 2009 it was 12.33 tones, and data for 2010 is still unavailable. It is important to clarify that even though the recovering of waste was greater in 2008 than 2009, the percentage of recovered waste was greater in 2009 as it was mentioned before.

The composition of the waste separated for their appreciation and later sale o conversion into natural fertilizer, is shown on Table **8**. In the column of 2008 is included some waste of 2007 (November and December).

From the cafeteria the greatest amount of recovered waste is organic, with the only objective of producing natural fertilizers monthly, to be used in the green areas of the university. Also a great deal of carton was generated and office paper due to its consumption in office areas and this is sold for recycling.

Approximately 95% of the waste that enter the storage center are recovered, on average 5.1% of the waste are returned in the general garbage containers, which will be taken to the sanitary landfill (see Fig. **2**). According to the

Table 8. Composition of Recovered Waste in the Storage Center

Waste	Kg Recovered 2008	Kg Recovered 2009	Treatment*
Aluminum	54.27	76.42	Recycled
Carton	1215.83	393.3	Recycled
Wood	10.20	-	Compost
Ferrous Metal	42.31	71.62	Recycled
Organic waste	6907.23	7040.4	Compost
File paper	1948.44	2316.3	Recycled
Mixed paper	630.26	511.6	Recycled
HDPE	182.65	374.5	Recycled
Newspaper	1084.610	279.4	Recycled
PET	626.544	754.55	Recycled
Glass	354.790	507.55	Recycled
Trash from the storage center	738.296	N.D.	Landfill

*Recycling and the landfill are outside the university.

chart, the waste that is generated in least amount include: wood, aluminum, and ferrous metal. In this case, aluminum is collected by the cleaning personnel before it arrives to the storage center.

The generation inside the university is affected by diverse factors, shown in Table **9**. One of the main factors that influences in the increment or decrement of the waste is the amount of students on each term. One of the main factors for decreasing waste production is holidays.

4. Containment Infrastructure Proposal

Fig. (**4**) shows the external islands that are used for the separation of waste; each island has 3 containers: the blue one is used to collect inorganic waste, the green one for organic waste, and the black one for garbage. The university has 27 islands for separating and containing the waste outside the buildings; the capacity for each island is 0.488 m^3, having a maximum capacity of 13.16 m^3. There also exist three general containers for garbage, where waste is contained to be taken to the sanitary landfill, where two containers have the capacity of 7.46m^3 and the other one 9.5m^3.

In the same way, 33 islands exist inside the buildings to separate the waste, these islands have less capacity (each one has a capacity of 0.233m^3), for a total capacity of 7.7m^3. There also exist 24 containers to separate paper and carton. The location of each container is specified by the sources of generation explained before.

For the operation of the storage center and separation of waste we have a space of 147m^2 (square meters) with walls and a roof, and we also have a New Holland vehicle that is used for the internal collection of waste and maintenance of the natural fertilizer.

According to the previous analysis, a requisition of more external and internal islands was made to cover the needs of the new areas, as also the acquisition of more paper containers. In the case of the waste containers a requisition was made for an additional container to satisfy the needs for an adequate contention capacity. The average density of the waste was 43.13kg/m^3 so a new waste container was required to avoid cleanness issues and to have the capacity required for contention special events take place at the university.

Table 9. Monthly Factors Involved in the Generation y Recuperation of Waste in 2008

Month	Factor(s)
January	The collecting of waste was affected by the little knowledge from the university's community about the program of waste handling.
February	The generation decreased because of the amount of holidays in the university.
March	The decrease of the generation was affected because of holidays (two weeks: holy week).
April	The increase of waste was caused by a special event called "Jornadas". Usually different kinds of cultural events happen: sports, workshops, conferences, get-togethers. In these events the amount of certain waste increases (organic, carton).
May	The increase of waste (generally organic, office paper and mixed paper) is due to the meals given to teachers during staff training week; which occurs the last week of the term. From this month till the end of summer, the generation of garden waste increases.
June	The high recovering of appreciable waste was because a description was made this month, additionally we had the celebration of TSU day (student's day) that generates a lot of organic waste, carton, PET, and food leftovers.
July	Waste generation was affected by summer vacation (2 weeks)
August	Once more the generation and recovering of waste was affected by vacation time at the end of the term. Organic waste increased because of the staff training week to professors.
September	Because the new students who enter the campus don't know the waste handling program it affects the recovering of appreciable waste and increases garbage generation.
October	Educating the entire community about the correct way of separating waste caused an increment in the recovery of appreciable waste.
November	Waste increased because of graduation ceremonies and other events inside the university.
December	The decrease of waste was due to vacation time in this month.

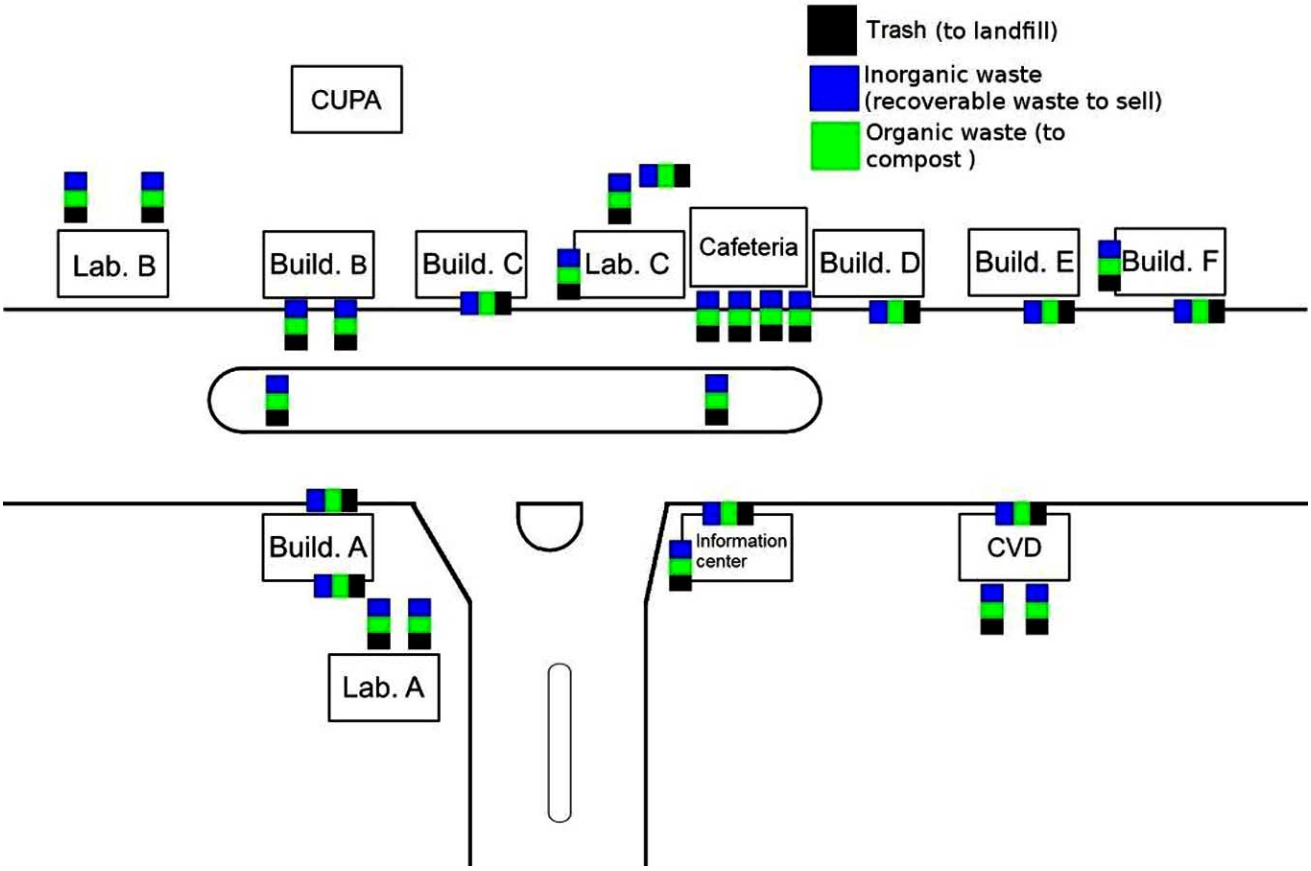

Fig. (4). Distribution of the exterior islands of the buildings.

5. Environmental Education

An environmental education campaign was put into action to demonstrate to the university community about the correct separation of the waste in the different containers inside the university (awareness campaigns, video, surveys, talks, forums, etc.) with the purpose of incrementing the indicators of separation and recovering of appreciable waste, and reducing the amount of waste sent for final disposal. The administrative personnel, teachers, and students that were trained during this campaign are shown on Table **10**.

CONCLUSIONS

The generation of waste inside the university is variable due to various factors, such as: number of students, holidays, and special events, among others. The UTL is not alien to these factors.

The waste management program has worked since 2008 in conjunction with the storage center with the intention of following up to all actions focused towards a comprehensive handle of waste. To increase the efficiency of the primary separation, permanent environmental educational campaigns

Table 10. Number of People Trained by Area

Program or Area	Number of People Trained 2008	Number of People Trained 2009
Industrial Electromechanics	390	351
Information Technologies	484	361
Economical Administrative	563	551
Sustainability for Development[1]	155	95
Guided Visits	99	0
Administrative and supporting personnel	60	7
Others[2]	-	640
TOTAL	1751	2005

[1]Includes the degree of Environmental Technology.
[2]Includes students from Engineering and reinforcement in environmental education to students of 2008.

have been implemented for teachers, administrative personnel, directors, cleaning personnel, and students. All this has the intention of creating awareness of the importance of waste handling inside the university. The recovering percentage in 2009 it was better than 2008, and in the beginning of 2010 the amount of waste recovered seems to be better than 2008 and 2009. In fact, January 2008 is not representative due to the fact that the program was barely starting, and in that year a lot of factors affected the generation of waste, but by 2009 and 2010, we expect that the consolidation of this program could be clearly perceived.

The generation *per capita* calculated during the sampling was 0.08kg/day (2008), 0.05kg/day (2009), and 0.063kg/day (2010), compared to other universities in Mexico, it is inside a range of +0.02 to -0.05kg/person a day:

- Universidad Iberoamericana de León, Guanajuato, México: 0.041 kg / person / day [3]
- Universidad Autónoma Metropolitana, México: 0.110 kg / person / day [6, 7]
- Universidad Autónoma del Estado de Morelos 0.082kg / person / 6 day approximately [14]
- Tecnológico de Monterrey campus León, Guanajuato, México 0.0963 kg / person / day [15]

Nevertheless, it can be observed that it's a low indicator compared with the generation *per capita* in Mexico for 2008, which was 0.97kg/person/day [16], the UTL only generated in 2008 and 2009: 86.33 tons of waste. From which nearly 26% were recovered for their later appreciation. The organic wastes are recovered in great quantities and were used to produce natural fertilizer. This is why the waste management program is the main component of SGA-UTL. Of the universities in the United States, Brown University recycles 31% of the waste, the University of Florida 30%, and finally one of the most successful programs of waste handling is the University Santa Clara in California, which recycles around 50% [4].

The composition compared to other universities, for example, Universidad Autonoma de Baja California Mexicali I campus, the waste with greater generation in buildings was paper, and in their gardens and their community center were organic waste (between 54% and 80%) [4], in the cafeteria of the UTL (between 24 and 34%) and in its gardens is where the most organic waste are generated.

The special waste handling plan, which is the base for all the operation of the storage center, exists since 2008. Nevertheless, all the indicators inside the continuous betterment cycle, shown and discussed here, are in constant upgrading.

Even though there were a lot of activities in 2008 and 2009 in regards to the waste management program, there is still room for betterments, from facilities of the storage center to betterments in the process of collecting waste and measuring indicators. To achieve these betterments, it is required a multi-task job in conjunction with other areas of the university, because the handling of solid waste has a lot of complex components that require different abilities and knowledge to find the best solution to this problem. Since 2009, we have looked for the cooperation of other degrees, as well for technological development.

All that has been mentioned here has required a significant investment in time, money, and effort from teachers, students, and personnel in general. Nevertheless, it is the duty of each educational institution to generate knowledge and to generate innovation in technology to solve environmental problems, and the most important to teach by example. Also with actions that will lead us to be coherent with what is taught inside the classrooms, especially for students of environmental degrees.

For 2010, Rectory has expressed their interest in obtaining an ISO 14001 certification, which will support and motivate a lot of the activities mentioned before, but this also implies a great challenge in terms of time, effort and investment.

Therefore, we can conclude that a lot of work is still needed and a lot of future challenges will have to be overcome to achieve significant advances in waste handling, especially in Mexican universities, because depending on the advances obtained, this will help to minimize the negative impact caused by the same universities. This essay is a contribution to demonstrate specific and detailed indicators, and real life experience by implementing a waste management program, because few universities document their achievements and contribute with real changes in Mexico for the institutions that are starting their own programs and for the rest that need to better their established programs.

GLOSSARY

Inorganic waste: All waste with economical value; here we include plastic, paper (without counting napkins or toilet paper), carton, metal, and aluminum (without counting aluminum paper).

Organic waste: It only refers to organic matter; here we exclude plastic, paper, and carton, because that's the system of separating that we have implemented; this way is better for its later recycling because it maintains the waste free from food and other.

Garbage: Refers to the waste that can't be recycled or converted into natural fertilizer, or the waste mixed in primary segregation, which are sent to their final disposal at the local sanitary landfill.

Efficiency: It is defined as the level of achievement of the objectives of the program.

Organic matter: They are waste from food, gardening and other waste that can be converted into natural fertilizer (compost)

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