INTERNSHIP REPORT SUSTAINABLE ENERGY TECHNOLOGY

Aqualectra

Inventory of waste streams as a start to a companywide waste management policy

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AQUALECTRA

UNIVERSITY OF TWENTE.

Executive summary

This research study was carried out to give Aqualectra an insight into their waste streams, as well as to analyze how these waste streams can be treated by applying Lansink's ladder, and to give recommendations on waste management policy. The study looks at all the waste Aqualectra produces at its own locations, both office waste and waste from production and distribution units, as well as the Aqualectra Bottling Plant. Waste from external projects is disregarded.

Desk study and interviews with Aqualectra employees, Selikor employees and the employee of Green Force were used as methods to acquire data.

The resulting table 3.1 in Chapter 3 shows an inventory of the waste streams of Aqualectra. The most important ones are:

- General unsorted waste from the various Aqualectra offices.
- The waste streams identified by the Van Gansewinkel report: waste that Aqualectra cannot easily dispose of, mainly due to environmental considerations.
- Scrap waste, soot and sludge.
- Old batteries, old transformers, wooden and iron pylons, and cable reels / spools.

The analysis by applying Lansink's ladder to Aqualectra's waste streams yielded the following results:

- Prevention of waste could be reached by lessening consumption of employees, or by using less material for products. Minimization can also be reached by buying products with longer-than-average lifespans.
- Product reuse is already applied at Aqualectra, but sales to consumers are currently unsuccessful due to recent price changes.
- Product recycling is also already applied, mainly for scrap and soot; it could also be applied to the general unsorted office waste by recycling paper, glass, PET, LDPE and aluminum cans, which would lessen the amount of unsorted waste to be collected by Selikor.
- Some streams that cannot be reused or recycled could be used as fuel to produce energy. Aqualectra is looking at a waste-to-energy project, but nothing has been realized yet.

Based on the data acquired during the research project, the following main recommendations are given:

- Appoint one waste coordinator, who has the final responsibility on all waste-related concerns.
- Establish a central, companywide documentation on Aqualectra policy concerning waste.
- Find a way to dispose of the "Van Gansewinkel waste", and draw up a policy for future reference.
- Launch an educational / awareness campaign at Aqualectra concerning waste, so the people will cooperate more willingly with waste projects.
- Place separate containers for appear, glass, aluminum cans and PET bottles at the various Aqualectra locations in cooperation with Selikor, and do the same at the Aqualectra warehouses for cardboard and LDPE in cooperation with Green Force. Monitor these waste streams if either company requires a more precise insight into the amounts of waste.

Nederlandse samenvatting

Dit onderzoek is uitgevoerd om Aqualectra inzicht te geven in hun afvalstromen, om te kijken hoe hun afvalstromen behandeld kunnen worden volgens de Ladder van Lansink, en om aanbevelingen te geven op het gebied van afvalbeleid. Het onderzoek bekijkt al het afval dat Aqualectra op de eigen locaties produceert, zowel de kantoren als de productie en distributie units, plus de Aqualectra Bottling Plant. Afval van externe projecten wordt niet meegenomen.

Bureauonderzoek en interviews met medewerkers van Aqualectra, Selikor en Green Force werden gebruikt om data te verzamelen.

De resulterende tabel 3.1 in Hoofdstuk 3 laat een overzicht zien van de afvalstromen van Aqualectra. De belangrijkste zijn:

- Algemeen, ongesorteerd afval van de Aqualectra kantoren
- De afvalstromen die geïdentificeerd zijn in het Van Gansewinkel rapport: dat wil zeggen, afval waar Aqualectra niet eenvoudig van af komt door milieutechnische redenen.
- Schrootafval, roet en sludge.
- Oude accu's, oude transformatoren, houten en ijzeren masten en kabel spoelen.

De analyse waarbij de Ladder van Lansink werd toegepast op de afvalstromen gaf de volgende resultaten:

- Preventie van afval kan plaatsvinden door het verbruik van werknemers te verminderen, of door minder materiaal voor producten te gebruiken. Minimalisatie kan ook plaatsvinden door producten met een langer-dan-gemiddelde levensduur te kopen.
- Hergebruik van producten gebeurt al bij Aqualectra; echter, de doorverkoop naar consumenten is op het moment onsuccesvol door prijsveranderingen vanuit Aqualectra.
- Recycling van producten gebeurt ook al, met name voor schrootafval en roet. Het kan echter ook toegepast worden op het algemene, ongesorteerde kantoorafval door papier, glas, PET, LDPE en aluminium blikjes te recyclen. Dit zou de totale stroom van ongesorteerd afval dat door Selikor opgehaald wordt verminderen.
- Sommige afvalstromen die niet hergebruikt of gerecycled kunnen worden, zouden gebruikt kunnen worden als brandstof om energie te produceren. Aqualectra is bezig met een waste-to-energy project, maar er is nog niets gerealiseerd.

De volgende aanbevelingen zijn gevormd op basis van de resultaten die verkregen zijn tijdens deze studie:

- Stel één afvalcoördinator aan die eindverantwoordelijk is voor het afvalbeleid, die dient als aanspreekpunt, die de verschillende projecten organiseert en in het algemeen de kar trekt.
- Stel een centrale documentatie op van het Aqualectra beleid op het gebied van afval.
- Vind een manier om af te komen van het "Van Gansewinkel afval".
- Lanceer een bewustmakingscampagne bij Aqualectra over afval, zodat de medewerkers gewilliger meewerken aan afval- en recycling projecten.
- Plaats aparte containers voor papier, glas, aluminium blikjes en PET flessen bij de verschillende Aqualectra locaties in samenwerking met Selikor, en doe hetzelfde bij de

Aqualectra magazijnen voor karton en LDPE in samenwerking met Green Force. Monitor deze afvalstromen als één van de bedrijven een preciezer inzicht in een afvalstroom wil.

Definitions and abbreviations

Concept / Abbreviation	Description
N/A	Not Applicable
AQ	Aqualectra
FAD	Facilitaire Dienst, Facilities
NH	Nieuwe Haven
MN	Mundo Nobo
NAF	Antillean Guilder
PET	Polyethylene terephthalate, a type of plastic used for bottles
LDPE	Low-density polyethylene, a type of plastic used for wrapping

Preface and acknowledgments

This report was written as part of the internship assignment of Alexander Louwes for the master program Sustainable Energy Technology of the University of Twente, Enschede. The assignment was carried out at Aqualectra, Willemstad, Curaçao and consisted of 15 ECTS (1 ECTS equals 28 hours).

I would like to thank Raycelli Seferina and Karel Tujeehut for their supervision at Aqualectra, and all Aqualectra employees who were willing to participate in my interviews and who provided excellent information.

Contents

1 Introduction and supporting theory

1.1 Thematic background

Waste is not a problem. It is a challenge, a chance to improve. Financially, environmentally, and socially. Financially, it is a waste to waste waste. Butti (2012) even states that "A significant part of today's economy revolves around waste" (Butti, 2012). Parts of waste can be sold for reuse, other parts can be sold for recycling. But a company-wide waste management policy and insight into the various waste streams can do even more. By carefully assessing the waste streams, better deals can be made with scrapyard companies and waste collecting companies through contracting: guaranteeing certain amounts of waste, based on past experiences. Aligning the policy of various business locations makes it possible to show one solid fist to waste-customers, selling in bulk instead of each single finger selling just a part. Furthermore, by separating waste and giving the individual waste streams appropriate treatments, the environment can benefit. Not only is the waste dump on Curaçao almost full; almost everything is dumped, damaging the soil. Appropriate waste management strategies could also contribute to the mitigation of climate change (Polettini, 2012). Finally, organizing and managing waste streams has a positive social impact by creating additional jobs.

From this viewpoint, the Curaçao water and power (utility) company Aqualectra decided to do an exploratory study on its waste streams. Aqualectra services "approximately 69,000 households and companies through 130,000 electric and water meters. Aqualectra's workforce includes 700 dedicated workers […]" (Aqualectra Holdings, n.d.). Aqualectra Holding currently consists of three companies: Aqualectra Production, Aqualectra Distribution and Aqualectra Multi-Utility (see Figure 1.1). Aqualectra's slogan is: "Water you can trust and power you can rely on."

Figure 1.1: Aqualectra corporate structure (Aqualectra Holdings, n.d.).

1.1.1 Aqualectra and Sustainable Energy

Aqualectra has a history in sustainable energy technologies. In 1982, a feasibility study for an OTEC (Ocean Thermal Energy Conversion) project was carried out, which concluded that it was feasible, although the financial risks were deemed too high. (Tujeehut, 2012) In 1983, the first wind turbine project was launched in cooperation with the Dutch company Stork, totaling 350 kW. It was followed up by the first Caribbean wind farm in 1993: 3 MW at Tera Kora. In 1995, the first grid-connect solar energy project was installed, followed in 1998 by solar-powered street lighting and in 2000 by a 20 kWp PV-system at Mundo Nobo. In 2003 a feasibility study for a waste to energy plant was executed, followed up in 2008 by an agreement to develop a plan to realize this project. In 2005 a SWAC (Sea Water Air Conditioning) project was started together with the Dutch consultancy Ecofys, which is still under development (Tujeehut, 2012) (Procházka, 2012). In 2008, an assessment was started regarding the possibilities to produce algae-based biodiesel, and in 2010 a privately owned 7kW solar

power plant was connected to the grid. Lastly, in 2011 two 15 MW wind farms were acquired, which were officially opened in July 2012 (Tujeehut, 2012). Summing up all the projects, the Curaçao government aims at a total of 35% renewable energy by the end of 2012 (see Figure 1.2).

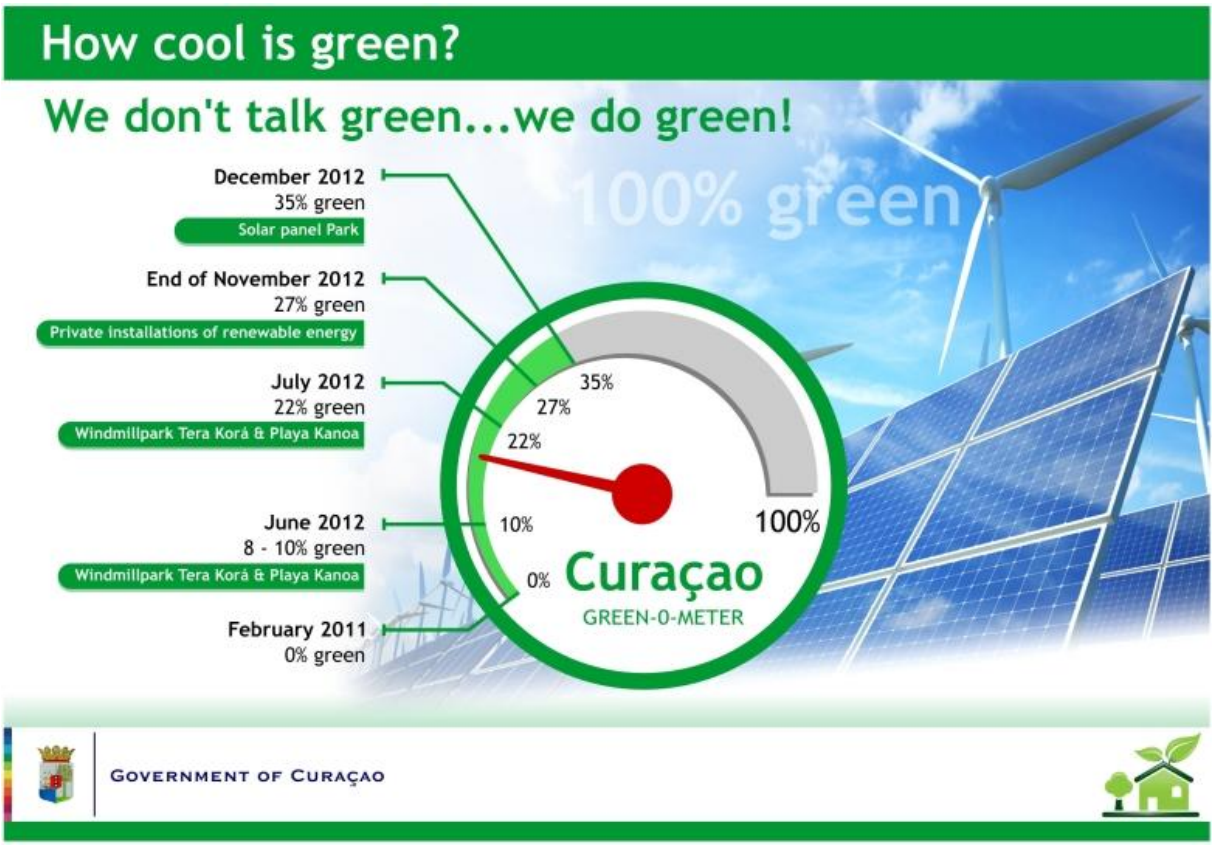

Figure 1.2: Curaçao "Green Meter" (Aqualectra Holdings, n.d.).

1.1.2 Selikor

Selikor NV is Curaçao's waste management company and promotes a green attitude on Curaçao (Selikor, Inc., 2012). Their office (see Figure 1.3) was built using as much recyclable material as possible (Amarica, 2012). Selikor, apart from managing the waste dump on Curaçao, also employs an "environment street" where people can drop off their separated waste in individual containers, as well as a recycle center. Appendix A shows an excerpt from their brochure which shows all the different waste solutions Selikor has to offer.

Selikor has offered to assist Aqualectra in its quest for a waste management policy. They gave some information and tips regarding this current report, as well as agreed to offer consultancy services afterwards, based on the results in this report.

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Figure 1.3: Selikor's office on Curaçao (Heijst, 2009).

1.1.3 Green Force

Green Force Curaçao is Timo Brouwer's company, its mission: "Through the collecting, processing and recycling of financially viable waste, Green Force and its allies can become a help for the environment and contribute to the reduction of global warming" (Green Force, 2012). In short, the company comprises of Timo putting (for a small price) containers for specific plastics, cardboard (OCC) and aluminum cans at companies that ask for it (see Figure 1.4), and he drives a small truck that collects (the contents of) the containers. He is very much engaged in the world of waste recycling and sustainability in general, and also tries to help educating the people (with a focus on schools) on the problems and solutions associated with waste.

Figure 1.4: A Green Force cubic meter container at the Aqualectra Bottling Plant.

1.2 Supporting theory: Lansink's ladder

There are multiple ways to deal with waste, some more favorable than others. The Dutch politician Ad Lansink proposed a waste hierarchy in 1979 that was named Lansink's ladder, a ladder which from top to bottom lists increasingly less favorable ways to handle waste (Wikimedia Foundation, Inc., 2012). Figure 1.5 shows this ladder. The first step of this ladder is the reduction of waste through quantitative and qualitative prevention (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, 2010). Quantitative prevention is the reduction or complete prevention of the creation of waste. Qualitative prevention means that products are manufactured using materials that have the least possible negative consequences on the environment. The second step is reuse of products: products are used again in their current form. These products do not necessarily have to be used in the same way. The third step is reuse of materials, also known as recycling. Products are broken down into their material components, and these components are used again. The fourth step is using the waste as fuel to produce energy, for instance by incineration and using the heat. These top four steps are all useful applications of waste. Some parts of the waste will not qualify for one of these steps; they have to be either incinerated (e.g. medical / laboratory waste; step 5) or dumped at a landfill (step 6).

Figure 1.5: Lansink's ladder (Brantjes Nijssen Groep, n.d.).

1.3 Previous research

In 2010, the Dutch company Van Gansewinkel (specialized in waste disposal) did an inventory at Aqualectra concerning some of their waste (Van Gansewinkel, 2010). Seven waste categories were identified: fluorescent lights (strip lights), batteries, transformer oil, chemical substances in large quantities, laboratory chemicals, waste from the diesel plant and halon fire extinguishers. The total weight of the waste was researched, and the costs for disposal of this waste was determined (both can be found in Chapter 3, table 3.1). An important conclusion of Van Gansewinkel is that a bilateral agreement between the governments of Curaçao and The Netherlands is needed, before it is allowed to export waste. This agreement was not made up until this date.

1.4 Research goal and system analysis

This research study has been carried out for Aqualectra because they require insight into their waste streams. This research project aimed to generate this insight. Aqualectra also requires some recommendations on how to treat their waste streams, and how to set up a waste management policy. Specifically, the following boundary conditions apply:

- All the waste Aqualectra produces at its own locations is taken into account, both office waste and waste from production and distribution units.
- Waste from external projects is disregarded.
- One source of waste is examined: the Aqualectra purchasing department that is responsible for the purchasing of all material. Other sources of waste such as incoming mail are not examined. This is because the purchasing department documents the incoming materials, while the amount of other waste is not documented and cannot easily be retraced.
- The Aqualectra Bottling Plant is also taken into account.

The system boundaries are highlighted in Figure 1.6.

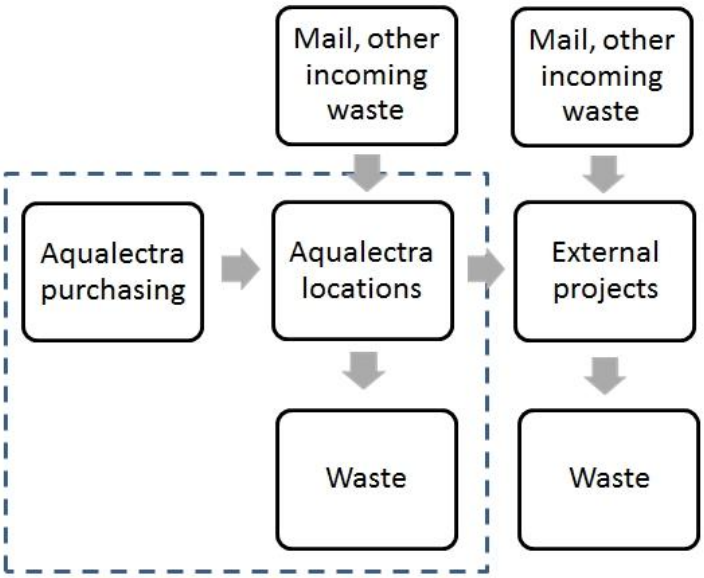

Figure 1.6: System boundaries.

Summing up, the overall research goal is to generate an insight regarding the waste streams of Aqualectra, to analyze how these streams can be treated, and to give recommendations on waste management policy.

1.5 Research question

Based on the research goal, the following research questions have been formulated:

1. *What are the most important waste streams of Aqualectra?*
2. *How can Aqualectra's waste streams be treated using Lansink's ladder?*
3. *What could be recommendations for Aqualectra's waste management policy?*

2 Methodology

This research makes use of two research methods: desk study and interviews. The interviews were of the semi-structured type:

- The interviews were non-standardized
- The themes and questions varied from interview to interview to suit the knowledge needs of the interviewer
- The data was recorded by note-taking

Some interviews could also be characterized as elite interviewing, addressing a particular type of interviewee: influential, prominent, and/or well-informed in the community. They are thus selected on the basis of their expertise.

Furthermore, apart from being selected on an expertise-basis, the interviewees were selected on the basis of convenience sampling.

Table 2.1 shows the various methods that have been employed to answer the various research questions. At the left hand side are the various methods that have been used, and at the top are the four research questions. Further on, for each part, a short explanation of the methodology used will be given.

Table 2.1: Methods to answer research questions.

Question: / Method:	Waste streams inventory	Lansink's ladder	Waste policy recommend.
Desk study	✓	✓	✓
Interview	✓	✓	✓

The data, consisting of information from desk research and the answers from interviews, was then applied to answer the research questions. Paragraphs 2.1 through 2.3 will explain in more detail how this was done.

2.1 Waste streams inventory

The first research question was:

1. *What are the most important waste streams of Aqualectra?*

For this question, information from the Aqualectra Purchasing department was obtained, to identify the largest incoming streams of materials. From Selikor, information was obtained as to which streams could be important for Aqualectra, i.e. with which waste streams something can be done. Selikor also provided information on the yearly waste disposal from Aqualectra. This information was also acquired from Aqualectra, and cross-referenced. Information from Van Gansewinkel was used

concerning waste that Aqualectra could not dispose of. Furthermore, the Aqualectra Environmental department provided information on certain waste streams that were mentioned in Aqualectra's yearly Environmental Report.

Interviews were planned with representatives from the Aqualectra Purchasing department: Ronald Carolina, Sharmon Chong and Randolph Fraai. The representatives from the Aqualectra Environmental department were Henry Schultz and Manuel Dorego. From Selikor, Mysella Martes, John Amarica and Yahaira Hofdam-Davelaar. Furthermore, interviews were held with key persons within the facilities management of both the Aqualectra Production and Distribution unit. For Production, these were Dudley Josepa and Anthony Maduro. For Distribution, this was Maritza Muller.

2.2 Lansink's ladder

The second research question was:

2. *How can Aqualectra's waste streams be treated using Lansink's ladder?*

For this question, a short literature study was done on waste treatment and Lansink's ladder. Information from Selikor on this subject was also obtained.

Concerning waste separation and recycling, an interview was planned with Timo Brouwer from Green Force, as well as the interviews with the people from Selikor, mainly John Amarica. The Aqualectra (scrap)yards and warehouses are recycling-treasures; interviews with Ronald Carolina, Louis Wilson, Dudley Josepa en Anthony Maduro revealed a lot of information on how Aqualectra currently treats waste products.

2.3 Waste policy recommendations

The third research question was:

3. *What could be recommendations for Aqualectra's waste management policy?*

For this question, the main part of the desk research was brainstorming on the subject with various people. Most prominently with the two supervisors, Raycelli Seferina and Karel Tujeehut.

Many people at Aqualectra were interviewed on possible recommendations for waste management policy, including Raichel Leito from General Affairs as well as the aforementioned people from Purchasing, Environment, Facilities and warehouse/yards. Timo Brouwer from Green Force and the people from Selikor were also interviewed on this question.

3 Results

This chapter will lay out the results of this study. Each research question will be dealt with in separate paragraphs, starting with the waste streams inventory.

3.1 Waste streams inventory

This paragraph on the waste stream inventory of Aqualectra tries to answer the following research question:

1. *What are the most important waste streams of Aqualectra?*

Selikor provided an Excel work sheet which contained a framework, where Aqualectra's waste streams could be inserted. All the collected information together yielded this filled in inventory, which is displayed in Table 3.1. On the left side from top to bottom are the different waste streams of Aqualectra. The top six rows are general office waste, non-separated, which is collected at the various Aqualectra locations. The next two rows are recycled waste from the Aqualectra Bottling Plant. The two rows after that are from the Aqualectra laboratory. Then there are twelve rows of other important waste streams. Finally, the last 21 rows are from the Van Gansewinkel inventory: waste that Aqualectra cannot dispose of, mainly due to environmental regulations.

The first column indicates the Aqualectra department involved. Van Gansewinkel is also under this column for convenience reasons, but is obviously not an Aqualectra department. The second column details the type of waste. Unsorted here means just that: the waste is not separated, but mixed. The third column contains the quantity of the waste: the weight in kg or volume in m^3 (for liquid waste). For the unsorted waste, the 57.680 kg applies to all unsorted waste from Aqualectra Distribution, while the 191.730 kg applies to Aqualectra Production. The fourth column shows the current disposal method or the expected disposal method (for the Van Gansewinkel non-disposable wastes). For a few waste streams, I was unable to determine their current disposal method. The fifth column details the responsible person or department for the respective waste stream. Both departments FAD and MMCB were asked to look over this column to confirm the responsibilities or alter the wrong ones; however, this should be done again, especially since MMCB had trouble viewing the table in Excel. The sixth column shows where, if anywhere, the waste is collected. The seventh column gives the number of waste containers, if any. The column also details these containers. The eighth column shows the emptying frequency by Selikor, while the ninth column shows the emptying frequency by Green Force. The tenth column shows the responsible person or department for the emptying of the waste containers. The eleventh column details if the waste requires any temporary storage; this applies mainly to goods that have to be stored over long periods to acquire enough bulk that it is profitable to sell. The twelfth column shows the final disposal method, and the thirteenth column shows the final disposal location. The fourteenth column shows the people of company that is responsible for the final disposal of the waste stream. The fifteenth column shows the current or expected costs of the disposal method of the waste stream. Finally, the sixteenth column shows any important notes associated with the waste stream, as well as any additional recommendations from the author of this report.

It is unclear where most of the waste streams detailed in the Van Gansewinkel report are currently stored. I was also unable to thoroughly analyze the waste streams of asbestos and small chemical waste. A lot of waste streams yield money, by selling the waste for reuse or recycling. The income

varies a lot, depending on current projects. As an example, 777 kg of copper was sold in March 2012, 443 kg in April, and 226 kg in May. The total for these three months, 1.446 kg, was sold for about NAF 10.000.

Table 3.1: Waste inventory of Aqualectra.

Department	Type of waste	Quantity	Disposal method	Containers responsibility	Collection location	Number of containers	Emptying frequency by Selikor	Emptying frequency by Green Force	Emptying responsibility	Temporary storage	Final disposal	Final disposal location	Final disposal responsibility (emptying on request)	Costs	Notes and recommendations
Offices (total)															
AQ Dis Rif	Unsorted		Throw away in waste bins	FAD	Volume dumpster Rif	2 volume dumpsters	Daily	N/A	FAD	N/A	Dump	Selikor	Selikor	Hiring 845,25/a Transport 515,10/a	
AQ Dis NH	Unsorted	57.680 kg in 2010, plus a few tons from Barber and Nieuwe Haven (not registered precisely)	Throw away in waste bins	FAD	Press container NH	1 press dumpster	Min. 2 times a month	N/A	FAD	N/A	Dump	Selikor	Selikor	Hiring 557,50/a Transport ~663,00 / month	
AQ Dis Santa Rosa	Unsorted		Throw away in waste bins	FAD	Dumpster Sta. R	1 dumpster (240 liters)	Weekly	N/A	FAD	N/A	Dump	Selikor	Selikor		Separate: plastic PET bottles, glass, tin cans, paper, cardboard, batteries > recycle
AQ Dis Santa Maria	Unsorted		Throw away in waste bins	FAD	Dumpster Sta. M	1 dumpster (240 liters)	Weekly	N/A	FAD	N/A	Dump	Selikor	Selikor		
AQ Dis Barber	Unsorted		Throw away in waste bins	FAD	Dumpster Barber	1 dumpster (240 liters)	Weekly	N/A	FAD	N/A	Dump	Selikor	Selikor	Transport 50,69 / month	
AQ Prod Mundo Nobo	Unsorted	191.730 kg in 2010	Throw away in waste bins	MMCB	Volume dumpster and press dumpster	1 volume dumpster and 1 press dumpster	1 time a month	N/A	MMCB	N/A	Dump	Selikor	Selikor		
Plants/processes															
AQ Bottling	LDPE plastic		Collect in collection unit, recycle	Operator	Collection unit MN	1 collection unit	N/A	When full	Operational manager	N/A	Recycling	Unknown	Green Force		Is going well; could be applied at other AQ locations
	OCC (cardboard)		Make flat, collect in collection unit, recycle	Operator	Collection unit MN	1 collection unit	N/A	When 1 cubic m.	Operational manager	N/A	Recycling	Unknown	Green Force		
Laboratory	Glass		Glass unit Selikor, recycle	MMCB?	Glass unit Mundo Nobo	1 glass unit	Irregular	N/A	MMCB?	N/A	Recycling	Selikor	Selikor		-
	Chemicals		Autoclave sterilization, incineration Selikor	MMCB?	Internally?	N/A	N/A	N/A	MMCB?	N/A	Incineration	Selikor	Selikor		-
General	Soot	155.400 kg in 2010	Collect in bags, sell	MMCB?	At plants	N/A	N/A	N/A	MMCB?	In building on yard MN	Recupal Curaçao N.V.	Recupal Curaçao N.V.	Recupal Curaçao N.V.	Yields money	Yields money
	Scrap waste	103.980 kg in 2010	Collect on scrapyard, sell	MMCB	N/A	N/A	N/A	N/A	MMCB/FAD	On scrapyard	Recycling sell to scrap company	Scrap company	Scrap company	Yields money	Yields money
	Aircos		Collect on scrapyard, sell?	MMCB/FAD	N/A	N/A	N/A	N/A	MMCB/FAD	On yard MN	Recycling	Scrap company	Scrap company	Yields money	Yields money
	Spent oil and contaminated products, incineration waste	4.658 kg in 2010	Collect in barrels (oil) and containers (products)	MMCB	N/A	N/A	N/A	N/A	MMCB	On yard MN	Incineration at Selikor	Selikor	Selikor		-
	Sludge	5.426 cubic meters in 2010	Transported with trucks to the ISLA refinery for further processing	MMCB	N/A	N/A	N/A	N/A	MMCB	N/A	Processed at ISLA	ISLA	ISLA	?	
	Old batteries		Collect, sell	MMCB	N/A	N/A	N/A	N/A	MMCB	In building on yard MN	Recycling / Reuse: sell	Unknown	Unknown	Yields money	Yields money
	Old transformers		Collect, sell	MMCB	N/A	N/A	N/A	N/A	MMCB	On yard MN	Recycling: sell to scrap company	Scrap company	Scrap company	Yields money	Yields money
	Cleaning rags		Collect in incineration waste dump	MMCB	N/A	1 container	Irregular	N/A	MMCB	On yard MN	Incineration at Selikor	Selikor	Selikor		-
	Small chemical waste		Unknown	MMCB	N/A	Unknown	Unknown	N/A	MMCB	Unknown	Unknown	Unknown	Unknown		-
	Asbestos		Unknown	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Unknown	Unknown	Unknown		Dump at Selikor
	Wooden pylons		Collect, sell to private people	FAD? Stock/purchasing?	N/A	N/A	N/A	N/A	FAD? Stock/purchasing?	Yard at NH	Reuse by selling	Private people	Private people	Yields money	Yields money
	Cable reels / spools		Collect, sell to private people	FAD? Stock/purchasing?	N/A	N/A	N/A	N/A	FAD? Stock/purchasing?	Yard at NH	Reuse by selling	Private people	Private people	Yields money	Yields money
Van Gansewinkel															
(Total weights per 30 December 2010)	Various inorganic acids	244 kg	Collect, package, transport	MMCB?	N/A	N/A	N/A	N/A	MMCB?	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,85/kg total = €207,40	
	Sulphuric acid	1 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,85/kg total = €0,85	
	Various inorganic caustics	2.635 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,73/kg total = €1923,55	
	Ammonia	1.375 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,40/kg total = €550,00	
	Hypochlorite solution, 12,5%	2.000 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,50/kg total = €1.000,00	
	Caustic soda	1.055 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,74/kg total = €780,7	
	Transformer oil, containing PCB	30.000 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	On yard MN	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,32/kg total = €9.600,00	
	Spent oil	1.400 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	On yard MN	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,25/kg total = €350,00	
	Organic caustics	335 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,97/kg total = €324,95	Van Gansewinkel offers a solution for all of these waste streams. However, the Curaçao government has to sign agreements with the Dutch government, before this solution can be applied. At this moment, these agreements are not yet signed. The total costs of these waste streams as of 30 December 2010 was €26.872,05, excluding costs for transport (€3.600,00 per 20ft container or €4.800,00 per 40 ft. container, return cargo) and costs for drawing up the agreements (€525,00 per agreement).
	Low caloric mixtures (grate incinerator)	520 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,40/kg total = €208,00	
	Low caloric mixtures (rotating barrel oven)	2.000 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,55/kg total = €1.100,00	
	Bitumen and tar	1.200 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,65/kg total = €780,00	
	Packaged waste substances (rotating barrel oven)	140 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,99/kg total = €138,60	
	Inorganic salts	1.210 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,95/kg total = €1.149,50	
	Laboratory chemicals	210 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€2,45/kg total = €514,50	
	Delsorb	2.100 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	?	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,48/kg total = €2.100,00	
	Fluorescent lights (strip lights)	4.500 kg	Collect, package, transport	MMCB/FAD	N/A	1	N/A	N/A	MMCB	Yard at MN	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,85/kg total = €3.825,00	
	Halon fire extinguishers	340 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	Yards	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€5,65/kg total = €1.921,00	
	Lead batteries	580 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	Yard at MN	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	-€0,25/kg total = -€140,00	
	Ni/Cd batteries	1.000 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	Yard at MN	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,49/kg total = €490,00	
	Starters for fluorescent lights	80 kg	Collect, package, transport	MMCB	N/A	N/A	N/A	N/A	MMCB	Yards	Van Gansewinkel	Van Gansewinkel	Van Gansewinkel	€0,60/kg total = €48,00	

3.2 Lansink's ladder

This paragraph on applying Lansink's ladder to the waste stream inventory of Aqualectra tries to answer the following research question:

2. *How can Aqualectra's waste streams be treated using Lansink's ladder?*

Figure 3.1 again shows Lansink's ladder. Starting with quantitative reduction, prevention of waste could be reached by lessening consumption of employees, for example not printing out every tidbit of information, or making all computer systems print on both sides of paper standard, or reusing washable mugs instead of plastic cups. It could also be possible to use less material for a product, such as thinner paper. There also exists a special computer font called "ecofont" which has small invisible holes in it, so up to 50% of ink is saved when printing (Ecofont BV, n.d.). Other identified waste streams where the "Reduce" method could be applicable are: corporate identity attributes (mostly paper), refreshments, paint and chemical substances, cleaning products, computer ware, and general office supplies. Also, the use of reparation fasteners that are used to temporary repair broken pipes could be lessened by acquiring better quality pipes (that do not break as easily). Furthermore, minimization of waste can also be achieved by buying products (cars, machines, electronic equipment, LED lamps) that have a higher life span and need less maintenance. Qualitative reduction, using materials that have the least possible negative consequences on the environment, can be applied to all waste streams. In particular, the most hazardous waste streams should be considered, such as asbestos, chemical substances (including paint), non-degradable plastics, oil-soaked materials and heavy metals (e.g. in batteries).

The second method, the reuse of products, is already being applied at Aqualectra. For example, cable reels or spools are sold to private people, who use them as bar tables. Wooden pylons are also sold to consumers, who use them for example as a fence. Lately, the prices for these pylons have gone up (Aqualectra purchasing policy), and no one wants to buy them anymore. The pylons are heaping up at the Aqualectra yards. Some machines Aqualectra uses in its production are refurbished when they are end-of-life for Aqualectra, and sold to poorer countries.

The third method, recycling, is currently being widely applied at Aqualectra. A large part of Aqualectra's waste consists of scrap, which is sold to a scrapyard company. Some metals are worth more than others, copper often being the most valuable metal sold. Aqualectra could keep this in mind when buying metal products with short shelf lives: end-of-life, a copper product will be worth more than an iron one. Recycling is also used for some other waste streams such as soot. It could be applied to even more streams, if Aqualectra would separate their general office waste. Paper, glass, certain types of plastics (mainly PET and LDPE) and aluminum cans could for example be recycled.

The fourth method, using waste as fuel to produce energy, is currently not used. When a waste-to-energy project is realized on Curaçao, this method could be applied to some of the waste streams that are non-recyclable, but do not need to be incinerated or landfilled. Examples are some types of plastics, gaskets/packings, old safety shoes, seals, office supplies, some cleaning products, building material, and almost all other general office waste.

The fifth method, incineration, is currently applied to laboratory waste.

The sixth and final method, landfilling, is currently applied to all general office waste, but most of this could be used as fuel to produce energy.

Figure 3.1: Lansink's ladder (Brantjes Nijssen Groep, n.d.).

3.3 Waste policy recommendations

This paragraph on formulating waste policy recommendations tries to answer the following research question:

3. *What could be recommendations for Aqualectra's waste management policy?*

The following is a list of recommendations based on the interviews that were held, combined with the author's own insight.

- It is recommended to appoint one waste coordinator, who will be responsible for waste management policy, who will serve as a contact person concerning all waste related questions, who will organize the various projects concerning waste management and who in general will be the one to carry the load with respect to waste management.
- It is recommended to establish central, companywide documentation on Aqualectra policy concerning waste. From this documentation, a general waste management policy can then be distilled, which could be put together in the form of an accessible waste pointer or waste manual for all employees. At the moment, the rules concerning waste are unclear, and change from department to department, from Production to Distribution and from person to person.
- There is waste at Aqualectra, of which no one knows what to do with it. The waste inventory by Van Gansewinkel showed that a mutual contract needs to be signed by the Curaçao and Dutch government; apparently, this has not happened yet. It is recommended that Aqualectra start a lobby for this. Eventually, this could lead to a policy for all the affected waste streams: collect the waste, store it temporarily, hire a company like Van Gansewinkel to transport the waste to the Netherlands or some other country.

- It is proposed to place separate containers for paper, glass, aluminum cans and plastic (PET) at the various Aqualectra buildings. Small paper containers could be place nearby all printers, which could be emptied regularly at a larger central container at the respective building. This central container could also contain a large paper shredder; when the paper is already shredded, Aqualectra saves the costs for letting an other company shred and/or destroy the paper. It also lets Aqualectra recycle the paper, which adds to the body of waste Aqualectra recycles. Furthermore, small containers for glass waste, cans and PET could be placed at the canteens, as well as a large central container for each of these waste streams at the respective building. Emptying of these central containers could be done in consultation with Selikor or Green Force
- At the Aqualectra Bottling Plant, cardboard and plastic wrap (LDPE) is collected separately by Green Force to be recycled. This is done through collection boxes that are emptied when they are full. According to Karel Tujeehut and the operational manager at the Bottling Plant, this project is working well. It is recommended to either expand this project to the other Aqualectra warehouses (where also a lot of cardboard and LDPE waste is produced), or to compare Green Force's current arrangement with possible arrangements from Selikor, and choose the best one.
- It is recommended to launch an educational / awareness campaign within Aqualectra concerning the management of waste. All people that were interviewed for this report were very reasonable and convinced of the importance of waste management. However, they indicated that this was not the case for every employee at Aqualectra. To make the waste management policy as effective as possible, as many employees as possible should do their part. Some proposals as to what such a campaign could entail:
    - Organizing movie lunches or evenings where movies concerning waste and recycling are shown and their importance is highlighted. Examples: From Cradle to Grave, Earth 2100, How many people can live on Planet Earth.
    - Timo Brouwer, the man behind Green Force, is willing to give a free speech on this subject.
    - Brochures, flyers, posters, fact sheets, e-mails, comics, magazines, a website (www.aqualectra.com/waste for example?) all concerning the subject of waste and recycling.
    - Discussion sessions concerning waste and recycling, preferably in small groups, under the guidance of an experienced panel chairman who is knowledgeable concerning the subject.
    - Workshops concerning waste and recycling. For example, building something with recycled or recyclable material such as aluminum cans or PET bottles. Or, a brainstorm concerning the general waste problems on Curaçao, or the concept of Cradle-to-Cradle.
    - Q&A sessions (Questions & Answers), where people with questions are given easily accessible room and times where they can ask their questions and receive satisfactory answers.
- For some waste streams, no precise numbers are available yet, be it from Aqualectra or Selikor. Some of these waste streams could be potentially interesting to recycle, such as paper; for these waste streams, it is proposed that monitoring projects are developed to analyze the waste stream. This could be done by for example placing individual bins for one

sort of waste (like paper) and weighing how much waste per unit of time (e.g. per day or per month) is being produced. This method has certain drawbacks; for instance, not everyone will deposit their waste in that particular bin. An other method to estimate the amounts of waste could be to dig into the general waste collection units (see Figure 3.2); this method was proposed by Selikor, it could be assumed that they are the ones who would carry out this task, as it is in their area of expertise.

Figure 3.2: The general waste collection units at Aqualectra Rif.

- Certain goods should first be temporarily stored, before they can be recycled or sold. In 2006, a plan was developed at Aqualectra concerning a new lay-out of the scrap yard at Mundo Nobo. The yard would serve as a temporary storage, and would be divided in zones, per department and per good. When the head of a department wants to store an object on the yard, a registration form would have to be filled out. The plant manager would have the final responsibility of the yard, and the heads of the various departments would be responsible for their own fenced off piece of the yard. This plan did not come to be due to financial reasons, but it is recommended as a well-organized and well-categorized way of storing waste that is to be recycled and/or sold. As a starting point, someone should register everything that comes in and goes out of the yard, right at the entrances/exists of the yards at Mundo Nobo and Nieuwe Haven. This person could also arrange and divide the yards and point out to people where they should place their goods.
- Certain goods will be sold when they are end-of-life. For example, metal is sold to scrap yard companies, reels and pylons to consumers. These deals are partly negotiated through the warehouses, and partly through the purchasing department (and maybe partly through other departments). The sales of these goods should be arranged centrally to acquire a univocal overview and administration. Aqualectra wants insight into the material that is being recycled within its company, but all sales of waste is dispersed throughout various

departments. It is proposed that one responsible department deals with the sales of waste materials, with one person having the final responsibility.

- It is recommended that Aqualectra fashion a fact sheet concerning the possibilities, barriers and costs for the waste to energy project they are currently working on, as well as possibilities for anaerobic digestion of organic waste. Only a few people, or maybe even only one person, have actual and up to date information on these subjects, but they should be easily accessible for others as well.

4 Conclusions

Based on the results of the previous chapter, we are now able to answer the research questions.

1. *What are the most important waste streams of Aqualectra?*

The most important waste streams, where "important" means "the largest streams, as well as the streams on which we can apply Lansink's ladder", are:

- General unsorted waste from the various Aqualectra offices
- LDPE and OCC waste from the Aqualectra Bottling Plant
- Laboratory waste (glass and chemicals)
- The waste streams identified by the Van Gansewinkel report: waste that Aqualectra cannot easily dispose of, mainly due to environmental considerations
- Scrap waste
- Soot
- Sludge
- Spent oil, oil-contaminated products and other incineration waste
- Old batteries, old transformers, iron and wooden pylons and cable reels / spools

These waste streams are detailed in Chapter 3, table 3.1.

2. *How can Aqualectra's waste streams be treated using Lansink's ladder?*

Prevention of waste could be reached by lessening consumption of employees, or by using less material for products. Minimization can also be reached by buying products with longer-than-average lifespans. Furthermore, it is important to note that qualitative reduction of waste requires using materials that have the least possible negative consequences on the environment. Product reuse is already applied at Aqualectra, but sales to consumers are currently unsuccessful due to recent price changes. Recycling is also already applied at Aqualectra, mainly for scrap and soot. It could also be applied to the general unsorted office waste by recycling paper, glass, PET, LDPE and aluminum cans. Aqualectra has been looking at a waste-to-energy project, but nothing has been realized at this point yet. Some streams that cannot be reused or recycled could be used as fuel to produce energy. This would lessen the amount of waste being landfilled.

3. *What could be recommendations for Aqualectra's waste management policy?*

Paragraph 3.3 gives several policy recommendations; the most important ones are:

- Appoint one waste coordinator, who has the final responsibility on all waste-related concerns.
- Establish a central, companywide documentation on Aqualectra policy concerning waste.
- Find a way to dispose of the "Van Gansewinkel waste", and draw up a policy for future reference.
- Launch an educational / awareness campaign at Aqualectra concerning waste, so the people will cooperate more willingly with waste projects.

- Place separate containers for paper, glass, aluminum cans and PET bottles at the various Aqualectra locations in cooperation with Selikor, and do the same at the Aqualectra warehouses for cardboard and LDPE in cooperation with Green Force. Monitor these waste streams if either company requires a more precise insight into the amounts of waste.

5 Discussion

This chapter shortly discusses meta aspects of the research this report is based on: the relevance and added value of the research for Aqualectra, the limitations of the research and any possibilities for future research.

5.1 Added value of the research

The results of this research give Aqualectra insight into their main waste streams. Possibilities to treat these waste streams using Lansink's ladder are also outlined. Finally, policy recommendations are proposed as to the management of waste at Aqualectra. With this report, Aqualectra should have a solid start to set-up a companywide waste management policy.

5.2 Limitations to the research

It should be noted that most data used in this research project could not be cross-referenced. It was first thought to deduct the amounts of waste from the specified purchasing records of Aqualectra. This could then be cross-referenced with the amount of waste Selikor collected at Aqualectra. But, because the purchasing records show over 5000 different materials that are purchased in various quantities, often on an on-demand basis, this attempt was abandoned due to time and reliability limitations. Aqualectra owns records of the waste that is collected at their sites, but not of the most recent years. Selikor could provide records of the recent years (see Appendix B), but it was more difficult to produce records from previous years. With a larger time investment, these barriers could be overcome, which would make the data more reliable.

Furthermore, this research is for a large part backed by interviews, which convey the (subjective) opinions of people. Although these people where experts in their respective fields of expertise, it is still their opinion, not fact. The hard facts of the data in this report should be weight first, before attempting to go through with any recommendations proposed.

5.3 Possibilities for future research

As mentioned in the above paragraph, cross-referencing the data from this report would make it more reliable. This could be done by obtaining information from both Aqualectra and Selikor on the waste collected by Selikor at Aqualectra. Also, data on purchased goods is available at the purchasing department, which could give an indication (but only an indication, as there are also other incoming streams of goods) as to the amount of waste expected.

Furthermore, monitoring projects on separate waste streams such as paper, glass, PET, LDPE, cardboard and aluminum cans could be needed to have an accurate overview of the total amounts of these waste streams.

Finally, if some of the recommendations are applied, it would be interesting to evaluate their effects with the expected effects that are described in this report.

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Appendix A: Waste solutions for Selikor

Below is part of the draft text of the Selikor company brochure, which outlays the waste solutions Selikor has to offer. This text was offered to me by Yahaira Hofdam-Davelaar of Selikor.

YOU HAVE A WASTE PROBLEM .....WE HAVE THE SOLUTION

The problem	The management	The solution	Contact us
Batteries (all types)	Recycling	▪ Industrial waste container ▪ Drop-off at Malpais landfill or Koral Specht transfer station	434-1383/434-1311/434-1332 (delete)
Bulky waste	Collection, transportation, recycling or disposal	▪ Grapple truck ▪ Industrial waste container	434-1383/434-1311/434-1313
Cardboard	Recycling	▪ Waste compactor ▪ Industrial waste container ▪ Drop-off at Koral Specht Transfer station	434-1383/434-1311/434-1313
Commercial waste	Collection, transportation and disposal	▪ 240 or 1,000-liter container ▪ Industrial waste container ▪ Waste compactor	434-1383/434-1311/434-1313
Confidential documents or data	Collection, transportation and incineration	▪ 240 or 1,000-liter container ▪ Industrial waste container ▪ Minivan	434-1383/434-1311/434-1313
Construction and demolition waste (e.g. concrete, dirt, etc.)	Recycling at the Caribbean Recycling Company (CRC)	▪ Industrial waste container ▪ Big Bag ▪ Drop-off at CRC	434-1383/434-1311/434-1313
Cooking oil waste	Collection, transportation, incineration	Special containers	434-1311/434-1311/434-1313
Dead animals/pets	Collection, transportation and incineration	▪ Collection and incineration service ▪ Drop-off at Malpais landfill	46-LIMPI
Dirty warehouse or parking lot	Sweeping and dirt removal	Sweeping machine	434-1383/434-1311/434-1313

Excessive waste	Prevention and reduction	Advice on prevention and reduction	434-1327/434-1319
Food waste	Collection, transportation and landfilling	▪ 240 or 1,000-liter container ▪ Waste compactor	434-1383/434-1311/434-1313
Glass (all types and colors)	Recycling at the Caribbean Recycling Company (CRC)	▪ Glass collection container on-site ▪ Industrial waste container ▪ Drop-off yourself at glass collection container at gas stations	434-1383/434-1311/434-1313
Liquid waste from residences, offices, and restaurants	Collection, transportation, and disposal	Vacuum truck	46-LIMPI/434-1332 (delete)
Loose waste	Consolidation	Plastic garbage bags	46-LIMPI
Medical, chemical, pharmaceutical, veterinary, laboratory, and hazardous waste	Collection, transportation and incineration	▪ 240 or 1,000-liter containers ▪ Industrial waste containers ▪ Special containers	434-1383/434-1311/434-1313
Metal and scrap	Recycling	▪ Grapple truck ▪ Industrial waste containers ▪ Drop-off at Malpais landfill or Koral Specht transfer station	434-1383/434-1311/434-1313
Motor oil, lubricants, hydrocarbons, etc.	Collection, transportation, and recycling	▪ Vacuum truck ▪ Special container ▪ Drop-off in special containers at gas stations	434-1383/434-1311/434-1313
Odor	Odor eliminator	Holebón	46-LIMPI
Paper (white only)	Recycling	▪ 240 or 1,000-liter container ▪ Office recycling containers ▪ Drop-off at Koral Specht transfer station	434-1383/434-1311/434-1313/434-1327
Party or other celebration	Waste collection, transportation, and disposal	▪ Portable toilet ▪ 240-liter container ▪ Plastic garbage bags	434-1383/434-1311/434-1313
Scrap vehicles	Collection, transportation and recycling	Free scrap vehicle collection service	46-LIMPI
Temporary – building, meeting place, or construction site	Collection, transportation, and disposal	Portable toilet	434-1383/434-1311/434-1313

Waste from ships	Collection, transportation, recycling, landfilling or incineration	▪ Waste compactor ▪ Industrial waste container ▪ Grapple truck ▪ 240 or 1,000-liter container	434-1319/1327
Yard waste	Collection, transportation, and disposal	▪ Industrial waste container ▪ Big Bag ▪ Grapple truck	434-1383/434-1311/434-1313
Questions and complaints	Answers and solutions	Customer service	46-LIMPI

Feel free to call us if you have a type of waste that is not mentioned above to arrange an efficient and responsible solution.

Appendix B: Non-separated waste collection by Selikor at Aqualectra 2011-2012

Below are the data concerning the (general non-separated) waste that was collected by Selikor at Aqualectra. The first table shows waste collected in 2011, the second table shows the data for January 2012 – July 2012.

Date:	LF-number:	Weight in kg:
3. jan. 2011	LF1150883	2405
4. jan. 2011	LF1150950	1800
14. jan. 2011	LF1153205	1170
14. jan. 2011	LF1153235	4620
21. jan. 2011	LF1155053	1110
28. jan. 2011	LF1156302	1905
2. feb. 2011	LF1157114	455
2. feb. 2011	LF1157134	985
2. feb. 2011	LF1157157	385
2. feb. 2011	LF1157108	2050
10. feb. 2011	LF1158734	720
10. feb. 2011	LF1158643	180
10. feb. 2011	LF1158600	310
19. feb. 2011	LF1160583	1115
22. feb. 2011	LF1161203	135
22. feb. 2011	LF1161106	320
22. feb. 2011	LF1161276	1270
2. mrt. 2011	LF1162873	2750
2. mrt. 2011	LF1162904	2410
9. mrt. 2011	LF1164257	1670
15. mrt. 2011	LF1165193	6240
16. mrt. 2011	LF1165394	720
16. mrt. 2011	LF1165425	330
18. mrt. 2011	LF1165943	260
18. mrt. 2011	LF1165971	580
19. mrt. 2011	LF1166138	2070
19. mrt. 2011	LF1166140	0
21. mrt. 2011	LF1166735	2600
24. mrt. 2011	LF1167416	410
24. mrt. 2011	LF1167454	740
24. mrt. 2011	LF1167301	140
24. mrt. 2011	LF1167384	1300
24. mrt. 2011	LF1167338	930
25. mrt. 2011	LF1167664	2255
30. mrt. 2011	LF1168607	2975
30. mrt. 2011	LF1168608	920
6. apr. 2011	LF1170173	340

6. apr. 2011	LF1170201	320
6. apr. 2011	LF1170313	240
6. apr. 2011	LF1170222	440
10. apr. 2011	LF1171167	160
10. apr. 2011	LF1171155	190
10. apr. 2011	LF1171145	270
10. apr. 2011	LF1171243	380
13. apr. 2011	LF1171872	740
14. apr. 2011	LF1172268	765
15. apr. 2011	LF1172429	350
16. apr. 2011	LF1172575	490
18. apr. 2011	LF1172841	520
19. apr. 2011	LF1173233	440
20. apr. 2011	LF1173419	1470
20. apr. 2011	LF1173337	4340
20. apr. 2011	LF1173488	480
21. apr. 2011	LF1173718	130
21. apr. 2011	LF1173685	410
29. apr. 2011	LF1175493	260
29. apr. 2011	LF1175416	1010
29. apr. 2011	LF1157400	780
29. apr. 2011	LF1175381	1150
4. mei. 2011	LF1176262	2300
4. mei. 2011	LF1176252	1640
11. mei. 2011	LF1177850	450
11. mei. 2011	LF1177836	200
19. mei. 2011	LF1179919	3115
20. mei. 2011	LF1180112	465
22. mei. 2011	LF1188405	370
23. mei. 2011	LF1180661	350
23. mei. 2011	LF1180738	1185
27. mei. 2011	LF1181867	1530
7. jun. 2011	LF1184673	440
8. jun. 2011	LF1184979	2280
10. jun. 2011	LF1185504	420
11. jun. 2011	LF1185662	510
15. jun. 2011	LF1186689	310
15. jun. 2011	LF1186659	210
16. jun. 2011	LF1186930	1125
17. jun. 2011	LF1187181	2860
21. jun. 2011	LF1188221	3170
21. jun. 2011	LF1188251	1550
22. jun. 2011	LF1188423	1510
22. jun. 2011	LF1188272	1450
22. jun. 2011	LF1188274	1050

27. jun. 2011	LF1189561	3690
30. jun. 2011	LF1190515	1950
6. jul. 2011	LF1192106	3910
6. jul. 2011	LF1192046	880
7. jul. 2011	LF1192396	13975
8. jul. 2011	LF1192675	1400
8. jul. 2011	LF1195051	1850
18. jul. 2011	LF1195093	3640
25. jul. 2011	LF1197318	2680
26. jul. 2011	LF1197548	1120
3. aug. 2011	LF1199871	2870
9. aug. 2011	LF1201665	980
10. aug. 2011	LF1201978	4590
10. aug. 2011	LF1201979	1490
16. aug. 2011	LF1203462	40
19. aug. 2011	LF1204452	2330
20. aug. 2011	LF1204864	2610
24. aug. 2011	LF1205834	300
27. aug. 2011	LF1206721	1035
27. aug. 2011	LF1206589	595
27. aug. 2011	LF1206558	2110
27. aug. 2011	LF1206616	1540
30. aug. 2011	LF1207534	450
1. sep. 2011	LF1208223	1355
3. sep. 2011	LF1208694	2540
3. sep. 2011	LF1208724	330
3. sep. 2011	LF1208673	1630
3. sep. 2011	LF1208848	1540
7. sep. 2011	LF1210109	2380
8. sep. 2011	LF1210262	740
8. sep. 2011	LF1210412	1760
8. sep. 2011	LF1210287	1130
8. sep. 2011	LF1210429	1480
10. sep. 2011	LF1210925	1940
10. sep. 2011	LF1210905	2200
10. sep. 2011	LF1210890	3030
10. sep. 2011	LF1211033	520
23. sep. 2011	LF1214787	310
26. sep. 2011	LF1215677	2870
26. sep. 2011	LF1215575	360
27. sep. 2011	LF1215931	2340
28. sep. 2011	LF1216246	3020
28. sep. 2011	LF1216361	2800
28. sep. 2011	LF1216384	1590
29. sep. 2011	LF1216620	1550

30. sep. 2011	LF1216959	2500
1. okt. 2011	LF1217131	2740
3. okt. 2011	LF1217910	2480
7. okt. 2011	LF1219123	1650
7. okt. 2011	LF1219147	2605
7. okt. 2011	LF1219301	610
7. okt. 2011	LF1219262	600
7. okt. 2011	LF1219164	880
12. okt. 2011	LF1220763	350
12. okt. 2011	LF1220713	380
12. okt. 2011	LF1220874	1370
13. okt. 2011	LF1221012	1090
13. okt. 2011	LF1221030	470
17. okt. 2011	LF1222091	650
17. okt. 2011	LF1222005	360
19. okt. 2011	LF1222515	500
19. okt. 2011	LF1222484	360
20. okt. 2011	LF1222671	1860
20. okt. 2011	LF1222764	570
20. okt. 2011	LF1222793	180
26. okt. 2011	LF1224120	720
26. okt. 2011	LF1224216	1560
26. okt. 2011	LF1224191	1625
27. okt. 2011	LF1224384	1560
28. okt. 2011	LF1224813	300
28. okt. 2011	LF1224703	290
1. nov. 2011	LF1225865	1230
1. nov. 2011	LF1225789	1200
1. nov. 2011	LF1225818	1400
1. nov. 2011	LF1225858	2050
1. nov. 2011	LF1225768	1270
2. nov. 2011	LF1226022	1700
2. nov. 2011	LF1226037	1790
4. nov. 2011	LF1226483	550
4. nov. 2011	LF1226513	640
14. nov. 2011	LF1229139	1360
18. nov. 2011	LF1230316	1960
30. nov. 2011	LF1233753	1940
30. nov. 2011	LF1233817	1725
30. nov. 2011	LF1233966	2950
27. dec. 2011	LF1242747	1140
28. dec. 2011	LF1243148	2730
28. dec. 2011	LF1243184	2250
30. dec. 2011	LF1243889	1510
	Total weight:	**245505**

Date:	LF-number:	Weight in kg:
17. jan. 2012	LF1248870	530
20. jan. 2012	LF1249491	1400
20. jan. 2012	LF1249559	1760
23. jan. 2012	LF1250225	2420
24. jan. 2012	LF1250427	2690
24. jan. 2012	LF1250416	2390
31. jan. 2012	LF1251986	1300
13. feb. 2012	LF1255148	1410
14. feb 2012	LF1255199	1460
15. feb. 2012	LF1255603	450
23. feb. 2012	LF1257302	2930
27. feb. 2012	LF1258387	3140
9. mar. 2012	LF1261537	1730
9. mar. 2012	LF1261581	1590
14. mar. 2012	LF1262572	1690
14. mar. 2012	LF1262592	700
15. mar. 2012	LF1262920	2340
20. mar. 2012	LF1263858	1475
20. mar. 2012	LF1264092	1525
22. mar. 2012	LF1264614	5080
4. apr. 2012	LF1267796	1220
4. apr. 2012	LF1267765	580
5. apr. 2012	LF1268132	1550
5. apr. 2012	LF1268106	2890
10. apr. 2012	LF1269130	2930
23. apr. 2012	LF1272302	1570
24. apr. 2012	LF1272758	3260
26. apr. 2012	LF1273276	1540
26. apr. 2012	LF1273318	4175
27. apr. 2012	LF1273489	1580
24. may. 2012	LF1279870	500
24. may. 2012	LF1279994	940
28. may. 2012	LF1280911	1740
28. may. 2012	LF1280938	1810
15. jun. 2012	LF1286048	1700
15. jun. 2012	LF1285997	670
19. jun. 2012	LF1286927	1490
19. jun. 2012	LF1286901	1830
20. jun. 2012	LF1287347	2965
27. jun. 2012	LF1288614	1880
13. jul. 2012	LF1293152	1760
	Total weight:	**76590**