Integrated Electronic Waste Management in Mexico: Law, Technology and Public Policy

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ABSTRACT

What is electronic waste? Why is it considered a problem? What are the public health implications of its mishandling? The electronic industry, a sector that has experienced one of the highest growth rates of the last decade, has had a great success in growing the mass consumer market for personal computers, cell phones, and other types of personal electronic equipment. Supporting this incredible growth, the electric industry has also provided electric cells and battery systems to power all these devices. Unfortunately, personal computers as well as other electric and electronic equipment (EEE) become obsolete faster than ever[1]. The mounting quantities of obsolete EEE and spent batteries represent a serious problem for the industrial sector, as well as for governments and citizens, not only because of the volumes being generated, but because of the hazardous materials and toxic metals, including lead, nickel, cadmium, mercury and chromium to mention some of the most important health wise and the gold, copper, aluminum, nickel, silver and palladium they contain. These contents also offer incentives for their collection and recovery. They need to be diverted from the waste stream reaching the sanitary landfills and in some instances incineration facilities, to reduce public exposure to these toxic substances and avoid the public health burdens they represent. What is the dimension of this problem in Mexico? Mexico has generated at least 6.3 million obsolete computers during the last decade, and by the end of 2006, 10 million additional personal computers will become obsolete. Not all of them will reach the municipal solid waste (MSW) stream the same year they become obsolete. Hoarding by final users must be considered in designing any collection program[2]. Even taking account of hoarding, almost 3 million computers will be available for collection in 2005 and 10 million computers will be available for collection by 2013. For spent cells and batteries in Mexico, the numbers are not very clear. The best estimate is that 450 million cells and batteries will be purchased annually (90 million rechargeable batteries

[1] Today it is considered that a computer that is manufactured today will become obsolete in a two year term. By the year 2005, one computer will become obsolete for every one that is manufactured and introduced into the market.

[2] According to studies done in Europe, only 5% of total number EEE (computers included) is estimated to be discarded due to hoarding practices from consumers. From this percentage, only 60% is introduced to the MSW stream and the remaining 40% is re-introduced in households by donation, re-sale and/or exchange. As a consequence, only 3% of total quantity of computers will be available for collection and only after 10 years from its acquisition date. Jean-Pol Wiaux, "Portable Rechargeable Batteries in Europe: Sales, Uses, Hoarding, Collection and Recycling", Elsevier, (2001).

and 148.5 million primary cells)[3] [4]. At least 25% of them (hoarding of spent batteries has been estimated at about 75%) will be introduced into the municipal waste stream, some 37 million batteries every year.

Taking into consideration Mexico's waste management infrastructure, what are the related Public Health effects of electronic waste? What are the risks associated with the final treatment options available? What can be done to reduce the E-Waste burden? Which collection and recycling mechanisms can be implemented in the Mexican context? The present work deals with these questions and introduces a proposed collection and recycling program to address Mexico's needs.

Thesis Supervisor: Dr. Lawrence Susskind

[3] The number of Computers, Cells and Batteries introduced into the Mexican market through the black market are not known, there are not estimates to it and therefore are not taken into consideration in present figures.

[4] "Revisión y Análisis de las Experiencias de Argentina, Brasil, Colombia, Ecuador, y México Respecto de los Cinco Elementos Claves para el Manejo Ambiental de Pilas y Baterías". Centro Nacional de Investigación y Capacitación Ambiental CENICA-México (2001). Reporte Final. REPAMAR-REMEXMAR-CEPIS-GTZ.

1. Introductlon

Current Waste Management Practices:

The waste problem is poorly understood, and its economic, public health, and environmental impacts have not been addressed by the world's population. So far, the question has been sidestepped because waste recollection and disposal are subsidized by governments around the world[5]. As a consequence, most communities do not have to pay much attention to their waste practices. As long as the waste generated in our homes and offices is removed from sight, we consider the issue resolved. Every human activity, including eating, working, playing, and even dying, requires the consumption of natural resources, and we, as a consequence, necessarily generate flows of waste. It is almost impossible to think about a manufacturing process, be it food production, chemical synthesis, electronic products manufacturing, or even simple assembly that does not generate byproducts.

These residues are often wrongly considered useless waste[6], but can in reality be reused, and, if the law allows, reintegrated as a resource in the industrial production cycle. Natural ecosystems have the intrinsic capacity[7] to absorb, transform or metabolize contaminants through the work of many types of living organisms and microorganisms. The wastes generated by one process can serve as an input to

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[5] There are some exceptions such as the German "Green Point" waste management program and its related regulations, where funding to manage packaging waste has been attributed to the industrial sector. $2.02 billion was spent in waste management from 1991 to 1998. http://www.gruenerpunkt.de/DER_GR_NE_PUNKT.50+B6Jkw9MQ__.0.html

[6] The word waste might even be considered misplaced when it is used to refer to the second hand materials or sub-products that are generated during our daily activities and that have the potential to be reused. Reuse can occur with or without a preconditioning stage either in the process that generated it or in an independent manufacturing process. Waste can also be transformed and recycled.

[7] Also referred to as carrying capacity.

another naturally occurring one in the same ecosystem. Yet, the natural equilibrium of such cycles can easily be broken. Two important variables are the physico-chemical and toxicological proprieties of the waste materials introduced and the quantity and rate at which they are introduced into the ecosystem. Therefore, the need to create and implement regulations to control these factors is important.

In general, worldwide regulations have commonly defined the term waste as "any substance or object which the holder disposes of or is required to dispose of"[8]. There are three general categories of waste, depending on the chemical-physical and toxicological proprieties of the material: Hazardous Waste (HW), which includes all those waste materials that are **C**orrosive, **R**eactive, **E**xplosive, **T**oxic, **I**gnitable (flammable), or **B**io-Hazardous (CRETIB); Non-Hazardous Special Wastes, which includes all those waste materials, industrial wastes included, that do not have any of the CRETIB characteristics, have limited recycle/reuse potential, and at the same time require special treatment because of its physico-chemical proprieties or volume and cannot be sent to a regular MSW landfill;[9] and Non-Hazardous Wastes, residual materials that have the potential to be reused or recycled. The remaining portion with no recycle/reuse value (mainly MSW) may be confined in controlled sanitary landfills or treated by other means.

The case of MSW is of special control interest, both because of the characteristics of often valuable materials contained in it (mixed with materials from the other two

[8] As given by the EU waste directive 75/442/EEC and the Mexican General Law for the Prevention and Integrated Waste Management. Still, waste definition varies widely depending on individual legislation and recycling thus becomes harder to achieve at the international level.

[9] The line between a HW and a Non-Hazardous Special waste may be very diffuse. A flammable material, for example, characterized based on proprieties like its boiling and flash points, may not have be flammable enough to be included in the hazardous category. The same occurs with the other CRETIB characteristics.

categories, including electronic waste, a growing concern), and because of its increasing volume and its coupling with population growth and quality of life pressures. MSW can be managed by many different treatment processes, and may be incinerated without any further operations stages. Also, incineration of materials rich in BTU can be used to generate energy. The waste materials contained in MSW can be separated for recycling or composting. In most cases, however, it is simply disposed of in landfills or open waste dumps. Of course, the best way to control this type of waste is to reduce generation rates at its many diverse sources.

Final disposal options such as land filling and incineration cannot be used if HW materials are present in the mix. Thus, segregation from the source becomes the key stage of the overall integrated approach to waste collection and treatment. Even when landfills have traditionally been used as the primary form of waste disposal, incineration has been gaining popularity among industrialized nations. *About 18% of MSW in the United States is currently incinerated, with about 75% of the incinerators generating energy (EPA 1994). In Japan, approximately 34% of MSW is incinerated (Hershkowitz & Salerni, 1987); in Canada, the amount is less than 5%*[10]. Some developing countries, including Puerto Rico[11], are subject to pressure from the international community and from their own limited land availability and are looking at incineration as a technology which will allow the reduction of waste volumes and the recovery of highly valued space. To see MSW management practices in a global perspective, please refer to Table 1

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[10] See Handbook of Solid Waste Management, second edition, George Tchobanoglous/Frank Kreith, McGraw Hill Handbooks, 2002.

[11] An Island of 8,959 km^2, nearly 3.9 Million inhabitants, and 67 operating landfills, which today are subject to environmental impact evaluations. Almost half are due for closure due to improper environmental conditions

Table 1. World municipal solid waste management practices in 1999, Figures in % (1994)

Country	Sanitary Landfill	Incineration	Compost	Recycle
U.S.	73	14 (18)	01	12
Japan	27	25 (34)	02	46
Germany	52	30	03	15
France	48	40	10	02
Sweden	40	52	05	03
Mexico	94*	--	--	6 -10

Source: Cortinas de Nava[12]

Although efforts had been made to reduce the amount of waste through recycling and incineration, landfills continue to be the cornerstone of waste management[13].

In Mexico, it is estimated that the waste generated by its municipalities reaches 30,598,315 MT annually, of which only 80 % (24,478,652 MT) is collected. Even less, approximately 76% (18,600,000 MT), is destined to a landfill facility, and the remaining 24% is thrown into open waste dumps. 82% of total volume of landfilled MSW is sent to controlled landfills[14]. In total, 12 million MT of MSW are simply lost or disposed of in an unknown location. 84% of municipal waste generated is household waste[15]. It is estimated that only 6–10% of the collected MSW is recycled[16]. MSW is not yet incinerated, but this method of disposal will gain importance in the near future. The location of Mexico's 10 primary sanitary landfill sites can be seen in Table 2 & Figure 1.

[12] Cristina Cortinas de Nava, Hacia un México sin Basura, Bases e Implicaciones de las Legislaciones sobre Residuos. Grupo Parlamentario del Partido Verde Ecologista, Cámara de Diputados, LVIII Legislatura. Julio 2001.

[13] George Tchobanoglous/Frank Kreith, Ibid.

[14] Controlled landfills are considered to be those that are fenced and restricted access. Not necessarily those with adequate engineering and sanitary controls.

[15] Environmental Performance Review – Mexico, OECD (2003).

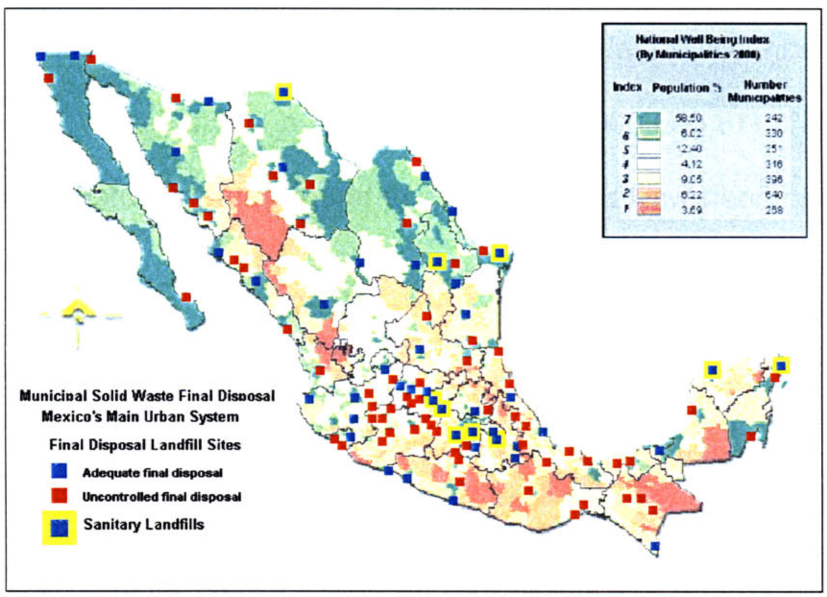
[16] The Mexico City Metropolitan Area (MCMA) generates, on a daily basis, 19,300 metric tonnes of MSW which must be disposed of. This figure rises to 21,800 tonnes if nearby cities are taken into consideration (Hidalgo, Morelos, Puebla and Tlaxcala).

Table 2. Municipalities with sanitary landfills in Mexico (1999)

MUNICIPALITY / SITE	STATE
Bordo Poniente	Distrito Federal
Querétaro	Querétaro
Cancún (Benito Juárez)	Quintana Roo
Puebla	Puebla
Mérida	Yucatán
Tequisquiapan	Querétaro
Tlalnepantla	Estado de México
Área Metropolitana de Monterrey	Nuevo León
Ciudad Juárez	Chihuahua
Nuevo Laredo	Tamaulipas

Source: Cortinas de Nava (2001)

Figure 1. Municipal Solid Waste Final Disposal in Mexico.



Source: Constructed from information of Subsecretaria de Desarrollo Urbano y Ordenacion del Territorio. Sedesol: www.sedesol.gob.mx., Cortinas de Nava, Ibid. (2001), And Environmental Performance Report-Mexico. OECD 2003.

Why should we collect electric and electronic consumer products? Especially obsolete computers and spent batteries?

Electronic waste is an emerging issue that demands immediate attention from the environmental authorities and Mexican society as a whole. The increasing volume and generation rate of the electronic waste stream (used computer CPUs / CRTs and spent batteries) require us to approach the final treatment of MSW in a different manner. E-waste growth is estimated to be about three times higher than that of average municipal waste[17]. Landfills are not viable options for MSW mixed with hazardous materials from e-waste. The problem requires enhancing our attention to collection and recycling processes which divert e-waste before it mixes with MSW and reaches landfills and incineration facilities. Today, incineration of MSW is not a common practice in Mexico, but it is expected to gain importance due to recent legislation that permits its use without any further restrictions. In addition, many landfills will soon reach holding capacity (some of them have already surpassed it), and space is becoming scarcer every day. Therefore, e-waste segregation will be necessary for future incineration practices to avoid important public health impacts.

The answer to the above questions is not straightforward for all electric and electronic products. In general, recycling prevents the flow of HWs into the MSW stream, reduces the demand for space at landfill facilities, generates jobs, extends the life cycle of many materials, and prevents the additional exploitation of natural resources. Computers are made from recoverable materials like iron, aluminum, copper, plastic, glass and other toxic and precious metals that are economically and technologically feasible to recycle and that, from a public health perspective, should be removed from the MSW stream. *For example, 1 metric ton of electronic scrap from personal computers contains more*

[17] Directive of the European Parliament and of the Council on Waste Electrical and Electronic Equipment. Commission of the European Communities, Brussels. 2000. COM(2000)347 final.

gold than that recovered from 17 metric tons of gold ore. In 1998, the amount of gold recovered from electronic scrap in the United States was equivalent to that recovered from more than 2 million metric tons of gold ore and waste[18]. Not every cell system used in batteries is economically feasible to recycle. *Reasons for collecting spent lead-acid automotive type batteries are obvious, they are hazardous, they are recyclable and they contain valuable resources (lead, plastic and spent acid) which make them economically feasible to recycle*[19]*, but in the case of spent dry cell batteries, the situation is not that clear. They contain toxic metals, but are very small; they are recyclable, but only a few types –mercuric oxide and silver oxide button cells, and nickel cadmium rechargeable batteries- are currently profitable to recycle*[20].

The main driving forces behind battery collection and recycling have been efforts to divert the flow of high density metals away from landfills and incinerators (a public health concern) and to recover the valuable materials contained in those systems. Heavy metals such as lead, chromium, nickel, and cadmium from used computers and mercury, cadmium and lead from regular batteries are particularly problematic. Public concern over this waste stream is fueled by the high content of toxic metals that may find their way to the environment after being disposed of in open dumps and landfills, where they can be subject to thermal processes.

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[18] Obsolete Computers, "Gold Mine." or High-Tech Trash. Resource Recovery from Recycling. U.S. Geological Survey, Fact Sheet FS-060-01. July 2001.

[19] Even though Mexico does not have the required infrastructure to recycle primary spent cells and batteries, ENERTEC, the main manufacturer of secondary SLI batteries in Mexico, actually recycles spent lead-acid battery systems through a so-called "Green Process" (ENERTEC at www.enertec.com.mx). Mexico is also considered a net importer of spent SLI lead-acid batteries which are destined to be recycled at ENERTEC's Cienenga de Flores facility (CENICA-Mexico, 2001, Ibid).

[20] Fleetwood Charlotte, Managing mercury, cadmium, and lead in Spent Household Batteries. MIT Thesis, 1990.

What are the risks of disposing used computers and spent batteries as MSW? What are the dimensions of the problem in Mexico? What can we do to reduce these risks? This thesis attempts to answer these questions and offers a strategy to manage heavy metals introduced into the environment by the disposal of increasing volumes of electronic products, both consumer and industrial.

2. Mexico's Current Waste Situation:

Waste has an intimate relationship with the commercial, service and transformation processes that generate it. As Mexico's trade policy has evolved to one relying on open domestic markets and consumerism, the volume and physico-chemical characteristics of the wastes being generated have changed, as have the consumption patterns of consumers who demand higher volumes of ever more sophisticated goods. Consequently, today's waste problems are more difficult to solve. Feasible solutions for environmental disposal demand the attention of every single member of society and must be more sophisticated technologically.

Nevertheless, this new trade policy also forces Mexico to compete in a more regulated market place (both formally and informally through private compliance standards), accelerating the country's transition into a sustainable economy and allowing it to leapfrog its way through technological developments to comply with trade and environmental requirements. E-waste, or waste materials generated from electric and electronic consumer products that reach the end of their life cycle, is one of the new waste streams that require sophisticated solutions to protect the public and the environment from toxic exposures during final treatment and disposal. Little can be done, however, if such toxic waste streams are mixed with MSW, and even fewer options are available without the infrastructure to treat, recycle and finally dispose of those waste streams. Collection programs, now required by law, will begin operation in 2006, and, so far, none of this infrastructure is in place.

Mexico has come a long way in its efforts to manage its waste burden, but it must go further in recognizing that legislation is not the only ingredient of the solution. Public and private incentives to participation and disincentives to waste generation and illicit behavior are required, as well as more traditional enforcement and monitoring. Given the size of the investment required, these last two items, in particular, are essential to provide judicial security and lure private investment in the sector.

First and foremost, the country's politics must be stabilized and its corruption mitigated. We do not need another Metalclad[21] case, where the Mexican government (or, more precisely, Mexican taxpayers) paid $15.6 million dollars to protect private interests in Guadacazar. $15.6 million is nearly 25 % of PROFEPA's budget and nearly 45% of the annual operating expenses of the General Directorate for Hazardous Materials (GDHMW). In 2004, the total dollar value of subsidies given to the states is expected to be a little less than $6 million[22].

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[21] To date the primary example of NAFTA's Chapter 11 law in Mexico is the Metalclad case, the first of such rulings under the agreement. In August of 2000 the Mexican government (the case actually began with a municipality) was ordered to pay US$16.7 million dollars in compensation. The case began after Metaclad, an American company, bought a Mexican company called Coterin. Coterin managed a toxic waste transfer station that contained 55,000 drums, or the equivalent to 20,000 tons of toxic and potentially explosive waste, about as much waste as was found in Love Canal. The site was located over a sensitive groundwater area in the state of San Luis Potosi, and the station had been protested by locals since 1991. Coterin wanted to expand the facility to process HW, but was denied construction permits by local municipal authorities in the city of Guadacazar in both 1991 and 1992. When Metalclad bought Coterin in 1993, it continued the project and began construction after it attained proper state and federal permits. It had not, however, secured municipal go-ahead. In 1994 local authorities ordered Metalclad to stop construction because of the lack of a local permit, but Metalclad reapplied for the permit and continued construction while the process was underway. In 1995 the permit was again denied, and in 1996 Metalclad announced its intentions to sue the Mexican government for damages under Chapter 11. In early 1997 Metalclad sued the government of Mexico for $90 million, and in late 1997 the area where the site was located was declared a special ecological zone because it contained rare cacti species and was considered biologically diverse. In 2000 a NAFTA tribunal operating under World Bank rules awarded $16,685,000 to Metalclad. Mexico later challenged the ruling and the award to Metalclad was dropped to $15.6 million. "NAFTA and the Environment in Mexico", Ross Dickinson. Web page accessed on April 06, 2004. http://www.webs.uidaho.edu/envs428/assignments/student_results/Dickinson.htm

[22] Informes Programaticos Presupuestales, SEMARNAT's Transparency web page accesed on April 06, 2004.
http://www.semarnat.gob.mx/wps/portal/.pcmd/changePageGroupJSPCommand/_s.155/2080?changePageGroupJSPCommand=%2Fwps%2Fportal%2F.cmd%2Fcs%2F.ce%2F155%2F.s%2F4348%2F_s.155%2F2080

Legal and Operational Infrastructure:

Framework legislation has been introduced recently, but implementation remains an extraordinary milestone as the gap between infrastructure development (capacity building) and legislation at all three levels of government is overwhelming. Even though almost every state in the country now has environmental legislation in place, many municipalities do not, and a lack of nearly every type of resource is evident. The vast majority of the 2,443 Mexican municipalities do not have the legal infrastructure or the economic or human means to address the MSW problem at this moment in time, and legislation, economic instruments, and private sector participation is needed to build capacity at the local level. Today, landfills are still the main final disposal option in Mexico, and will continue to be so even after new waste policy is pushed through the legislature extending and sharing responsibility for waste policy in the country. Without disincentive mechanisms for such practice, little will change. Incineration is being considered as an option for the final treatment and disposal of wastes[23] but no bans on the use of landfills for specific types of waste are in place, and there is therefore no disincentive to adding non-hazardous-industrial waste to the MSW stream.

In one specific case, new legislation[24] reclassifies electronic waste and spent batteries (mercury and nickel/cadmium) as HWs subject to integrated management plans. This proposal is assessed in chapter 5, but it should be noted that the classification of such wastes as hazardous highly impacts their recycle potential and the cost associated with recollection, storage, transportation and final treatment. Disposal costs are 2 to 10 times

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[23] Art. 50, fractions V and IX of the General Law for the Prevention and Integrated Waste Management (GLPIWM) published in the Federal Register (DOF), October, Wednesday 8 of 2003.

[24] Article 31 fractions IV, V, and VII of the General Law for the Prevention and Integrated Management of Waste (GLPIMW) published in the Federal Register (DOF), October, Wednesday 8 of 2003.

higher for used batteries considered hazardous (rather than special) waste. The less stringent special waste [25] category is not subject to all the requirements of HW regulations. Would it not be better if E-waste were considered hazardous and a ban was put in place on landfilling non-hazardous industrial wastes (or at least wastes that, because of their volume or their physical-chemical characteristics, have the potential to cause harm to the environment if dumped)? This new policy would allocate incentives to different societal sectors to develop new environmentally friendly alternatives for industrial non-HW, and would allow the recycling of electronic waste and spent batteries (mercury and nickel/cadmium) to be economically feasible.

Municipal Solid Waste:

Estimates about waste generation of any kind (hazardous or non) are very difficult to obtain. In Mexico, however, it is estimated that the waste generated by its municipalities reaches 30,598,315 MT of MSW annually, of which only 80 % (24,478,652 MT) is collected. Even less, approximately 76% (18,600,000 MT), is destined to a landfill facility, and the remaining 24% is thrown into open waste dumps. 82% of total volume of landfilled MSW is sent to controlled landfills[26]. In total, 12 million MT of MSW are simply lost or disposed of in an unknown location. . 84% of municipal waste comes from households[27].

[25] Comparisons in the U.S. show a shipping cost increase of a factor of 2 to 10 for the same used batteries, depending on whether they are characterized as hazardous or non-hazardous. The size of the increase is dependent upon the shipment size and whether it is a dedicated of backhaul trip. – Used Battery Collection and Recycling, G. Pistoia, et al. Elsevier, 2001.
[26] Controlled landfills are considered to be those that are fenced and restricted access. Not necessarily those with adequate engineering and sanitary controls.
[27] Environmental Performance Review – Mexico, OECD (2003).

Table 3. Annual MSW generation in Mexico

Region	Population Proyected-1998	Per-capita Generation (kg/person/day)	Generation Daily (MT)	Generation Annual (MT)
Center	51,117, 711	0.788	40,281	14,702,565
Federal District	08,683,824	1.329	11,541	04,212,465
North	19,501,930	0.891	17,376	06,342,240
South	12,615,849	0.679	08,328	03,039,721
North Border	06,347,055	0.956	06,067	02,214,455
Total	**98,266 369**	**0.853**	**83,831**	**30,598,315**

Source: Cortinas de Nava (2001)[28]

Annual growth in municipal waste generation is approximately 1 to 3% per year depending on the locality, and per-capita generation is higher in zones with higher well-being indexes (as measured by INEGI). Waste generation per capita in the Federal District is 1.32 kg per day, nearly twice the generation rate of the southern part of the country; where the well-being index is lower[29] (See Table 3).

The key importance of urban centers is clear. Mexico City accounts for 14% of national waste generation even though its share of the national population is only 18%[30].In the international context, Mexico's average per-capita generation is still comparatively low. Both developed and developing countries like the U.S., Canada, Finland, Holland, Brazil, Argentina and Chile, have higher per-capita generation rates (See Table 4).

[28] Cortinas de Nava, Ibid.

[29] To see how the well-being index is calculated please refer to: http://www.inegi.gob.mx/prod_serv/contenidos/espanol/niveles/jly/nivbien/variables/estatal4.asp?c=127 to see the national well-being index for Mexico refer to : http://www.inegi.gob.mx/prod_serv/contenidos/espanol/niveles/jly/nivbien/entidad.asp?c=127&e=14

[30] Environmental Performance Review – Mexico, OECD, 2003.

Table 4 International per-capita generation rates

Country	Per-Capita Generation Kg/person/day
U.S	1.970
Canada	1.900
Finland	1.690
Holland	1.300
Swiss	1.200
Japan	1.120
Brazil (Sao Paulo)	1.350
Argentina (Buenos Aires)	0.880
Chile (Santiago)	0.870
Mexico	0.853

Source: Cortinas de Nava (2001)

Hazardous Waste:

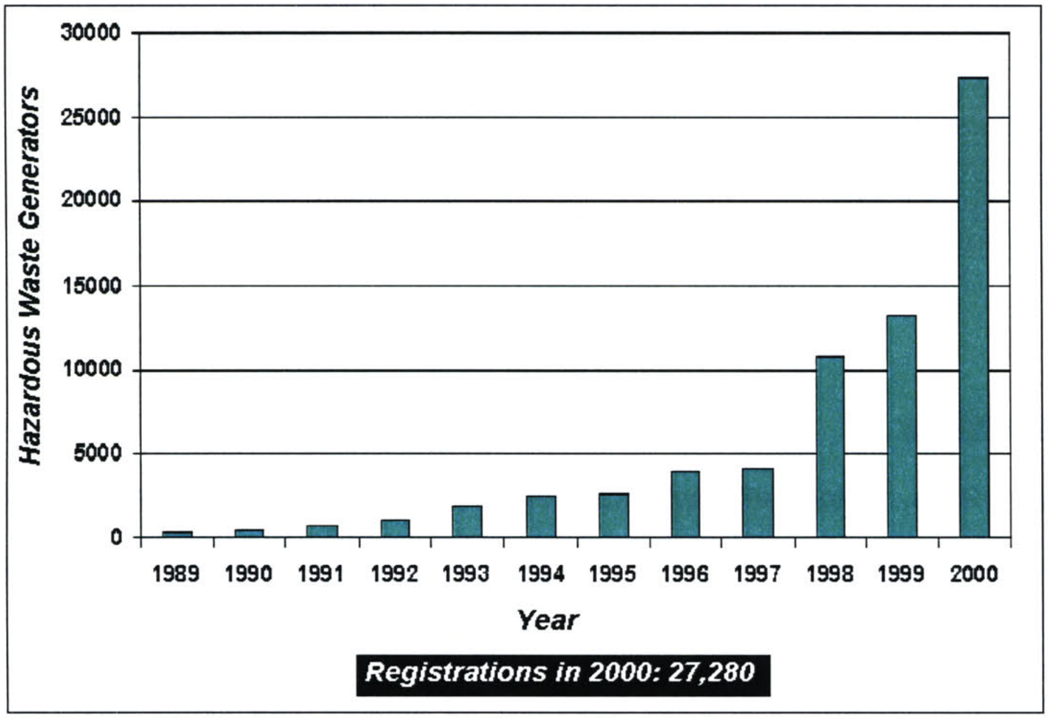
During the 1990s, various attempts were undertaken to determine the total volume of HWs being generated in Mexico. Both modeling and manual inventory counts (with data through 1996) were used. It was estimated that Mexico generated 8 million MT of HW annually, a figure which has been criticized as inflated and which has resulted in treatment overcapacity for some HW streams. Bio-hazardous waste facilities, in particular, reached 100% excess treatment capacity.

The figure was soon reconsidered and removed from existing publications. In 1998[31], the Instituto Nacional de Ecología (National Ecology Institute, INE) began analyzing HW Shipment Manifests and HW Generator annual reports. The information was continuously stored for two years, and in 2000, INE established a new estimate of

[31] 1998 was the first year in which HW generators were obliged to use the HW Shipment Manifests and to report all shipments on an annual basis to the Environmental Ministry.

3,706,000 MT of HW per year created by 27,280 HW generators[32]. The total quantity of generators is estimated to reach some 100,000, and as in the US, 2-10% will be responsible for nearly 98% of the waste by volume.

Figure 2. Hazardous Waste generators registrations



Source: Cortinas de Nava, (2001).

The quantity of HW estimated by the manifest analysis is considered a good estimate, and even more accurate data will be available by 2006, when the national registry of HW generators is completed. For the time being, we can only conclude that the number of HW registrations has been increasing sharply and that additional efforts are required to identify the total population of HW generators (See

[32] Cortinas de Nava, Ibid.

Figure 2). The chemical, electronics, metal processing, petrochemical and steel industries are major sources of HW.

The amount of HW in the MSW stream has not been estimated, but several studies have been carried out to characterize the MSW composition in the entire country as well as in the Mexico City Metropolitan Area (MCMA). Of these studies, performed by both private and public entities, five are considered the most important. [33]. Out of the five, only one addresses the presence of electronic equipment and batteries, and it does so only in the context of the MCMA. The study from "Centro de Eco-desarrollo" estimates the existence of 1,230 MT of WEEE and Spent Batteries, which represents 0.03% of the total MSW generated annually in the MCMA[34].

Operational Infrastructure:

Landfilling is the only organized final disposal method available for MSW in the country. According to Mexico's Environmental Performance Review, published by the OECD in 2003, 64 of the 77 landfills[35] in the country were identified as controlled. These landfills received approximately 80% of the landfilled MSW in the country (15.2 million MT out of an estimated 18.6 million overall). Total collection, however, is less than 60% of the total municipal waste generated, and not all controlled landfills are sanitary (designed in an environmentally sound manner). The potential for environmental impacts from these sites remains high

[33] SEDUE, 1988-2000, Policies and Strategies for MSW Management in Mexico; SEDESOL, 1990-1998, Present Situation on MSW Management in Mexico; Centro de Ecodesarrollo, 1980-1983-1987, Consumerism and its Demons (Garbage and Pollution); INE, 1997, MSW Investment Statistics in Mexico's Core Urban Centers; JICA/GDF, 1999, MSW Management Assessment in Mexico City.

[34] Cortinas de Nava, Ibid.

[35] According to information from Sedesol, (Subsecretaria de Desarrollo Urbano y Ordenación del Territorio), there are 108 MSW disposal sites, of which 61 are classified as uncontrolled and 47 as adequate final disposal. Further, other publications referenced here and in Table 2 indicate the existence of only 10 sanitary landfills in the country.

Table 5. Municipal waste collection and disposal, by type of settlement

	Sites (number)	Population (Million)	Collection Rate (% MSW)	Appropriate Disposal (% MSW)
Large metropolitan areas	7	31	95	85
Cities in the 100 Cities Program	126	31	80	43
Small cities	267	29	70	6
Settlements in rural areas	199,600	8	60	0
Mexico Total	**200,000**	**99**	**83**	**53**

a) Disposal in controlled landfills with good sanitary standards
Source: Mexico Environmental Review, OECD (2003)

Table 6. Municipal solid waste disposal, by type of facility

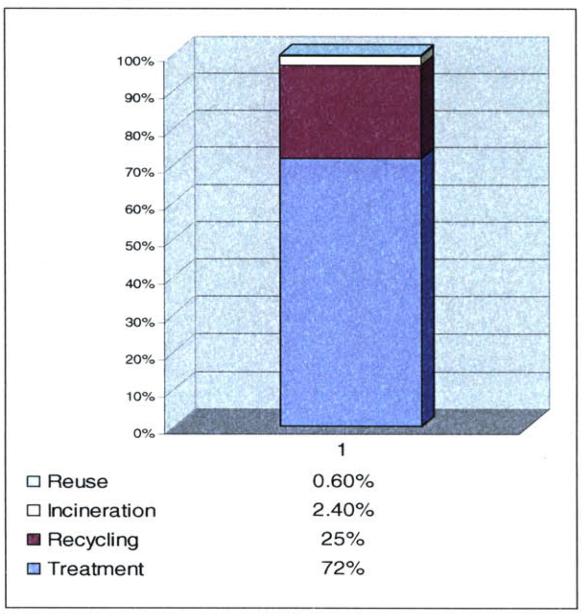
		1999	2000	2001
Landfills	Number[a] Quantities (1,000 MT)	97 16,936	76 16,912	77 18,604
Controlled Landfills	*Number[a]* *Quantities (1,000 MT)*	*70* *16,429*	*71* *14,491*	*64* *15,252*
Uncontrolled Landfills	*Number[a]* *Quantities (1,000 MT)*	*27* *507*	*5* *2,421*	*13* *3,351*
Open dump sites	Number[a] Quantities (1,000 MT)	.. 13,286	.. 13,096	.. 12,141

a) Number of landfills used in the year
b) Quantities disposed of are estimated as total MSW, minus quantities in controlled and uncontrolled landfills, minus recovery and recycling.

Source: Mexico Environmental Review, OECD (2003)

According to the OECD[36] Mexico requires investments of over $1.7 billion to upgrade its MSW infrastructure. This is true even when local governments have access to credit and (to a lesser extent) grants from BANOBRAS. Between 1995 and 2000, BANOBRAS identified over $380 million in available funds for general municipal investments (including waste management). Less than $15 million was spent, reflecting a lack of technical and administrative capacity to plan and manage infrastructure investment projects.

Figure 3 Distribution of Hazardous Waste Management infrastructure in Mexico



HW operational infrastructure, as is seen in Figure 3, is a different story. The investment of approximately $155 million from the public and private sectors has had some success, increasing the country's HW treatment capacity (12% of the total HW generation in 1994, when no trustworthy information on national HW generation was available) to 7.3 million

[36] Mexico Environmental Performance Report , OECD (2003)

MT today, and creating nearly 9,000 jobs in the process, both direct and complementary. As mentioned above, it is estimated that 3.7 million MT of HW are generated nationwide. The distribution of HW management infrastructure shows that incineration infrastructure has not been developed. The only thermal treatment of this waste in Mexico is labeled "recycling" and includes the burning of wastes rich in BTU used as alternative fuel in cement furnaces and, to a lesser extent, in boilers[37].

[37] A 1996 voluntary agreement between the Ministry of Natural Resources and Environment (SEMARNAT), the National Chamber of the Cement Industry, and the Cruz Azul Co-operative promotes recycling of waste oils and other high BTU hazardous materials.

3. The Electronic Waste (E-Waste) in Mexico:

The electronics industry has grown rapidly in the last decade and has helped create a growing mass consumer market for computers, cell phones, and many other types of personal electronic equipment. Electronic products have become integral components of modern society, and although the presence of these products in our daily lives is considered essential and their benefits have contributed to an increased quality of life, society as a whole has begun recognize the costs of this development and is looking for ways to safely and economically recover the materials, some of them toxic, embedded in these new products. Today, obsolete products are stored in garages or dumped in mixed MSW landfills. Recycling of mass produced consumer products is not new, and infrastructure to reuse, dismantle, and recycle white goods has been in place for a long time. The situation is more complicated for batteries and personal computers, where the high speed of technological development shortens the lifespan of these products and increases the rate of their obsolescence; the useful life of new computers and the rate at which obsolete computers are being generated is catching up to the rate of their manufacture.

Estimates vary about the rate at which end-of-life computer products have been piling up, but the total worldwide population of spent computers in 2000 was estimated at approximately 156 million units – an annual increase of 18% from 1995, when 69 million units had surpassed their useful lifespan. Between 1997 and 2004, 315 million computers will become obsolete. It is estimated that, by 2005, one computer will become obsolete for every new one put in the market.

Table 7 Basic material constituents of a Desktop Personal Computer, (based on a Personal Computer of approximate weight of 29.5 Kg and 14" monitor.

Name	Content (% total weight)	Content % Accum	Recycle Efficiency	Use / Localization
Silica	24.880%	24.880%	0%	glass, solid state devices/CRT,PWB
Plastics	22.991%	47.871%	20%	Includes organic compounds, oxides and silica
Iron	20.471%	68.342%	80%	structural, magnetivity/(steel) housing, CRT, PWB
Aluminum	14.172%	82.515%	80%	Structural, magnetivity /housing, CRT,PWB, connectors
Cooper	6.929%	89.443%	90%	Conductivity /CRT, PWB, connectors
Lead	6.299%	95.742%	5%	Metales ionizados, Protector de radiaciones/CRT, PWB
Zinc	2.205%	97.947%	60%	Battery, phosphor emitter/PWB, CRT
Tin	1.008%	98.954%	70%	Ionized Metals /PWB, CRT
Niquel	0.850%	99.805%	80%	structural, magnetivity/(steel) housing, CRT, PWB
Barium	0.032%	99.836%	0%	getter in vacuum tube/CRT
Manganese	0.032%	99.868%	0%	structural, magnetivity/(steel) housing, CRT, PWB
Silver	0.019%	99.887%	98%	conductivity/PWB, connectors
Cobalt	0.016%	99.902%	85%	structural, magnetivity/(steel) housing, CRT, PWB
Tantalum	0.016%	99.918%	0%	capacitor/PWB, power supply
Beryllium	0.016%	99.934%	0%	thermal conductivity/PWB, connectors
Titanium	0.016%	99.949%	0%	pigment, alloying agent/(aluminum) housing
Antimony	0.009%	99.959%	0%	diodes/housing, PWB, CRT
Cadmium	0.009%	99.968%	0%	battery, glu-green phosphor emitter/housing, PWB, CRT
Bismuth	0.006%	99.975%	0%	wetting agent in thick film/PWB
Chromium	0.006%	99.981%	0%	decorative, hardener/(steel) housing
Mercury	0.002%	99.983%	0%	batteries, switches/housing, PWB
Gold	0.002%	99.985%	99%	connectivity, conductivity/PWB, connectors
Ruthenium	0.002%	99.986%	80%	resistive circuit/PWB
Selenium	0.002%	99.988%	70%	rectifiers/PWB
Indio	0.002%	99.989%	60%	Transistors, rectifiers/PWB
Germanium	0.002%	99.991%	0%	Semiconductors/PWB
Gallium	0.001%	99.992%	0%	Semiconductors/PWB
Arsenic	0.001%	99.994%	0%	doping agents in transistors/PWB
Palladium	0.000%	99.994%	95%	connectivity, conductivity/PWB, connectors
Vanadium	0.000%	99.994%	0%	red phosphor emitter/CRT
Europium	0.000%	99.994%	0%	phosphor activator/PWB
Niobium	0.000%	99.995%	0%	welding allow/housing
Vitriol	0.000%	99.995%	0%	red phosphor emitter/CRT
Platinum	0.000%	99.995%	95%	thick film conductor/PWB
Rhodium	0.000%	99.995%	50%	thick film conductor/PWB
Terbium	0.000%	99.995%	0%	green phosphor activator, dopant/CRT,PWB

Source: Microelectronics and Computer Technology Corporation, accessed through the World Wide Web at www.retrosystems.com/inside

In terms of materials wasted, this translates into 550,000 MT of lead (Pb), 900 MT of cadmium (Cd), 180 MT of mercury (Hg), and 500 MT of chromium VI (Cr VI), and an additional 1,800,000 MT of plastic materials. The discarded monitors will contain at least 159,000 MT (8.8% by weight) of brominated flame-retardants.[38]

But how big is the problem in Mexico? Information about the electronic waste problem is difficult to obtain, as there is little published research work on the subject in the Mexican context. Other means to obtain an estimate were therefore considered.

The dimension of the problem for Obsolete Computers:

According to the 8th edition of the Computer Industry Almanac, Mexico had the 14th most computers of any country in 2000, with 6.3 million (6 million of which were for personal use). These numbers represent a 142% increase from 1995. Nearly 98% of these computers were introduced into the Mexican market between 1985 and 2000. Figures for the dates between 1985 and 2003 were obtained directly from the 8th edition of the Computer Industry Almanac and from the Euromonitor Database for Trade and National Statistics. This information was combined with data on CPU life span proposed by the U.S. National Safety Council (Figure 4) to construct Table 8.

According to this estimation, 6.3 million computers became obsolete by the year 2003, and a total of 9.74 million will succumb to the same fate by 2006. These units are likely to entre the MSW stream.

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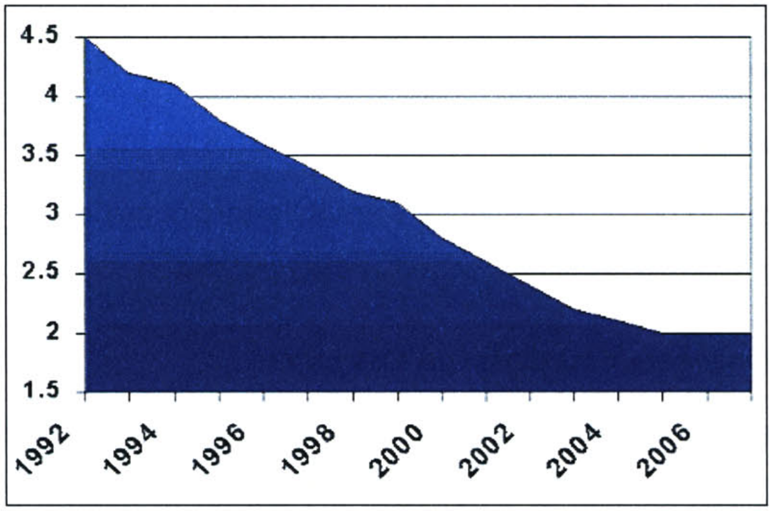
[38] Matthew J. Realff, et al. E-Waste and Opportunity. Materials Today. ISSN:1369 7021 © Elsevier Ltd 2004.

Figure 4 CPU Life Span vs. year of manufacture



Source: U.S. National Safety Council [39]

Table 8 Total Computers in Mexico and Obsolescence

Year	Total Computers Retail in Mexico		Obsolete By
	Units	Units Accum	Year
1985	150,000	150,000	1,991
1988	220,000	370,000	1,993
1989	120,000	490,000	1,994
1991	380,000	870,000	1995 - 1996
1992	340,000	1,210,000	1996 - 1997
1993	400,000	1,610,000	1997 - 1998
1994	440,000	2,050,000	1,998
1995	550,000	2,600,000	1,999
1996	458,800	3,058,800	1999 - 2000
1997	538,500	3,597,300	2,000
1998	743,000	4,340,300	2000 - 2001
1999	959,000	5,299,300	2001 - 2002
2000	1,000,700	6,300,000	2,003
2001	1,095,800	7,395,800	2003 - 2004
2002	1,138,180	8,533,980	2004 - 2005
2003	1,206,180	9,740,160	2005 - 2006
2004			
2005			
2006			
2007			
2008			
2009			
2010			
2011			
2012			
2013			
Total	**9,740,160**		

Source: Constructed from information from the 8th edition of the Computer Industry Almanac, the Euromonitor Database for Trade and National Statistics (2004) and the Us National Safety Council (see Figure 4)

[39] Electronic Product Recovery and Recycling Baseline Report, U.S. National Safety Council, May, 1999.

Hoarding:

Not all obsolete computers can be subject to collection immediately the year they become obsolete, when equipment and/or battery systems reach their end-of-life, because consumers do not immediately discard them. Consumers may store equipment, or, in the case of EEE, transfer it to another person. This behavior is known as hoarding. Hoarding is important because, in the case of computers, its occurrence has been estimated at rates as high as 97%. That is, 97% of all obsolete computers will be either stored or transferred to another person before they are discarded into the MSW stream. Because of this behavior, the total life-cycle of a computer, independent of its obsolescence, has been found to be between 5 and 10 years. The remaining 3% of WEEE are discarded and introduced into the MSW stream. This 3% is what I will refer to, in my estimations, as Available for Collection[40]. For the purpose of the present work, consumers are assumed to retain EEE for 10-years – a worst case scenario for the recycling industry.

Hoarding characteristics for batteries vary by type. Hoarding of primary (non-rechargeable) batteries has been estimated at 75%, with retention times up to 5 or 6 years. Hoarding of rechargeable (secondary) battery systems varies, depending on whether the battery was introduced into the market integrated within an EEE or by its individual sale to replace an old unit. When integrated in EEE, rechargeable batteries have estimated hoarding rates as high as 91%, with retention times ranging from 5 to 10 years depending on the type of EEE. Using information from Table 8 and Figure 4, we can estimate that nearly 3.44 million computers introduced into the Mexican market

[40] Portable Rechargeable Batteries in Europe: Sales, Uses, Hoarding, collection and recycling. Jean-Pol Wiaux. Published in Used Battery Collection and Recycling. G. Pistoia, et al. (2001) Elsevier Science.

from 2000 to 2003 (in additional to the 6.3 Million obsolete ones already in existence), will become obsolete by the year 2006.

Computers Available for Collection:

When hoarding is considered along with the information provided in Table 8, the number of computers available for collection is projected and shown in Table 9.

Table 9. End-of-Life Computers Available for Collection in Mexico

Year	Total Computers Retail in Mexico		Obsolete By	Available for collection	
	Units	Units Accum	Year	Units	MT
1985	150,000	150,000	1,991	4,500	133
1988	220,000	370,000	1,993	6,600	195
1989	120,000	490,000	1,994	3,600	106
1991	380,000	870,000	1995 - 1996	11,400	336
1992	340,000	1,210,000	1996 - 1997	10,200	301
1993	400,000	1,610,000	1997 - 1998	12,000	354
1994	440,000	2,050,000	1,998	13,200	389
1995	550,000	2,600,000	1,999	162,000	4,779
1996	458,800	3,058,800	1999 - 2000	13,764	406
1997	538,500	3,597,300	2,000	16,155	477
1998	743,000	4,340,300	2000 - 2001	235,690	6,953
1999	959,000	5,299,300	2001 - 2002	145,170	4,283
2000	1,000,700	6,300,000	2,003	30,021	886
2001	1,095,800	7,395,800	2003 - 2004	401,474	11,843
2002	1,138,180	8,533,980	2004 - 2005	363,945	10,736
2003	1,206,180	9,740,160	2005 - 2006	424,185	12,513
2004				426,800	12,591
2005				533,500	15,738
2006				445,036	13,129
2007				522,345	15,409
2008				720,710	21,261
2009				930,230	27,442
2010				970,679	28,635
2011				1,062,926	31,356
2012				1,104,035	32,569
2013				1,169,995	34,515
Total	**9,740,160**			**9,740,160**	**287,334.72**

Notes and assumptions:

a 97.00% of total computers in the market are discarded but not introuduced into the MSW stream (transferred or hoarded).
it is estimated that these units will become available only after 10 years from its introduction into the market.

b 3.00% of the remaining total computers in the market are discarded and available for collection in MSW stream.
Jean-Pol Wiaux, G. Pistoia, et al. (2001), Ibid.

c 29.50 Kg. per Unit (industry computer weight average). U.S. National Safety Council, (1999), Ibid.

The dimension of the problem for Spent Battery Systems:

Retail information on spent cells and batteries in Mexico is not readily available, and only one estimate was found on the annual consumption of batteries within the Mexican territory. According to the Mexican Association of Batteries, 450 million batteries are sold per year[41] (AMEXPILAS)[42]. It is expected that at least 53%[43] of them, 238.5 million, are destined for primary and secondary battery systems, and the rest for industrial applications. In addition, 6 million lead-acid batteries are used in starting, lighting and ignition (SLI) applications yearly. [44]. Calculation of the quantity of batteries available for collection explicitly acknowledges the differences between primary and portable rechargeable battery systems.

Spent and End-of-Life Battery Systems Available for Collection:

The portable rechargeable battery market has been estimated at 20% of total battery sales, and is driven by the most advanced electric and electronic equipment in the fields of computing, communication, and household equipment. Portable electrical devices like cordless power tools, tooth brushes, dust busters, and compact disc and mini-disc players also use this technology. 95% is introduced into the market incorporated in electric and electronic household equipment and only a few (<5% in the European market[45] and 20% in the U.S[46]) are sold individually as substitutes for primary batteries or as replacements[47].

Applying these estimates to the Mexican case (see Figure 5), only 90 of the 450 million batteries sold are estimated to be rechargeable, and of these, 4.5 million to 18 million

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[41] The number of computers, cells and batteries introduced into Mexico through the black market are not known, and is therefore not considered in the following calculations.
[42] "Revisión y Análisis de las Experiencias de Argentina, Brasil, Colombia, Ecuador, y México Respecto de los Cinco Elementos Claves para el Manejo Ambiental de Pilas y Baterías". Centro Nacional de Investigación y Capacitación Ambiental CENICA-México (2001). Reporte Final. REPAMAR-REMEXMAR-CEPIS-GTZ.
[43] According to studies performed in Europe, portable rechargeable batteries represent 20% of the market and primary batteries account for 33%. "Used Battery Collection and Recycling" G. Pistoia,et al., Elsevier 2001
[44] This figure was obtained directly from electronic communication with Blanca Raymundo Garcia. EH&S Coordinator for ENERTEC de Mexico S. de R.L. de C.V. ENERTEC is Mexico's biggest automobile batteries manufacturer (75% market share) and the only accumulator recycling facility in the country. Electronic communication: Wed, 7 April 2004
[45] G. Pistoia, et al. (2001), Ibid.
[46] "Managing mercury, cadmium and lead in Spent Household Batteries" Charlote Fleetwood, (1990), MIT / DUSP Thesis
[47] G. Pistoia, et al. (2001), Ibid.

are introduced into the market as substitutes for primary batteries or as replacements. The remaining 72 to 85.5 million are found in EEE[48] and, as stated before, are often hoarded. 91% of EEE are generally hoarded for long periods of time, and are not readily introduced into the MSW until 5 to 10 years after their useful life. Therefore, 65.5 to 77.8 million secondary batteries will be hoarded and the remaining 9% (6.5 to 7.7 7 million) will be available for collection on annual basis.

75% of all rechargeable batteries introduced into the market by individual sales are hoarded (3.4–13.5 million units), and those available to collection amount to 1.12- 4.5 million annually. In total, 8.82-11 million rechargeable batteries are available for collection on yearly basis.

Primary battery systems are estimated to represent 33% of battery market, some 148.5 million batteries. When hoarding is taken into account, only 37.5 million primary batteries are considered available for collection (25%).

A total of 46.3-48.5 million batteries, both primary and secondary, are estimated to be available for collection each year.

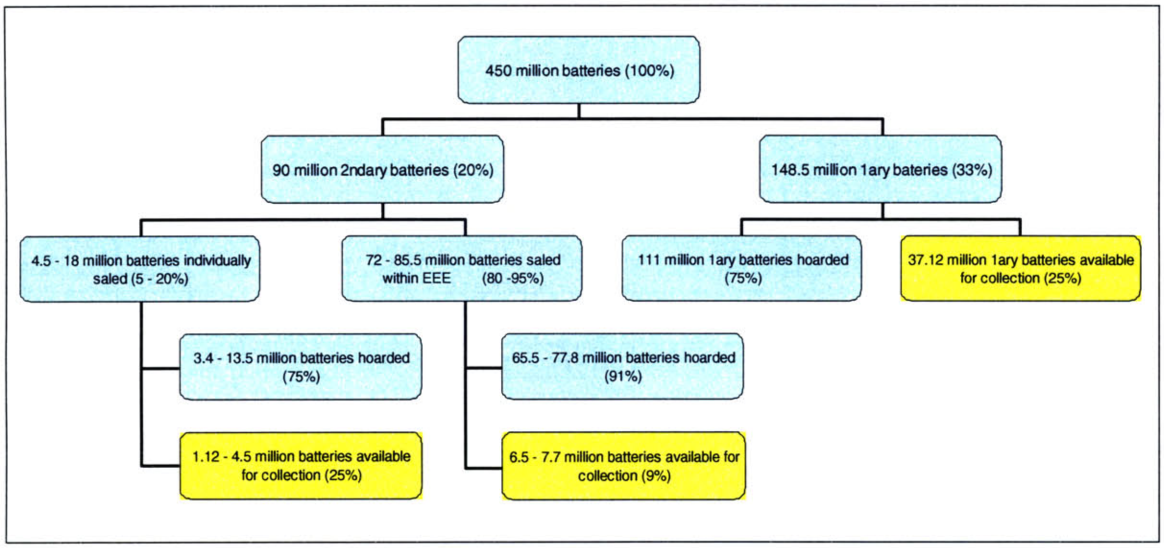
Emissions to the MSW stream from End-of-life Computers available for collection:

When the abovementioned generation rates are taken into consideration and the content of toxic materials contained in computers and batteries are accounted for, it is possible to estimate the pollutant emissions from end-of-life computers and spent battery systems introduced into the MSW stream in Mexico. From the information in Table 9, and given the information on heavy metal content of a typical personal

[48] This is the main reason why battery collection programs need to focus on the collection of WEEE as well in order to achieve high collection rates and specifically to recover secondary spent battery systems existing in the market.

computer (Table 7), the E-waste pollutant emissions into the MSW stream was projected (Table 10).

Figure 5. Batteries available for collection in Mexico (annual)



Hoarding is an important factor. Again, not all end-of-life computers or spent battery systems existing in the market are available for collection; only 5% of end-of-life computers are discarded. Of this percentage, only 60% is integrated into the MSW stream and the remaining 40% is transferred to other users.

That is, 97% of all computers in the market will be discarded and introduced into the MSW stream after 10 years of acquisition. The remaining 3% are discarded and available for collection or introduced into the MSW stream annually.

Table 10. Emissions to the MSW stream from End-of-life Computers available for collection in Mexico (1985 – 2013)

Year	Total Computers Retail in Mexico		Obsolete By	Available for collection		Lead	Chromium	Niquel	Cadmium	Mercury	BFR
	Units	Units Accum	Year	Units	MT	MT	MT	MT	MT	MT	MT
1985	150,000	150,000	1,991	4,500	133	8.36	0.01	1.13	0.01	0.00	2.69
1988	220,000	370,000	1,993	6,600	195	12.26	0.01	1.66	0.02	0.00	3.94
1989	120,000	490,000	1,994	3,600	106	6.69	0.01	0.90	0.01	0.00	2.15
1991	380,000	870,000	1995 - 1996	11,400	336	21.18	0.02	2.86	0.03	0.01	6.80
1992	340,000	1,210,000	1996 - 1997	10,200	301	18.95	0.02	2.56	0.03	0.01	6.09
1993	400,000	1,610,000	1997 - 1998	12,000	354	22.30	0.02	3.01	0.03	0.01	7.16
1994	440,000	2,050,000	1,998	13,200	389	24.53	0.02	3.31	0.04	0.01	7.88
1995	550,000	2,600,000	1,999	162,000	4,779	301.02	0.30	40.64	0.45	0.11	96.69
1996	458,800	3,058,800	1999 - 2000	13,764	406	25.58	0.03	3.45	0.04	0.01	8.21
1997	538,500	3,597,300	2,000	16,155	477	30.02	0.03	4.05	0.04	0.01	9.64
1998	743,000	4,340,300	2000 - 2001	235,690	6,953	437.95	0.44	59.12	0.65	0.15	140.67
1999	959,000	5,299,300	2001 - 2002	145,170	4,283	269.75	0.27	36.41	0.40	0.09	86.64
2000	1,000,700	6,300,000	2,003	30,021	886	55.78	0.06	7.53	0.08	0.02	17.92
2001	1,095,800	7,395,800	2003 - 2004	401,474	11,843	746.00	0.75	100.71	1.11	0.26	239.62
2002	1,138,180	8,533,980	2004 - 2005	363,945	10,736	676.26	0.68	91.29	1.01	0.24	217.22
2003	1,206,180	9,740,160	2005 - 2006	424,185	12,513	788.20	0.79	106.40	1.18	0.28	253.17
2004				426,800	12,591	793.06	0.79	107.06	1.18	0.28	254.73
2005				533,500	15,738	991.32	0.99	133.82	1.48	0.35	318.41
2006				445,036	13,129	826.94	0.83	111.63	1.23	0.29	265.61
2007				522,345	15,409	970.59	0.97	131.02	1.45	0.34	311.76
2008				720,710	21,261	1,339.18	1.34	180.78	2.00	0.47	430.15
2009				930,230	27,442	1,728.50	1.73	233.34	2.58	0.60	555.20
2010				970,679	28,635	1,803.66	1.80	243.48	2.69	0.63	579.34
2011				1,062,926	31,356	1,975.07	1.98	266.62	2.95	0.69	634.40
2012				1,104,035	32,569	2,051.46	2.05	276.93	3.06	0.72	658.93
2013				1,169,995	34,515	2,174.02	2.17	293.48	3.24	0.76	698.30
Total	**9,740,160**			**9,740,160**	**287,334.72**	**18,098.64**	**18.10**	**2,443.21**	**27.01**	**6.32**	**5,813.30**

Notes and assumptions:

a 97.00% of total computers in the market are discarded but not introuduced into the MSW stream (transferred or hoarded). it is estimated that these units will become available only after 10 years from its introduction into the market.

b 3.00% of the remaining total computers in the market are discarded and available for collection in MSW stream. Jean-Pol Wiaux, G. Pistoia, et al. (2001), Ibid.

c 29.50 Kg. per Unit (industry computer weight average). U.S. National Safety Council, (1999), Ibid.

d 8.80% Brominated Flame Retardants content in Plastics (by weight). Matthew J. Realff, et al., Elsevier (2004).

Spent Batteries' emissions into MSW stream:

Three basic chemistries exist for secondary battery systems: Ni-Cd, invented in 1899 but not commercially available in sealed portable devices until 1960,[49], lithium-ion, first commercially available in 1977-78, and, finally, nickel-metal hydride, introduced in 1989-90.

Ni-hydride and lithium-Ion chemistries have not been able to fully supplant the use of Ni-Cd batteries. Although they have higher energy densities, they have shorter recharge cycles (and take between 2 and 15 times longer to recharge), and are more expensive. Today, nearly 70% of all secondary battery systems use Ni-Cd chemistry, of which 20%

[49] "Battery Lesson Plan" Rechargeable Battery Recycling Corporation/National Geographic. Accessed through the World Wide Web at www.RBRC.org .

are used for industrial purposes and 80% is used in portable EEE. The remaining 30% use NI-MH and lithium-Ion chemistries instead[50].

Table 11. Metal contents in portable rechargeable batteries

Chemistry	Metal	Content %	Total Metal %
NI-Cd	Ni	15 - 20	Approx. 80
	Cd	20 - 25	
	Fe	30 - 35	
Ni-MH	Ni	40 - 45	Approx. 85
	Co	5 - 10	
	Fe	15 - 20	
	RM	10 - 15	
Lithium-Ion	Fe	20 - 25	Approx. 65
	Co	15 - 20	
	Al	5 - 10	
	Cu	5 - 10	
	Li	2 - 4	

Source: G. Pistoia, et al. (2001)[51]

Batteries weigh, on average, 37.8 gr. per cell[52]. When the above information is combined with the basic metal content of secondary battery systems shown in.

Table 11 and the number of secondary batteries available for collection estimated in Figure 5, it is possible to estimate the total amount of Ni, Cd and Hg that are being emitted through the MSW stream in Mexico (See Table 12 and Table 13).

Total nickel emissions into the MSW stream are estimated at 76–95 MT per year; cadmium, 52–73 MT.

While it has been banned from manufacturing processes since the early 1990's, mercury is still found in old primary batteries and is estimated separately. Black market batteries and ones disposed after hoarding for several years may still contain the toxic metal.

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[50] "Cell and Batteries Recycling", Jorge Alberto Soares Tenorio. Department of Metallurgy and Materials Engineering. University of Sao Paulo, Brazil. (2001).

[51] "Battery Collection and Recycling in Japan, Kinya Fujimoto. (2001). Verified with information in product MSDS from main Battery OEM web sites: www.rayovac.com www.duracell.com and www.energizer.com

[52] G.Pistoia, et al., (2001). Ibid.

Table 12. Rechargeable batteries emissions to MSW stream (Mexico, annual).

Rechargeable Batteries Available for Collection	Chemistry	Rechargeable Batteries Market Distribution			Metal *	Content			Total Metal			Metal *	Emissions to MSW		
Units		%	Units	MT		%			%		MT		MT		
11,000,000	NI-Cd	70.00%	7,700,000	291	Ni	15%	to	20%	Approx.	80.00%	232.848	Ni	43.66	to	58.21
					Cd	20%	to	25%				Cd	58.21	to	72.77
					Fe	30%	to	35%				Fe	87.32	to	101.87
	Ni-MH	20.00%	2,200,000	83	Ni	40%	to	45%	Approx.	85.00%	70.686	Ni	33.26	to	37.42
					Co	5%	to	10%				Co	4.16	to	8.32
					Fe	15%	to	20%				Fe	12.47	to	16.63
					RM	10%	to	15%				RM	8.32	to	12.47
	Lithium-Ion	10.00%	1,100,000	42	Fe	20%	to	25%	Approx.	65.00%	27.027	Fe	8.32	to	10.40
					Co	15%	to	20%				Co	6.24	to	8.32
					Al	5%	to	10%				Al	2.08	to	4.16
					Cu	5%	to	10%				Cu	2.08	to	4.16
					Li	2%	to	4%				Li	0.83	to	1.66
Total		100.00%	11,000,000	416							331				

Average cell weight in grams: 37.8
Average cell weight in MT: 0.0000378
* RM : Recycleable Metals

Table 13. Metal emissions to MSW stream
(Mexican Rechargeable Battery Market)

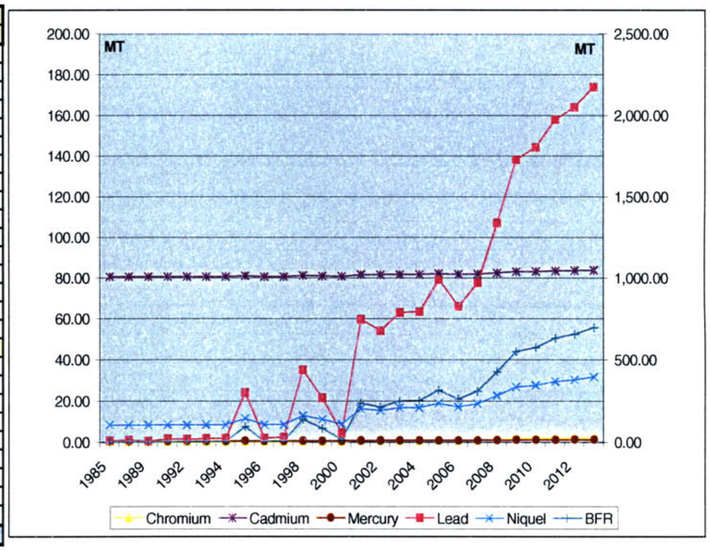
Metal	Total Metal Emissions into MSW		
	MT		
Al	2.08	to	4.16
Cd	58.21		72.77
Co	10.40		16.63
Cu	2.08		4.16
Fe	108.11		128.90
Li	0.83		1.66
Ni	76.92		95.63
RM	8.32		12.47

A statistical method developed by the European battery industry was used to determine the concentration of mercury in the MSW stream at any point in time. The method was developed over a period of many years beginning in 1996 through the use of stockpile analysis in Germany, Sweden, Belgium and the Netherlands. A graph was constructed in order to predict the amount of mercury that would be found in MSW batteries in

Europe at any point in time[53]. According to the information provided by the diagram, a maximum concentration of 0.04% of mercury was detected in batteries within the MSW stream in 1996, and, from that year on, the concentration has gone down, dropping to background levels by 2004. When translated into the Mexican context, the method predicts maximum mercury emissions of nearly 0.56 MT into the MSW stream[54].

Table 14. Total estimated End-of-life Computers and Spent Battery Emissions to MSW in Mexico (1985 – 2013)

Year	Lead	Chromium	Niquel	Cadmium	Mercury	BFR
	MT	MT	MT	MT	MT	MT
1985	8.36	0.01	107.20	80.72	0.56	2.69
1988	12.26	0.01	107.72	80.72	0.57	3.94
1989	6.69	0.01	106.97	80.71	0.56	2.15
1991	21.18	0.02	108.93	80.73	0.57	6.80
1992	18.95	0.02	108.63	80.73	0.57	6.09
1993	22.30	0.02	109.08	80.74	0.57	7.16
1994	24.53	0.02	109.38	80.74	0.57	7.88
1995	301.02	0.30	146.70	81.15	0.67	96.69
1996	25.58	0.03	109.52	80.74	0.57	8.21
1997	30.02	0.03	110.12	80.75	0.57	9.64
1998	437.95	0.44	165.19	81.36	0.71	140.67
1999	269.75	0.27	142.48	81.11	0.66	86.64
2000	55.78	0.06	113.60	80.79	0.58	17.92
2001	746.00	0.75	206.77	81.82	0.82	239.62
2002	676.26	0.68	197.36	81.71	0.80	217.22
2003	788.20	0.79	212.47	81.88	0.84	253.17
2004	793.06	0.79	213.12	81.89	0.84	254.73
2005	991.32	0.99	239.89	82.18	0.91	318.41
2006	826.94	0.83	217.70	81.94	0.85	265.61
2007	970.59	0.97	237.09	82.15	0.90	311.76
2008	1,339.18	1.34	286.85	82.70	1.03	430.15
2009	1,728.50	1.73	339.40	83.28	1.17	555.20
2010	1,803.66	1.80	349.55	83.39	1.19	579.34
2011	1,975.07	1.98	372.69	83.65	1.25	634.40
2012	2,051.46	2.05	383.00	83.76	1.28	658.93
2013	2,174.02	2.17	399.55	83.95	1.32	698.30
Total	18,098.64	18.10	5,200.94	2,125.29	20.92	5,813.30



In 2004 alone, combined annual emissions of brominated flame retardants (BFRs) from end-of-life computers and spent battery systems in the MSW stream could reach up to 255 MT, in addition to 793 MT of lead, 203 MT of nickel, 74 MT of cadmium 790 Kg of chromium and 840 Kg of mercury (see Table 14).

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[53] "Primary Battery Recycling in Europe", Neil Watson (G. Pistoia, et al. 2001, Ibid).

[54] (Primary Batteries in Mexico) times (hoarding factor) times (average weigh of batteries) times (maximum concentration of mercury in Batteries) = [Maximum mercury emission into MSW stream in Mexico from primary batteries]. This is (148,500,000 units) times (25%) times (0.0000378 MT./unit) (0.04 %Hg weight) = 0.56 MT Hg.

But if diversion of heavy metals from the MSW stream is not enough incentive for the design and implementation of collection and recycling programs can the value of recyclable materials embedded in end-of-life computers overcome the gap? In order to make these incentives visible, the following tables were constructed taking into consideration the metal content, recycle efficiency and current primary metal scrap market prices of the wasted materials[55]. Once these elements were factored in, the value of potentially recoverable metal materials was projected in the following tables.

Table 15. Recycle efficiency, Recycling factor and Market value for metal materials embedded in end-of-life computers.

Name	Content (% total weight)	Recycle Efficiency	Recycling Factor	Use / Localization	Market Value $/MT *
Gold	0.00160%	99.0000%	0.0016%	connectivity, conductivity/PWB, connectors	13,602,666.67
Silver	0.01890%	98.0000%	0.0185%	conductivity/PWB, connectors	246,000.00
Palladium	0.00030%	95.0000%	0.0003%	connectivity, conductivity/PWB, connectors	10,408,666.67
Platinum	0.00000%	95.0000%	0.0000%	thick film conductor/PWB	30,342,333.33
Copper	6.92870%	90.0000%	6.2358%	Conductivity /CRT, PWB, connectors	2,991.28
Cobalt	0.01570%	85.0000%	0.0133%	structural, magnetivity/(steel) housing, CRT, PWB	58,422.50
Iron ***	20.47120%	80.0000%	16.3770%	structural, magnetivity/(steel) housing, CRT, PWB	216.50
Aluminum **	14.17230%	80.0000%	11.3378%	Structural, magnetivity /housing, CRT,PWB, connectors	1,494.70
Nickel	0.85030%	80.0000%	0.6802%	structural, magnetivity/(steel) housing, CRT, PWB	13,266.88
Ruthenium	0.00160%	80.0000%	0.0013%	resistive circuit/PWB	2,250,000.00
Tin	1.00780%	70.0000%	0.7055%	Ionized Metals /PWB, CRT	8,968.44
Selenium	0.00160%	70.0000%	0.0011%	rectifiers/PWB	64,000.00
Zinc	2.20460%	60.0000%	1.3228%	Battery, phosphor emitter/PWB, CRT	1,035.13
Indium	0.00160%	60.0000%	0.0010%	Transistors, rectifiers/PWB	620,006.40
Rhodium	0.00000%	50.0000%	0.0000%	thick film conductor/PWB	
Plastics	22.99070%	20.0000%	4.5981%	Includes organic compounds, oxides and silica	20.00
Lead	6.29880%	5.0000%	0.3149%	Metales ionizados, Protector de radiaciones/CRT, PWB	760.13

* Prices obtained from the World Wide Web at www.metalprices.com accessed on 26 April 2004.
April Average / Cash
** Aluminum (1% Mg, 1% Fe, 3% Zn) ingots of Scrap Metal.
*** Shreded Iron
**** Price obtained from www.recycle.net/price/computer

The value embedded in end-of-life computers reaches nearly $26.5 per unit without taking into consideration health-related costs avoided by their collection. This table does not account for the costs of collection and recycling operations, but can serve the

[55] Prices obtained from the World Wide Web at www.metalprices.com accessed on 26 April 2004

purpose of luring the private and governmental sectors to address E-waste as an issue that has the potential for profit.

Table 16. Value of recyclable materials embedded in end-of-life computers available for collection in Mexico by year (a)

Year	Total Computers in Market	Available for collection		Gold	Silver	Palladium	Platinum	Cooper	Cobalt
	Units	Units	MT	$	$	$	$	$	$
1985	150,000	4,500	133	28,603.14	6,048.64	3,937.99	0.00	24,762.01	1,034.98
1988	220,000	6,600	195	41,951.28	8,871.33	5,775.72	0.00	36,317.61	1,517.98
1989	120,000	3,600	106	22,882.51	4,838.91	3,150.39	0.00	19,809.61	827.99
1991	380,000	11,400	336	72,461.30	15,323.21	9,976.24	0.00	62,730.42	2,621.96
1992	340,000	10,200	301	64,833.79	13,710.24	8,926.11	0.00	56,127.22	2,345.96
1993	400,000	12,000	354	76,275.05	16,129.70	10,501.30	0.00	66,032.02	2,759.95
1994	440,000	13,200	389	83,902.55	17,742.67	11,551.43	0.00	72,635.22	3,035.95
1995	550,000	162,000	4,779	1,029,713.16	217,750.93	141,767.60	0.00	891,432.30	37,259.39
1996	458,800	13,764	406	87,487.48	18,500.76	12,045.00	0.00	75,738.73	3,165.67
1997	538,500	16,155	477	102,685.28	21,714.61	14,137.38	0.00	88,895.61	3,715.59
1998	743,000	235,690	6,953	1,498,105.52	316,800.72	206,254.36	0.00	1,296,923.94	54,207.81
1999	959,000	145,170	4,283	922,737.40	195,129.03	127,039.52	0.00	798,822.39	33,388.55
2000	1,000,700	30,021	886	190,821.10	40,352.47	26,271.64	0.00	165,195.61	6,904.72
2001	1,095,800	401,474	11,843	2,551,870.75	539,637.88	351,333.37	0.00	2,209,178.33	92,337.51
2002	1,138,180	363,945	10,736	2,313,329.43	489,194.13	318,491.77	0.00	2,002,670.89	83,706.07
2003	1,206,180	424,185	12,513	2,696,230.18	570,165.22	371,208.31	0.00	2,334,151.64	97,561.05
2004		426,800	12,591	2,712,849.24	573,679.61	373,496.37	0.00	2,348,538.92	98,162.39
2005		533,500	15,738	3,391,061.55	717,099.51	466,870.46	0.00	2,935,673.65	122,702.99
2006		445,036	13,129	2,828,761.89	598,191.37	389,454.85	0.00	2,448,885.58	102,356.61
2007		522,345	15,409	3,320,157.54	702,105.61	457,108.63	0.00	2,874,291.38	120,137.38
2008		720,710	21,261	4,581,015.88	968,736.25	630,699.56	0.00	3,965,828.22	165,760.59
2009		930,230	27,442	5,912,778.23	1,250,360.78	814,052.32	0.00	5,118,747.32	213,949.40
2010		970,679	28,635	6,169,882.35	1,304,729.97	849,449.59	0.00	5,341,324.76	223,252.52
2011		1,062,926	31,356	6,756,227.72	1,428,722.99	930,175.74	0.00	5,848,929.42	244,468.98
2012		1,104,035	32,569	7,017,524.43	1,483,978.77	966,150.23	0.00	6,075,136.42	253,923.80
2013		1,169,995	34,515	7,436,782.95	1,572,638.34	1,023,872.39	0.00	6,438,092.43	269,094.36
Total	**9,740,160**	**9,740,160**	**287,335**	**61,910,931.74**	**13,092,153.66**	**8,523,698.27**	**0.00**	**53,596,871.63**	**2,240,200.15**
			%	**24.05**	**5.09**	**3.31**	**0.00**	**20.82**	**0.87**

Table 17 Value of recyclable materials embedded in end-of-life computers available for collection in Mexico by year (b)

Year	Total Computers in Market	Available for collection		Iron	Aluminum	Niquel	Rethenium	Tin	Selenium
	Units	Units	MT	$	$	$	$	$	$
1985	150,000	4,500	133	4,706.80	22,496.70	11,980.24	3,823.20	8,398.93	95.16
1988	220,000	6,600	195	6,903.31	32,995.17	17,571.02	5,607.36	12,318.43	139.56
1989	120,000	3,600	106	3,765.44	17,997.36	9,584.19	3,058.56	6,719.14	76.12
1991	380,000	11,400	336	11,923.89	56,991.65	30,349.94	9,685.44	21,277.28	241.06
1992	340,000	10,200	301	10,668.75	50,992.53	27,155.21	8,665.92	19,037.57	215.69
1993	400,000	12,000	354	12,551.47	59,991.21	31,947.31	10,195.20	22,397.14	253.75
1994	440,000	13,200	389	13,806.61	65,990.33	35,142.04	11,214.72	24,636.85	279.12
1995	550,000	162,000	4,779	169,444.79	809,881.33	431,288.62	137,635.20	302,361.39	3,425.59
1996	458,800	13,764	406	14,396.53	68,809.92	36,643.56	11,693.89	25,689.52	291.05
1997	538,500	16,155	477	16,897.41	80,763.17	43,009.06	13,725.29	30,152.15	341.61
1998	743,000	235,690	6,953	246,521.25	1,178,277.35	627,471.69	200,242.22	439,898.49	4,983.81
1999	959,000	145,170	4,283	151,841.36	725,743.66	386,482.52	123,336.43	270,949.40	3,069.71
2000	1,000,700	30,021	886	31,400.63	150,083.01	79,924.17	25,505.84	56,032.04	634.81
2001	1,095,800	401,474	11,843	419,923.94	2,007,075.92	1,068,834.36	341,092.31	749,322.45	8,489.41
2002	1,138,180	363,945	10,736	380,670.69	1,819,460.41	968,922.89	309,208.01	679,278.00	7,695.84
2003	1,206,180	424,185	12,513	443,679.05	2,120,616.28	1,129,298.37	360,387.92	791,711.65	8,969.65
2004		426,800	12,591	446,413.80	2,133,687.36	1,136,259.15	362,609.28	796,591.61	9,024.94
2005		533,500	15,738	558,017.26	2,667,109.20	1,420,323.94	453,261.60	995,739.51	11,281.18
2006		445,036	13,129	465,487.85	2,224,854.01	1,184,808.41	378,102.59	830,627.80	9,410.55
2007		522,345	15,409	546,349.62	2,611,342.38	1,390,626.26	443,784.31	974,919.50	11,045.30
2008		720,710	21,261	753,830.58	3,603,022.07	1,918,728.52	612,315.22	1,345,153.56	15,239.85
2009		930,230	27,442	972,979.18	4,650,468.59	2,476,528.47	790,323.41	1,736,207.62	19,670.27
2010		970,679	28,635	1,015,287.03	4,852,683.97	2,584,214.85	824,688.88	1,811,702.78	20,525.59
2011		1,062,926	31,356	1,111,773.29	5,313,851.39	2,829,801.77	903,061.93	1,983,875.20	22,476.21
2012		1,104,035	32,569	1,154,771.05	5,519,364.28	2,939,244.18	937,987.80	2,060,601.45	23,345.47
2013		1,169,995	34,515	1,223,762.28	5,849,115.96	3,114,847.87	994,027.41	2,183,711.06	24,740.24
Total	**9,740,160**	**9,740,160**	**287,335**	**10,187,773.85**	**48,693,665.21**	**25,930,988.59**	**8,275,239.94**	**18,179,310.53**	**205,961.53**
			%	**3.96**	**18.92**	**10.07**	**3.21**	**7.06**	**0.08**

Table 18. Value of recyclable materials embedded in end-of-life computers available for collection in Mexico by year(c).

Year	Total Computers in Market	Available for collection		Zinc	Indium	Rhodium	Plastics	Lead	Total $
	Units	Units	MT	$	$	$	$	$	
1985	150,000	4,500	133	1,817.65	790.14	0.00	122.08	317.80	118,935.45
1988	220,000	6,600	195	2,665.89	1,158.87	0.00	179.05	466.10	174,438.66
1989	120,000	3,600	106	1,454.12	632.11	0.00	97.66	254.24	95,148.36
1991	380,000	11,400	336	4,604.72	2,001.68	0.00	309.27	805.09	301,303.14
1992	340,000	10,200	301	4,120.01	1,790.98	0.00	276.72	720.34	269,587.02
1993	400,000	12,000	354	4,847.07	2,107.03	0.00	325.55	847.46	317,161.20
1994	440,000	13,200	389	5,331.78	2,317.73	0.00	358.10	932.21	348,877.32
1995	550,000	162,000	4,779	65,435.43	28,444.90	0.00	4,394.90	11,440.70	4,281,676.24
1996	458,800	13,764	406	5,559.59	2,416.76	0.00	373.40	972.04	363,783.90
1997	538,500	16,155	477	6,525.37	2,836.59	0.00	438.27	1,140.89	426,978.27
1998	743,000	235,690	6,953	95,200.48	41,383.82	0.00	6,394.04	16,644.81	6,229,310.32
1999	959,000	145,170	4,283	58,637.42	25,489.79	0.00	3,938.32	10,252.14	3,836,857.65
2000	1,000,700	30,021	886	12,126.16	5,271.26	0.00	814.44	2,120.13	793,458.04
2001	1,095,800	401,474	11,843	162,164.35	70,493.14	0.00	10,891.60	28,352.75	10,610,998.06
2002	1,138,180	363,945	10,736	147,005.71	63,903.65	0.00	9,873.48	25,702.42	9,619,113.40
2003	1,206,180	424,185	12,513	171,338.00	74,480.94	0.00	11,507.74	29,956.66	11,211,262.64
2004		426,800	12,591	172,394.09	74,940.02	0.00	11,578.67	30,141.31	11,280,366.78
2005		533,500	15,738	215,492.61	93,675.03	0.00	14,473.34	37,676.64	14,100,458.47
2006		445,036	13,129	179,760.02	78,142.01	0.00	12,073.39	31,429.17	11,762,346.08
2007		522,345	15,409	210,986.86	91,716.37	0.00	14,170.71	36,888.85	13,805,630.70
2008		720,710	21,261	291,110.93	126,546.45	0.00	19,552.16	50,897.71	19,048,437.53
2009		930,230	27,442	375,740.76	163,335.19	0.00	25,236.23	65,694.36	24,586,072.13
2010		970,679	28,635	392,079.02	170,437.46	0.00	26,333.58	68,550.93	25,655,143.26
2011		1,062,926	31,356	429,339.65	186,634.73	0.00	28,836.15	75,065.56	28,093,240.71
2012		1,104,035	32,569	445,944.33	193,852.81	0.00	29,951.38	77,968.72	29,179,745.13
2013		1,169,995	34,515	472,587.06	205,434.45	0.00	31,740.81	82,626.92	30,923,074.54
Total	**9,740,160**	**9,740,160**	**287,335**	**3,934,269.05**	**1,710,233.91**	**0.00**	**264,241.05**	**687,865.94**	**257,433,405.03**
			%	**1.53**	**0.66**	**0.00**	**0.10**	**0.27**	

What are the public health concerns associated with this waste? What illnesses can be tied to its disposal, and how can they be valued?

4. Public Health Concerns related to E-waste:

The metals contained in personal computers commonly include aluminum, **antimony**, **arsenic**, barium beryllium, **cadmium**, **chromium**, **cobalt**, copper, gallium, gold, iron, **lead**, manganese, **mercury**, palladium, platinum, **selenium**, silver, and zinc (see Table 7). Of all those metals, eight are listed as hazardous by the U.S. Resource Conservation and recovery Act (RCRA). Cadmium, lead and mercury are also present in the cell chemistry of electric batteries. *Heavy metals, have long been associated with acute and sub-acute food-borne intoxications, however, with exception of mercury poisoning from aquatic foods, little attention has been given to the significance of their food chain accumulation. Heavy metals are not man-made and on the contrary, it is believed that the environmental pollution problem associated with heavy metals is one of re-distribution by man's industrial and agricultural societies*[56]. As a consequence, traces of all of these toxic materials are found everywhere; their toxic effects have been identified; at the industrial level in workers, in people coming in contact with the effluence of these factories and finally at the consumer level as the consumer gets exposed to these products. Exposure can also be naturally occurring; we are exposed to them in our daily lives through our food, water, and air. But the event of contamination and toxicological effects are dependent upon the concentration and the duration of the exposure. Indeed, the mere presence of a metal species does not constitute a threat and it is considered that in some of these cases –like Iron and copper- their presence is required to perform important body functional tasks, therefore our organism is able to tolerate limited exposures to such materials.

[56] Frederick W. Oehme, Toxicity of Heavy Metals in the Environment. 1991.

Other heavy metals such as antimony, arsenic, barium, beryllium, cadmium, mercury, lead, silver and thorium have not known nutritive value and on the contrary, their presence is considered hazardous. Once absorbed into the body, these inorganic metals are capable of reacting with a variety of binding sites and thus interrupt the ongoing living chemistry responsible for sustaining life. This chapter will briefly outline some of the known public health effects of the exposure to lead, chromium, nickel, cadmium and mercury, as they are present in higher concentrations in the electronic scrap from personal computers and in spent batteries and how populations' exposure to these materials is affected by final disposal treatment decisions, this is landfilling or incineration.

Additionally, the use of brominated flame retardants in the EEE have also been associated with environmental and public health concerns that will be addressed in the following lines.

Lead: (Pb) Trace metals such as lead can be present in the environment in a variety of forms, these include: 1. free hydrated ions, 2. Ion pair salts; 3. Organic complexes/chelates, 4. Undissoleved compounds; and 5. surface-adsorbed material. The prime medium for lead transport is air, because fine particles -generated specially by anthropogenic high temperature sources- may travel long distances before settling out via wet, dry or cloud deposition. Most of the lead particles deposited on soil are retained and eventually become mixed into the surface layer. lead accumulated at the soil surface may be taken up directly by animals, microorganisms and so enter the food chain[57]. Children are considered to be at greater risk by the ingestion of dust and normal hand-to-mouth activity. Via the ingestion route, lead can only be absorbed by adults in 5% to 15% while absorption rates in children are much higher, reaching 50%. The fact that children's bodies absorb more of the lead they ingest means that lead is especially toxic for children[58]. Like methyl mercury, researchers have noted a definite pattern of learning disability, behavioral problems, lack of concentration and general underachievement in children who have been exposed to mild or moderate amounts of lead. The body normally accumulates lead in bones; however lead that is not stored in bones has the potential to damage both, the central and peripheral nervous systems of humans. Effects on the endocrine system have also been observed. Additionally, lead can also impact the cardiovascular system and the kidneys. Lead accumulates in the environment and has high acute and chronic toxic effects on plants, animals, and micro-organisms. The relative importance of a single source of exposure is difficult to predict and will vary with geographic location, climate and local geochemistry. In any case, consumer electronics in the European Community constitute 40% of lead found in landfills. The main concern with the presence of lead in landfills is the potential for the lead to reach and contaminate drinking water supplies.

Chromium[59]: (Cr) is abundant in the earth's crust, with both the hexavalent [Cr(VI)] and more predominant trivalent [Cr(III)] forms readily found in nature. Commercially, Cr compounds are used directly in leather / pelt tanning and for electroplating and as

[57] "Environmental Toxicants, Human Exposures and their Health Effects". Edited by Morton Lippmann. Van Nostrand Reinhold. 1992

[58] Age Substantially influences absorption of lead in humans and non-human primates. Wiles et al. (1977) reported that infant monkeys at 10 and 150 days of age retained 64.5% and 69.8% of an oral dose of $Pb(NO_3)_2$. similar differences have been observed for humans Kehoe (in 1961 established that gastrointestinal absorption of lead by adult males was 5 – 10% of ingested lead. Thos range of absorption was confirmed by later studies at a range of 5-15%. (Lippmann, 1992, Ibid.).

[59] Morton Lippmann, 1992. Ibid.

additives in the production of pigments, catalysts, corrosion inhibitors and wood preservatives. Chromium metal is widely used in the steel industry as a super-alloy for jet engines. Exposure to Cr occurs primarily within the industrial setting or from contact with its pollutants in the general environment. Symptoms of acute toxicity include allergic contact dermatitis, skin ulcers, nasal membrane inflammation as well as ulceration. Chronic exposure results in nasal septum perforations, rhinitis, liver damage, pulmonary congestion, and edema. Increased incidences of lung and gastric cancers also occur among the chronically exposed.

Chromium metal is biologically inert and has not been reported to produce toxic or other harmful effects in man or animal. The toxicity of Cr compounds has been largely associated with the hexavalent form, whereas trivalent Cr is virtually inactive in vivo. In humans, the primary effects of Cr exposure occur during and after its inhalation. Hexavalent Cr is highly corrosive and caused chronic ulcerations. These occur rapidly and are independent of the dose and any hypersensitivity reactions. Less information is available on exposure from [Cr (VI)] compared to the most commonly targeted heavy metals (lead, cadmium, mercury). However, the hazard profile of [Cr(VI)] raises even more concerns that those related to lead cadmium and mercury. Therefore, same treatment (risk reduction) should be given to [Cr(VI)] as for the other targeted substances.

Possible exposure to [Cr(VI)] contained in wastes can easily ;each from landfills which are not properly sealed. During incineration, [Cr(VI)] contaminated wastes the metal evaporates and integrates in fly ash. [Cr(VI)] in fly ash is easily soluble therefore it should not be subjected to incineration[60].

Nickel[61]: (Ni) is widely distributed in nature, constituting 0.008% of the earth's crust and 8.5% of its core. The main use of Ni is in the steel industry, with further applications as alloys, chemical catalyst, in electroplating metals, and for the production of ceramics, pigments, Ni-Cd batteries, and coins. In addition, Ni-containing compounds, such as ferrite are used in the electronic industry. The release of Ni into the environment is mainly as a pollutant from industrial processes and through the combustion of fossil fuels. Exposure to humans is therefore primarily in the industrial setting, however, Ni metal and most of its derivatives have little toxicity except for [$Ni(CO_4)$] in which case, acute inhalation produces irritating effects of pulmonary tissues that can develop into pulmonary edema. In contrast to inorganic Ni compounds, exposure to [$Ni(CO_4)$] can result in acute poisoning. Ni compounds have shown to be potent carcinogenic substances in experimental animal models. Cancer of the nasal cavity and lung has also been associated with prolonged exposure to NI compounds. In addition to inhalation-related cancers, malignant neoplasm could be induced by Ni compounds at the site of exposure. Asthma has been associated with inhalation of Ni-containing mists in the Ni plating industry and has been seen in hypersensitive patients as a result of non-occupational exposure. Epidemiological studies have also shown a positive association between the incidence of respiratory cancer and industrial exposure to Ni-containing aerosols and dusts.

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[60] European Parliament, COM(2000) 347 final. Ibid.
[61] Morton Lippmann, 1992. Ibid.

Cadmium: (Cd) is closely related to Zinc in its chemical proprieties and is found as a contaminant of many Zn containing minerals. Although Cd is obtained primarily as a commercial by product of the refinement of Zinc, mineral ores of Cd do exist. Its major uses are in the electroplating metals to inhibit corrosion, and in pigments and heat stabilizers for plastic production. Cadmium is considered non-essential to humans even when rat studies have demonstrated to the contrary. Absorption of cadmium from respiratory tract has been estimated to be in the range of 10 to 50% depending on the size of the particle and chemical nature of the aerosol. On the other hand, gastrointestinal absorption is only 5 to 8% with absorption being higher for finer particle size. The major toxic effects of Cd in man are dependent on the two primary routes of exposure: Inhalation and absorption. Pulmonary edema is the immediate cause of death of acutely exposed individuals. In contrast the effects from acute ingestion of Cd-containing products are more immediate and usually appear within 15 – 30 min. The chronic ingestion of cadmium also results in a painful degenerative disease called itai – Itai[62]. This condition was first reported in Japan, predominantly in older women with Calcium deficient diets[63].

Cadmium compounds are classified as toxic with a possible risk of irreversible effects on human health. Cadmium and cadmium compounds accumulate in the human body, in particular in the kidneys which in time may lead to damage. Due to its long half-life (30 years), Cadmium can easily be accumulated in amounts that cause symptoms of

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[62] In 1956 in the fishing village of Minamata, Japan, 52 victims were stricken with a strange brain illness that caused spasm, convulsions paralysis and even death. The symptoms appear to be similar to the symptoms villagers had seen in cats and dogs in the are which were often seen stumbling around, senseless, engaging in sudden wild frenzies before falling down and dying. They called this sickness as "Cats Dancing Disease, but it was latter named Minamata disease, although the affliction was not actually a disease but the result of methyl mercury poisoning .

[63] Fleetwood, 1990. Ibid.

poisoning. With prolonged exposure cadmium chloride may cause cancer[64]. It is known that in printed circuit boards cadmium occurs in certain components, such as in SMD chip resistors, infrared detectors, and semiconductors. Older types of Cathode Ray Tubes contained cadmium and it has also been used as a stabilizer in plastics (PVC)[65].

Mercury: (Hg) occurs as elemental Hg and as inorganic and organic compounds in nature. The major source of Hg in the biosphere is the natural degassing of the earths crust emanating from land areas, river beds, and the ocean floor and has been estimated to be in the range of 25,000 to 150,000 tons/year. Mercury is extensively used in the production of EEE as well as in the manufacture of industrial and control instruments[66]. It is also used in oils as ant mildewing agent in oils and ship bottom paints, in dentistry (amalgams), as well as in other laboratory applications. In general, exposure to Hg occurs primarily through exposure to emission from the combustion of fossil fuels and through the intake of food contaminated with organomercurials. Exposure to Hg occurs in three major forms: elemental mercury, inorganic mercury compounds, and organomercurials. While methyl mercury is very well absorbed after ingestion (95%) inorganic mercury is less well absorbed (10%) and elemental mercury is the least well absorbed (0.01%) by ingestion[67].

Brominated Flame Retardants[68]: BFR are regularly design into EEE today as a means of ensuring flammability protection. The use in mainly in four applications: printed circuit boards, components such as connectors, plastic covers and cables. 5-, 8-, and 10-

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[64] COM(2000)347 final. Ibid.

[65] COM(2000)347 final, Ibid.

[66] Global man-made release of mercury to the atmosphere is approximately 2000 to 3000 tonnes per year. It is estimated that of the yearly world consumption of mercury 22% is used in EEE. COM(2000)347 final, Ibid.

[67] Morton Lippmann, 1992. Ibid.

[68] COM(2000)347 final. Ibid.

Brominated diphenyl ethers (BDE) show effects above all on the liver but also on thyroid hormone and affect the behavior of experimental animals. They occur widely in the environment, in human blood and in mother's milk. OctaBDE and decaBDE are persistent, have effects on reproduction and can cause tumor formation in the liver. There are scientific data to support the assumption that these compounds can be transformed into toxic lower-brominated compounds which produce effects resembling those of chlorinated dioxins and PCB. PBDEs, may also act as endocrine disrupters. In the case of pentaBDE and octaBDE, the highest exposure in animal experiments which has not given rise to harmful effects (NOAEL) is, for rats and rabbits, 1 -2 mg/Kg per day.

The lower brominated PBDE compounds are persistent, bio-accumulative and toxic in the aquatic environment. PentaBDE, octaBDE and decaBDE are persistent, both microbially and abiotically in water and air. And even when octa and deca BDEs have not shown significant bio-accumulation, successive debromination in UV light and sunlight has, however, been demonstrated for decaBDE.

The presence of Polybrominated Biphenyls (PBB) in arctic seal samples indicates a wide geographical distribution. The principal known routes of PBBs from point sources into the aquatic environment are PBBs production plants and waste dumps. Just as with PBDEs, human and environmental exposure can occur in connection with the use of products, in the recycling of plastics containing PBBs and after disposal to landfills. Emission is probably slow, but PBBs can be released after degradation of PBB-bearing materials.

Taking the above health information in consideration, what are the viable technological alternatives for E-waste final disposal and what are its repercussions?

Impacts of E-waste management practices on health:

There is a large body of literature on the potential adverse health effects of the different E-waste management options, particularly from landfill and incineration. Much of the health related literature on the toxicity of individual materials highlighted above relates to occupational or accidental exposure to such toxic substances, and therefore, to higher levels of exposure than those expected from either waste disposal method, incineration or landfilling. In addition, the toxic effects of heavy metals such as its carcinogenesis are based on animal studies or studies of people exposed to high levels. While incineration is a means to extract value from wastes through energy production, social fear is kept alive by a number of studies reporting emissions of heavy metals, acid gases and chlorinated organic compounds. Modern procedures to remove dust in the stacks have drastically reduced emissions of metals, thus making the use of this technology increasingly attractive. Assessing health impacts from incineration is still difficult because the effects, if any, are delayed over long periods of time. Evidence that these toxic materials actually cause cancer, at environmental concentration levels, is still not strongly grounded and disputes over these issues continue to take place at the international level.

Mexico is not immune to this debate. Even when landfills are still the only organized method for the final disposal of MSW in the country, incineration will soon become an important method of MSW management. The attention of policy makers is required to be focused on this specific issue before population's health is unreasonably impacted. It is acknowledged that the magnitude of the impact is what is to be contested by many of the involved in policy decisions, as today, it is still unknown -at least in the country's context- what would the size of the impacts (health and economic) could be. It is hoped that, by reading the following lines of the work I'm presenting, at least the need to study the potential health impacts of the populations living in the vicinity of MSW management installations, mainly landfills and incinerators, is recognized, and basic regulatory mechanisms, additional to those recently mandated by the new General Law, are designed to anticipate those outcomes. In this section, I will try to bring to surface some of the risks associated with the incineration and landfilling of heavy metal containing wastes. This section will end with a rough estimation on health related costs of the incineration of E-waste.

What are the costs associated with E-waste incineration and landfilling?

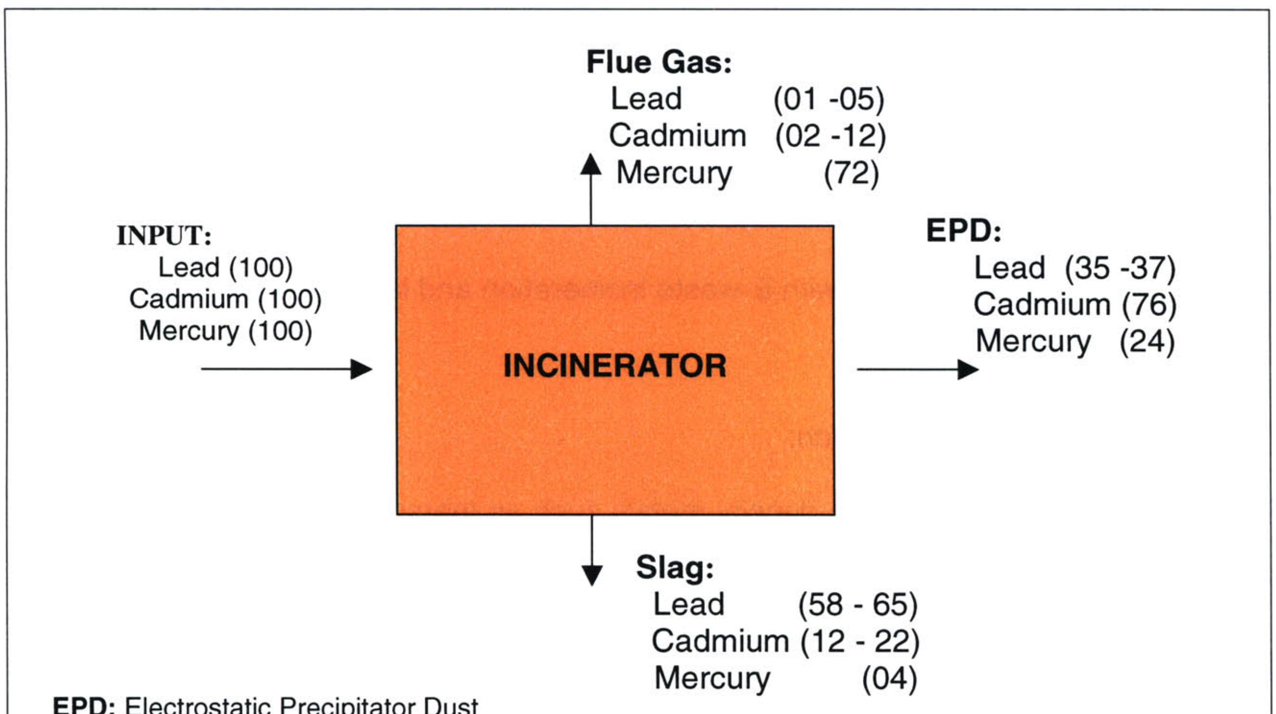
Risks associated with incineration:

The risks from incinerating high density metals such as mercury, cadmium and lead are considered to be of most significance. Shared proprieties of these toxic metals make them more likely than many other types of metals to be released and cause harm to living organisms[69]. Compared to other metals, these three have relatively low boiling points and high vapor pressures, making them readily volatile when exposed to high temperatures in incineration processes. Most incinerators in the U.S. are required to

[69] Charlotte Fleetwood, Ibid. (1990)

operate at a minimum temperature of 982 C in order to break down organic pollutants, a temperature that is higher than the boiling points of mercury (B.P.: 357 C) and cadmium (B.P.: 765 C), but lower than the boiling point of lead (B.P.: 1740 C). This characteristic combined with the high vapor pressures of these metals, largely explains why mercury and cadmium are evaporated in incinerators and emitted in high concentrations in fly ash and fugitive atmospheric emissions, while lead tends to be dispersed throughout all of the products of incineration[69] (see Figure 6). After incineration, 65% of the lead is found in the slag, 35% in the solid residues (Electrostatic Precipitator Dust) and 1% in air emissions[70].

Figure 6. Partitioning of Metals by Municipal Waste Incineration



Source: Constructed from Charlotte Fleetwood, Ibid. (1990) and Jean-Pol Wiaux. G.Pistoia et al. Elsevier (2001)

[70] Directive of the European Parliament and of the Council on Waste Electrical and Electronic Equipment. Commission of the European Communities. COM(2000) 347 final.

Because of its low boiling point, mercury tends to be released from the stack as a vapor phase emission. However, cadmium and lead tend to condensate on fine particles after leaving the combustion chamber, and these particles are readily inhalable when released as emissions and soluble in lechate when captured and landfilled as ash[69].

The flue gas treatment in MSW incinerators, according to Jean-Pol Wiaux[71], should lead to the recovery of more than 98 % of cadmium in fly ash and in the Slag (wet sludge), which are then expected to be transferred to controlled landfills for final disposal.

In Europe, incineration of waste electric and electronic equipment makes a large contribution to the total lead-emissions from incinerators. Lead from E-waste represents about 50% of the lead input in incinerators. Recent studies also identify cadmium and mercury emissions as important sources of the heavy metals found in the European environment. 36 MT per year of mercury and 16 MT per year of cadmium are attributed to incineration practices[70].

People may be exposed to these toxic metals in a number of ways, initially; people may be exposed to cadmium and lead dust from handling and transportation activities from the incinerator site to the landfill. Consequently, if the fly ash is disposed of in an uncontrolled landfill site, people may be exposed by contaminated drinking water or by the food chain through products in contact with contaminated water (irrigation) or soil. Exposure from MSW incinerators is more widely attributed to atmospheric emissions than it is to underground drinking water contamination. Some of the most important potential sources of contamination with high density metals have been mentioned all of

[71] "Portable Rechargeable Batteries in Europe: Sales, Uses, Hoarding, Collection and Recycling" published in Used Battery Collection and Recycling. G. Pistoia, et al. Elsevier (2001).

which can be amply reduced by the implementation of collection and recycling schemes focused at the retrieval of different sources of toxic materials found in the MSW stream. Macauley et al. accept air emissions rates from CRT incineration at 0.00026 lbs per CRT without any averting measures to limit human exposure.

Risks associated with landfilling:

Due to a variety of different substances contained in waste electric and electronic equipment, adverse environmental effects occur during landfilling of these wastes. Leaching of mercury takes place when certain electronic devices, such as circuit breakers, are destroyed. When brominated flame retarded plastics are landfilled, Polybrominated diphenylethers (PBDEs) may leach into the soil and groundwater with its consequent wider distribution into the environment. Additionally, according to the Commission of the European Communities, It has also been found that significant amounts of lead ions are dissolved from broken lead containing glass (CRTs) by the acidic groundwater often found in landfills. On the other hand, Macauley et al. exclude lead emissions into the groundwater from landfill lechate as a potential source of public health impacts on the following grounds; emission rates of lead from CRTs –which is considered to be one of the major sources of lead in the MSW stream- could range between 4.1 E-10 lbs per CRT and 3.5 E-3 lbs per CRT. The top end of this range represents the result of grinding CRT glass into very small pieces, thereby mobilizing more of the lead than would typically be released, and assumes that all of the lechate is released into the environment immediately and not contained. Lead tends to be concentrated in soil, thus further attenuating the effect on human population.

In any case, it is clear that when scientific debate exists over the environmental and public health impacts of the use of landfills or incinerators as E-waste final disposal alternatives, caution should precede.

The case of spent batteries is to be taken with special consideration. In a life cycle impact assessment of battery systems, regardless of composition, performance and whether or not they are rechargeable, it is clearly the final disposal of the battery which determines its major environmental and human health impact. The total emissions associated with all the stages up to the disposal of the battery are perhaps only 1% to 2% of the total potential emissions if the battery is simply discarded into the environment. Incineration, even when it is not preferred option because of the low caloric value of spent batteries; it is used as a final disposal option by countries where landfilling is not a viable option to reduce volumes of combustible wastes. As long as batteries are disposed of with out affecting its structural integrity, Landfilling is considered as the best option for their final disposal. A Swiss review by the university of Berne for the OECD on landfill lechate data from landfills in Canada, Denmark, France Germany, Italy, Japan and Switzerland indicated that the vast majority of lechate samples passed the World Health Organization's recommended cadmium drinking water standard of 3 µg per liter. Some of the data included in this survey were obtained from 50 year old unlined landfills which theoretically should represent the worst case environmental impact scenario. Thus, the disposal of NI-Cd or primary battery systems in landfills does not appear to pose an eminent risk from the perspective of leaching cadmium into the environment[72]. At least this holds true as long as the structural

[72] "Environmental and Human Health Impact Assessments of Battery Systems" Hugh Morrow. Published in "Used Battery Collection and Recycling" G. Pistoia, et al. Elsevier (2001).

integrity of the battery system is unaffected. This condition constrains the toxic materials embedded in the battery chemical systems to enter into contact with environmental factors such as rain and acid lechate and high temperatures encountered in landfills, avoiding the solubility and consequent introduction into soil and underground water bodies.

We can conclude that the most effective method to reduce total E-waste environmental impacts is first, to reduce the toxic content of EEE and batteries and second, to divert WEEE and spent battery systems from the MSW stream before it reaches landfills and incineration sites. This will only be accomplished by the design and implementation of urgent legal measures and market mechanisms that can jointly address the different types of E-waste contained in the MSW stream. E-waste is diverse and regulations must be reflective of this condition not otherwise.

Landfilling of primary batteries is seen as a viable option for final disposal of spent batteries[73] as long as it is done in controlled sanitary landfills. MSW incineration practices will be present in Mexico's near future and should be promoted in order to reduce the increasing pressure on existing landfills space, but not before specific regulations are design and implemented. Today incineration is starting to gain importance and no specific regulatory controls are in place. This condition need to be pointed out.

[73] Recycling of primary batteries today is still prohibitly costly to achieve due to the low value of the metals used in their chemistries. More so in Mexico where the probability of having mercury-containing batteries is high. The costs associated with mercury recovery systems is still not cost effective.

E-waste health impact from an economic perspective:

Comprehensive health related cost estimates, of any kind, are a difficult task to do. Even more difficult when it is attempted in a context where information is not readily available, disseminated and not standardized. Nonetheless a rough estimation exercise was performed in order to size the potential impact of only one type of E-waste present in Mexico's MSW stream:-end-of-life computers- and a specific toxic material embedded in these, which is though to have the biggest potential health impact on the exposed population: lead.

Cathode Ray Tubes (CRTs) comprise most of the lead that is contained in typical desk top computers. Especially in the form of electronic beams shields, lead is adhered to the glass of color monitors. Leaded glass in the CRT is mainly concentrated in the neck, funnel, frit and to a smaller extent, the face panel. For the purposes of our specific task, we will focus our efforts to estimate first, the allocation of the end-of-life computers in the national territory which will enable us to project the estimated population that is potentially at risk. The cost allocation in the national context was also done based on this initial exposure allocation and using health cost estimates from other studies. As it was necessary, specific educated assumptions were taken and will be discussed when used. We initiate the process with the number of end-of-life computers available for collection for years between 1985 through 2013 which was calculated in Chapter 3 and can be seen in Table 9. The assumption is being made that the concentration of end-of-life computers available for collection will be found in those areas of the country where the purchasing power of the local resident is high enough to allow them have access to this type of information management technology. Following this approach, I proceed to define what population could be considered to have enough purchasing power to buy a computer. It was determined that occupied population with wage levels of 5 minimum wages per day and above would have the economic means to acquire this type of equipment. The National Institute of Statistics, Geography and Information Systems (INEGI, Institute Instituto Nacional de Estadistica Geografia e Informatica) holds information on these populations and stratifies them in the following groups; less than 0.5 Minimum Wages (MW) per day, from 0.5 to 1.0 MW per day, from 1 to 3 MW per day, from 3 to 5 MW per day, from 5 to 10 MW per day and above 10 MW per day. These last two groups were taken into consideration for the calculations. An analysis was performed on both, the state and municipal level in order to identify those national regions with higher potential for exposure to the toxic materials embedded in end-of-life computes. At the national level no identification was possible as every state –with the exemption of Zacatecas- contributed with at least one municipality in the 5% elite. The populations with high concentrations of people with medium high and high income levels were identified. Out of the total 2443 municipalities of the country, only 122 (5%) concentrate 80% of the people receiving more than 5 MW per day levels[74] (see Figure 7 and Table A1 in Appendix A for detailed information on municipalities)

According to this information, the states with higher concentrations of high income population and as a consequence, of end-of-life computers are; Baja California, Jalisco, Nuevo Leon, the Federal District, Mexico State, Querétaro, Puebla, Sinaloa, Yucatan and Quintana Roo. In order to see which municipalities within each of these states is where the concentration is expected to occur, please refer to table A2 in Appendix A.

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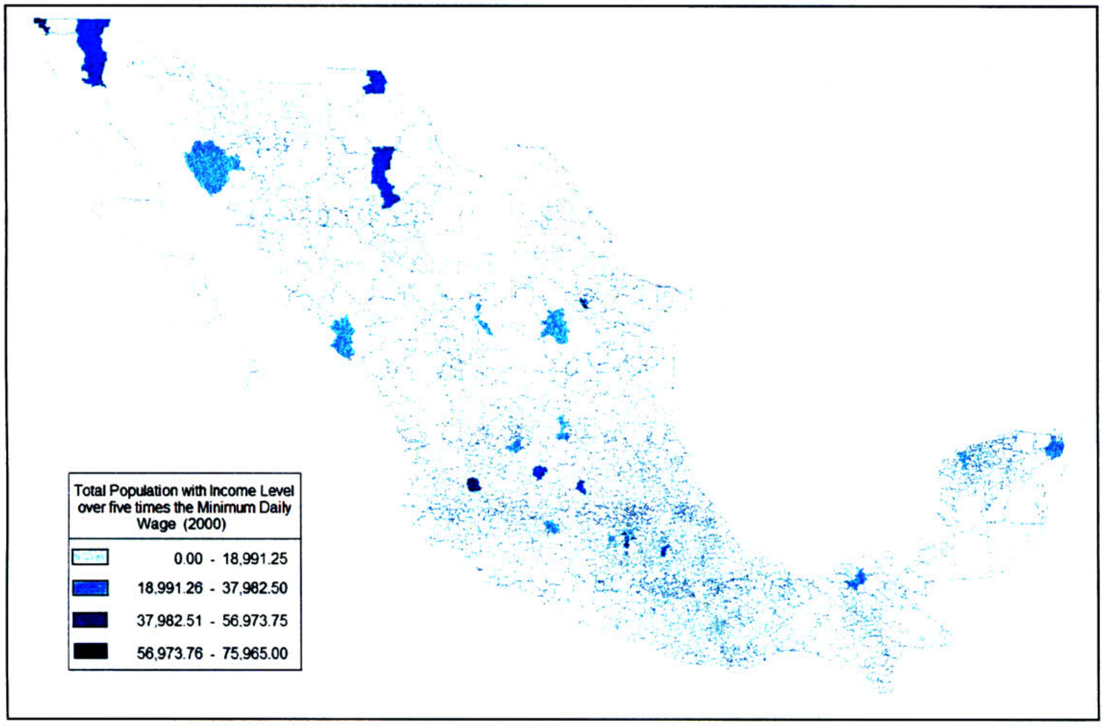
[74] From another perspective, these groups receive in approximate terms more to 600 USD per month.

Figure 7. End-of-Life computers generation zones
Based on populations' income level (2000).



Source: Constructed from the Municipal Information Data Base System (Simbad) accessed on May 2004 at: www.inegi.gob.mx

The next step in the estimation was to allocate the health costs to each and every one of the different municipalities according to its estimated exposure level. Information on health costs associated with incineration of E-waste in general was difficult to obtain as there are not many studies addressing the issue. Macauley et al. in their discussion paper "Modeling the Costs and Environmental Benefits of Disposal Options form End-of-Life Electronic Equipment: The case of Used Computer Monitors" from June 2001, published by Resources for the Future addressed the costs associated with different market mechanisms in order to treat CRTs from end-of-life computers, and a cost of $1.30 per unit (U.S.S. currency) was inferred from tables 8 and 9 of the publication.

They draw the majority of the data used for the lead health effects calculations from the RCG/Hagler Bailly New York State Environmental Externalities Costs Study (1994).

Please refer to Table 19 in order to see health costs allocation in Mexico (by state and by year). As indicated earlier, from the number of end-of–life computers available for collection estimated in Table 9 five different case scenarios were contemplated. Every one differing on the proportion of end-of-life computers destined to incineration and contemplating a gradual introduction of incineration practices in Mexico. With this in mind, 2%, 5%, 10%, and 20% (actual MSW incineration in the U.S.) cost estimates were calculated and reported in Table 19. A 100% incineration scenario was calculated with the intention to describe to the reader what would be the estimated health costs avoided if a ban on CRTs incineration is implemented in Mexico and the recovery of these waste materials from MSW stream is promoted by other mechanisms.

Depending on the different case scenarios, health costs attributable to incineration of CRTs range from $253,244 to $12,662,208 U.S. dollars.

Caution is then suggested when interpreting the information on the present estimation exercise as is acknowledged that costs from the health sectors of Mexico and the U.S. are not the same. Nevertheless, it is expected that the obtained health costs estimates get the reader closer to dimension the health impacts attributed to E-waste incineration practices and the potential costs avoidance expected by the implementation of collection and recycling schemes that could help diminish the burden on the Mexican population.

Table 19. Incineration health costs allocation by states and by year (Mexico).

Year	Total Computers Retail in Mexico		Obsolete By	Available for collection		Health Costs due to Incineration[N3]				
	Units	Units Accum	Year	Units	MT	2.00%	5.00%	10.00%	20.00%	100.00%
1985	150,000	150,000	1,991	4,500	133	$117.00	$292.50	$585.00	$1,170.00	$5,850.00
1988	220,000	370,000	1,993	6,600	195	$171.60	$429.00	$858.00	$1,716.00	$8,580.00
1989	120,000	490,000	1,994	3,600	106	$93.60	$234.00	$468.00	$936.00	$4,680.00
1991	380,000	870,000	1995 - 1996	11,400	336	$296.40	$741.00	$1,482.00	$2,964.00	$14,820.00
1992	340,000	1,210,000	1996 - 1997	10,200	301	$265.20	$663.00	$1,326.00	$2,652.00	$13,260.00
1993	400,000	1,610,000	1997 - 1998	12,000	354	$312.00	$780.00	$1,560.00	$3,120.00	$15,600.00
1994	440,000	2,050,000	1,998	13,200	389	$343.20	$858.00	$1,716.00	$3,432.00	$17,160.00
1995	550,000	2,600,000	1,999	162,000	4,779	$4,212.00	$10,530.00	$21,060.00	$42,120.00	$210,600.00
1996	458,800	3,058,800	1999 - 2000	13,764	406	$357.86	$894.66	$1,789.32	$3,578.64	$17,893.20
1997	538,500	3,597,300	2,000	16,155	477	$420.03	$1,050.08	$2,100.15	$4,200.30	$21,001.50
1998	743,000	4,340,300	2000 - 2001	235,690	6,953	$6,127.94	$15,319.85	$30,639.70	$61,279.40	$306,397.00
1999	959,000	5,299,300	2001 - 2002	145,170	4,283	$3,774.42	$9,436.05	$18,872.10	$37,744.20	$188,721.00
2000	1,000,700	6,300,000	2,003	30,021	886	$780.55	$1,951.37	$3,902.73	$7,805.46	$39,027.30
2001	1,095,800	7,395,800	2003 - 2004	401,474	11,843	$10,438.32	$26,095.81	$52,191.62	$104,383.24	$521,916.20
2002	1,138,180	8,533,980	2004 - 2005	363,945	10,736	$9,462.58	$23,656.45	$47,312.90	$94,625.80	$473,129.02
2003	1,206,180	9,740,160	2005 - 2006	424,185	12,513	$11,028.82	$27,572.05	$55,144.10	$110,288.20	$551,441.02
2004	0	0	0	426,800	12,591	$11,096.80	$27,742.00	$55,484.00	$110,968.00	$554,840.00
2005	0	0	0	533,500	15,738	$13,871.00	$34,677.50	$69,355.00	$138,710.00	$693,550.00
2006	0	0	0	445,036	13,129	$11,570.94	$28,927.34	$57,854.68	$115,709.36	$578,546.80
2007	0	0	0	522,345	15,409	$13,580.97	$33,952.43	$67,904.85	$135,809.70	$679,048.50
2008	0	0	0	720,710	21,261	$18,738.46	$46,846.15	$93,692.30	$187,384.60	$936,923.00
2009	0	0	0	930,230	27,442	$24,185.98	$60,464.95	$120,929.90	$241,859.80	$1,209,299.00
2010	0	0	0	970,679	28,635	$25,237.65	$63,094.14	$126,188.27	$252,376.54	$1,261,882.70
2011	0	0	0	1,062,926	31,356	$27,636.08	$69,090.19	$138,180.38	$276,360.76	$1,381,803.80
2012	0	0	0	1,104,035	32,569	$28,704.90	$71,762.25	$143,524.50	$287,049.00	$1,435,244.98
2013	0	0	0	1,169,995	34,515	$30,419.86	$76,049.65	$152,099.30	$304,198.60	$1,520,992.98
Total	**9,740,160**	**0**	**0**	**9,740,160**	**287,334.72**	**$253,244.16**	**$633,110.40**	**$1,266,220.80**	**$2,532,441.60**	**$12,662,208.00**

Health Costs Associated with Incineration[N1]: $1.30 per unit[N2]

N1. Assuming that every discarded computer is discarded with its monitor. Care should be taken in the interpretation of this estimated costs as these are estimates based on U.S. data.

N2. Modeling the Costs en Environmental Benefits of Disposal Options for End-of-life Electronic Equipment: The Case of Used Computer Monitors Molly Macauley, et al. Resources for the Future (2001).

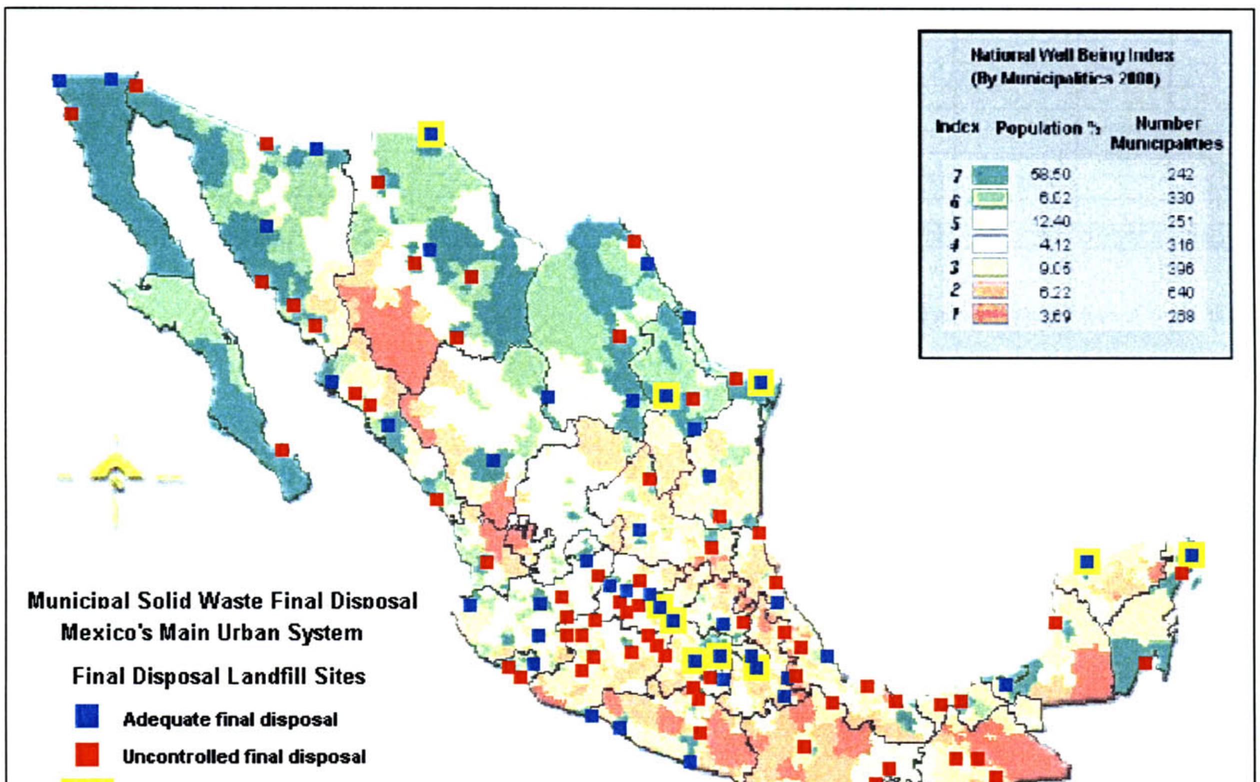
N3 Assuming 5 case scenarios for final disposal of End-of-Life computers: Different % of MSW incineration being done in the country and a final case scenario in which 100 % of end-of-life computers' CRTs are incinerated.

One step further is taken in order to identify the health costs that could potentially be faced by individual municipalities, in the different case scenarios. With this information in mind we can size the potential health costs which are attributable to all the historic waste that is estimated already exists in MSW landfills (up to $100,000 U.S. Dollars) and future health costs (years 2005 to 2013) that municipalities could be facing in the near future with the initiation and potential growth of MSW incineration -up to 420,000

U.S. Dollars in the case of Tijuana and $12,662,000 in the national context-. Please refer to tables A3 to A7 to see the details of the cost allocation by municipality and by year.

In the effort to describe the potential impacts of incineration of end-of-life computers available for collection in the MSW stream, I continue by estimating the size of the potentially exposed population. The process is initiated by identifying all the known MSW final disposal facilities without regard to its technical or environmental condition.

Figure 8. Municipal Solid Waste final disposal sites (Mexico)



Source: Constructed from information of Subsecretaria de Desarrollo Urbano y Ordenacion del Territorio. Sedesol: www.sedesol.gob.mx., Cortinas de Nava, Ibid. (2001), And Environmental Performance Report-Mexico. OECD 2003.

From information obtained from different publications and government World Wide Web sites the map on Figure 8 was constructed identifying to the extent possible, the municipalities which have a MSW final disposal facility (landfills).

According to this information, there are approximately 108 landfills in the country of which, only 47 are considered as controlled landfills where MSW final disposal is adequate and even a lesser quantity is considered to be sanitary landfills. The remaining 61 are classified as uncontrolled.

Information on the number, quality and location of the different landfills is diverse and changes depending on the source being consulted and the year the information was last updated. Thus, the information presented in Figure 8 is as accurate as the information from the different sources is considered as such. Information requests were sent to the Social Development Ministry's Urban Development and Land Use Department without any response. Nevertheless, the following assumptions were made in order to project the total number of people potentially exposed to emissions from end-of-life computers' CRTs incineration:

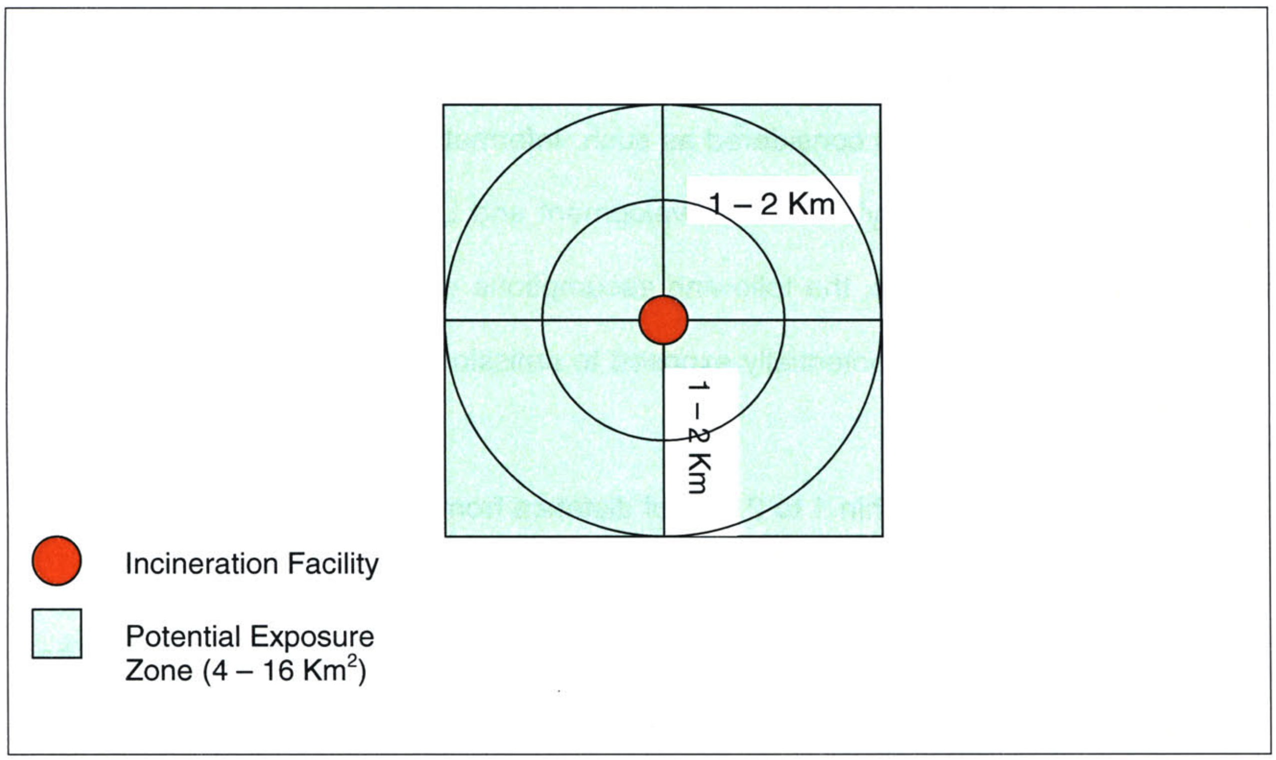
1. Populations living within 1 to 2 Km. of distance from the MSW incineration facility are potentially exposed to the incinerators' emissions.[75] [76] [77] [78]
2. It is assumed that for every municipality with a landfill site within its territory has also an incinerator facility in place. This assumption is not considered to have an incremental impact on the estimates. The higher the capacity of the incinerator

[75] "Methods for assessing risk to health from exposure to hazards released from waste landfills" WHO Regional Office for Europe. European Centre for Environment and Health. (2000).
[76] "Risk of adverse birth outcomes in populations living near lanfill sites" Paul Elliot, et al.BMJ, vol. 323, 2001.
[77] "Risk of congenital anomalies in the vicinity of municipal solid waste incinerators" S. Cordier, et al. Occup. Environ Med 2004; 61: 8 – 15.
[78] "Cancer risks in populations living near landfill sitesin Great Britain" : Jarup, et al. British Journal of Cancer (2002) 86, 1732 – 1736.

the greatest the distance its emissions will reach and higher the number of population potentially exposed. 1 to 2 Km is considered to be adequate (lower end) for the present estimation where many small incinerators are contemplated.

3. Population density at the state level is taken to project the estimated number of people living in the surroundings of incineration facilities. This is, people living within an area of 4 Km^2 to 16 Km^2 with the incinerator in its center (see Figure 9).

Figure 9. Potential Exposure zone from air emissions of incineration facilities.



Under these assumptions, the exposed population size, and its distribution by municipalities were projected and table A8 in Appendix A, was constructed. Nationwide, nearly 1,600,000 people could be potentially exposed to lead emissions from end-of-life

CRTs incineration practices. Out of them, 1,273,839 is people between ages 6 and 65, 248,194 are children under 6 years old (which have considerable higher risk from the exposure to lead) and 77,967 people over 65 years old.

As a conclusion we can anticipate that neither the size of exposed population nor the health costs associated with diseases attributable to CRTs incineration practices are negligible. We also need to keep in mind that the estimations here made were specifically addressing the economic and health impacts of one type of WEEE (CRTs) and one toxic material embedded in them (lead). The potential impacts from WEEE and spent batteries mishandling could be significantly higher.

Finally it is important to recall that estimates on batteries consumption do not take into account all the products that make their way into the country by unlawful means. Thus the impacts associated with batteries disposal are suspected to be considerably increased. Batteries' quality and price make these illicit products difficult to control and represent a real threat to the general population.

5. Collection and Recycling Programs:

To tackle this mounting solid and HW problem, avoid the health costs associated with it, and recover valuable materials embedded in them, policy makers and business entrepreneurs are promoting product recovery as an environmentally preferable alternative to disposal, and product recovery infrastructure and strategy has begun to develop in recent decades worldwide, in Mexico, waste regulation has really been in place for only two decades; in the case of MSW (since 1984) and little over one decade in the case of HWs (publication of Mexican Technical Norms in 1988 and latter in 1993 as Mexican Official Norms), and the country already has started to approach the electronic waste dilemma through new waste policy that requires extended and shared responsibility from the OEMs and Mexican society. Today, policies are being implemented in developed, and in some extent in some developing countries, to internalize the costs of such recovery and final disposal. The efforts have require the investment of significant amounts of capital from governments, and individuals, but specially, costs have been bared by the electronic industrial sector and consumers; Original Electronic product Manufacturers (OEMs), being attributed with most of the responsibility to recover and adequately dispose of the electronic wastes produced at the end point of their products life cycle. The wide range of programs dealing with the reuse and recycle of materials is a strategy that intensifies materials' use and reduces disposal, helping to achieve more sustainable patterns of production and consumption that will be put into test by the growing world population with still higher life quality expectations. This is particularly true in the developing world where most of the growth is expected and where the required infrastructure needed for reuse and recycle programs to be successfully implemented is simply not in place. Mexico, a member of the OECD since 1994, is not the exception and has been subject to international pressure to bring the country in line with these international special-waste management standards; pressure comes in various forms, such as these basic recommendations emitted by the OECD in its publication "Environmental Performance Review: Mexico"[79] released in 2003.

"It is recommended to:

- *Enforce waste regulations and reduce illegal disposal of hazardous and municipal waste, at the national and local government levels;*
- *Continue to enhance hazardous waste management, and to improve monitoring of hazardous waste generation, by working towards the completion target for the national registry (100% coverage by 1996);*
- *Implement the newly adopted framework legislation for municipal waste management; increase the waste management capacity of municipal authorities and operating enterprises;*
- *Develop a national strategy and local programs to reduce urban and hazardous waste generation;*
- *Increase investment in infrastructure (e.g. new sanitary landfills, closure of illegal landfills) for municipal waste management and extend services to medium and small cities;*
- Improve and modernize recycling and reuse of municipal waste, introducing **producer responsibility** for selected waste streams and taking social factors

[79] See Environmental Performance Review – Mexico, OECD, 2003. Section 1, Conclusions and Recommendations, page 22.

into account. (e.g. the role of the informal sector); increase composting of organic waste;

- Speed up identification of contaminated sites; develop and implement a national remediation strategy."

Municipal waste management in Mexico has a long way to improve, in contrast to the HW Management were most of the efforts have been directed, MSW is still in a early stage of achieving an integrated management scheme. Framework regulation has recently been approved in the form of its General Law for the Prevention and Integrated Waste Management (GLPIWM, from this point on) but implementation remains to be a great obstacle to overcome as national infrastructure to collect and dispose of the generated MSW is almost nonexistent and State and Municipal resources (economic and human) to deal with the increasing problem are also missing.

Mexico's collection programs:

Two documented cases of battery systems recycling programs were found in Mexico's recent history. One, which has proven to be successful, is being implemented by ENERTEC Mexico and is focused to Lead-Acid SLI battery systems. Recycling operations take place in the northern part of the country (Cienega de Flores, NL.)[80]. Due to this operation, Mexico is considered a net importer of spent lead-acid batteries to be recycled at the ENERTEC facility. In 1998 spent batteries imports reached 84,000 MT[81]. The second was focused on the collection and recycling of secondary NI-Cd and Ni-MH

[80] 6 million lead-Acid Batteries used in Starting, Lighting and Ignition applications (SLI) are being recycled annually. Figure was obtained directly from electronic communication with Blanca Raymundo Garcia. EH&S Coordinator for ENERTEC de Mexico S. de R.L. de C.V. Mexico's biggest automobile batteries manufacturer (75% market share) and the only accumulator recycling facility in the country. Electronic communication: Wed, 7 April 2004.
[81] CENICA-Mexico (2001), Ibid.

batteries through a pilot program on the hands of Motorola, it was considered successful in its initial collection phase, but recycling and final disposal failed as the costs to transport and finally dispose of the collected spent batteries –considered as HW by legislation- were prohibitly high. Profitability of collection and recycling programs can, very easily, be disrupted by policy decisions to classify them as HWs, a classification that causes the waste materials to be subject to compliance to many additional legal provisions for identification, storage, transportation, emergency response, financial environmental liability, trans-boundary movement (OECD shipping requirements for notification and tracking forms) for recycling and final disposal, to mention some of the more important ones. Motorola's pilot program, initiated in 1998, was successful at collecting used NI-Cd batteries from telecommunications equipment - cellular phones and two-way communication radios- by offering a discount on the purchase price of new replacement batteries as an incentive to customers that returned used batteries to the company for recycling. In six months Motorola was able to collect 2.5 MT of spent batteries (10,000 batteries.)[82] [83]. But because no facilities existed in the country, capable of processing the collected batteries for recycling of the constituent metals, the collected batteries had to be sent abroad for recycling at INMETCO, the metal recycling facility located in Pennsylvania, U.S. At the end, the operation costs and paper work made the overall pilot program come into halt until new economic incentives are developed and introduced by Mexican authorities.

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[82] G. Pistoia, et al. Elsevier (2001), Ibid

[83] CENICA-Mexico (2001), Ibid.

World collection programs:

The main driving force behind batteries collection and recycling efforts has been to divert the flow of high density metals from getting into landfills and incinerators (public health) and recover all the valuable materials contained in those systems. Heavy metals such as lead, chromium, nickel and cadmium from used computers and mercury, cadmium and lead from spent batteries. Public concern over this waste stream is more related to the high content of toxic metals that might find their way to the environment through the disposal of used electronic products and spent batteries in open dumps or landfills, and ultimately may be subject to thermal processes.

But how can we design and implement a successful used batteries and computers collection and recycle program within the aforementioned context? A strategy to do so is proposed in the following chapters; first by looking at other countries experiences and secondly by identifying those core program elements that are required to succeed and thirdly by identifying the players and the structure required for such enterprise.

Program Design for the Collection and Recycling of Used Computers and Spent Batteries in Mexico:

Producer Responsibility (PR) requires producers to be financially or physically responsible for their products at their end-of-life. They can assume such responsibility by either take back spent / obsolete products and manage them through reuse, recycling or remanufacturing, or they can delegate this responsibility to a third party which is paid by the producer for spent / obsolete product management. The main objective of such policy is to create enough incentives for producers to return to the designing stage of their manufacturing process and redesign less material–intensive and recyclability-improved products, internalizing the social impacts of their life-cycle in their final consumer price. PR has not been applied equally in every country, and some countries like the United States, consider law-mandated PR programs to be too costly and have developed voluntary programs instead, programs in which the responsibility is not only assign to the producer as described above, but also to the final user or consumer of a product, creating an extended and shared responsibility between the producers, and final consumers (Extended Producer Responsibility, EPR). Nevertheless it is important to clarify that even when the EPR is a voluntary approach, the states have taken measures to ensure that E-waste materials are economically feasible to be collected and recycled, in the case of Massachusetts, a two step mechanism was applied to handle Cathode Ray Tubes (CRTs); first by the state exempted intact CRTs from HW handling laws and second, by adding the CRTs to the states' disposal site ban. The disposal ban obliges the reuse, de-manufacture, or recycle of CRTs and their exemption as HWs, works as an incentive by allowing the process of recovery, reuse and recycle to be economically feasible. Other states, such as Connecticut, Florida, Minnesota and Wisconsin, are considering a similar approach to handle CRTs. North Carolina and California are taking legislation into consideration to force the implementation of Product Take Back programs.

The New Jersey Department of Environmental Protection (NJDEP) adopted an amendment to the Universal Waste Rule in which consumer electronics were included as a universal waste. The adopted amendment is effective since December 2002. Under this scheme, companies that are strictly refurbishing electronics for resale or donation do not need an approval from NJDEP to operate, unless they store any unusable electronics, in which case they would be regulated as a Universal Waste Handler. Batteries were included in the Universal Waste Rule by the NJDEP on December 1996, thus allowing the collection and transportation to be done as a Universal Waste and not as a HW, which could be considered as an incentive to the collection and recycling of E-waste[84].

Under the EPR scheme proposed by U.S., the producer still has the responsibility to collect and environmentally dispose of the spent / obsolete products at their end-of-life and therefore, the incentives to redesign their products remains. But despite some successful cases, whether an EPR policy, in comparison to PR policies, is better in the grounds of environmentally and economically effectiveness remains a controversial question.

Classification of E-waste is a core decision to determine which approach -PR or EPR- is used for the collection and recycling process in a specific country context. It will work as an incentive –or disincentive- for the sitting and development of recycling infrastructure in the country. Mexico has chosen a mixed policy between the European scheme of PR implementation enforced through legislation and the U.S. EPR approach by suggesting[85] the extension of the responsibility to entities participating in the distribution chain and consumers, but has also made a questionable decision when classifying NI-Cd and mercury- containing batteries, and any mercury, cadmium or

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[84] Information was accessed online through the Department of Environmental Protection of New Jersey web page, on April 16, 2004. www.nj.gov/dep/dshw/lrm/index.htm

[85] Art. 35 of the General Law for the Prevention and Integrated Waste Management (GLPIWM) published in the Federal Register (DOF), October, Wednesday 8 of 2003, specifies the government's responsibility to achieve public participation in the design and implementation of integrated waste management policies and programs but the main responsibility for the implementation of collection and recycle programs remains on the side of OEMs.

Lead-containing devices as HWs. An exemption directed at these waste materials or an amendment to the Waste Law is recommended for the successful implementation of collection and recycling programs in Mexico.

The use of individual or industry-wide collection schemes is also a matter of decision which can determine the success or failure of any collection programs in Mexico.

Unless there is a market sector with very few market players, or in which a monopoly arrangement exists, individual waste management systems under the control of many different producers become too expensive as they lose the benefits that economies of scale can generate. Synergies between the many different companies to implement reverse distribution channels logistics and treatment facilities are also lost, making the EPR policy less efficient in environmental and economical terms. An integrated approach is therefore seen as the best alternative for developing countries to follow. Industrial and commercial sectors will not be interested in participating in any effort that would put their competitive edge at stake; political resistance generated could be strong enough to stagnate any effort to implement EPR policies that impact competitiveness in the global scale.

Integrated waste management of electronic waste has proven to be a very difficult task, not only in developing countries where infrastructure (legal and operational) is clearly not as strong as in developed countries; but even in this strong economies, the problems to properly implement and maintain collection and recycle programs have deserved huge efforts and still some cases have failed to successfully complete the task. A common first step, for all programs, has been the introduction of legislation in the many different stages of the products' life cycles, beginning by their basic design, and continuing to the manufacture, package, labeling, commercialization, distribution, sale, and, at the backend of the cycle, their collection, treatment, recycle and final disposal. This initial step is critical to achieve a successful national effort to deal with such waste stream, as this legislation will be responsible to delineate the basic skeleton of the collection and recycling programs that will be designed to comply with such legislation and in many cases will be core to their success[86]. Within the designed legislations, responsibilities for collection of obsolete equipment or spent battery systems are differently assigned depending on the country's social, political, economical and environmental characteristics. Based on those dimensions, in Mexico, the responsibility for the collection of obsolete equipment and spent batteries relies on the manufacturers (OEMs), but the specifics as how are the OEMs to collect and recycle the obsolete equipment or batteries are not defined by the law. This is, the means and economics of the operation are to be defined by the OEMs and they are to build the required infrastructure to do so within the following twenty four months (by January 2006). In Mexico, the creation of such infrastructure requires a vast amount of logistics and, once again, a huge investment[87]; which if the global competitiveness of the Mexican electric and electronic sectors is not to be impacted, the need to approach the creation of such

[86] As I have stated previously, if EEE, as well as NI-Cd battery systems and battery systems containing mercury, are classified by the Mexican legislation as HWs, the sole investment required in order to operate the collection and recycling programs within compliance of the HW regulations is prohibitly high for most recycling organization created or that will be created for this purpose.

[87] Despite PR's growing popularity in the EU, its environmental effectiveness and economic efficiency are contested. As they are relatively new, there are few available data about most PR programs. Germany, through its packaging ordinance, has had the longest experiences with PR. The effects of the ordinance are well documented and achievements can be assessed. Since the introduction of the Duales System Deutschland (DSD) in 1991, 30 million MT of packaging wastes have been recovered, amounting in 1998 alone to about 5.6 million MT. Between 1991 and 1998, per capita consumption of packaging was reduced 13.4 %, from 94.7 kg. to 82 kg. Significant costs have been incurred in order to obtain such results; in 1998, DSD spent $2.02 billion for waste management or $360.8 per MT of packaging waste. "Is Extended Producer Responsibility Effective?" Carola Hanisch, American Chemical Society (2000) April 1 2000?Vol34,Issue7/pp.170 A – 175 A

infrastructure in a collective basis is reinforced. Additionally, the high degree of integration of the electric and electronic products –many different brand devices or subassemblies used to assemble an EEE- causes every company that manufactures mercury, cadmium or lead-containing products (subassemblies included) to comply with the legal requirement of implementing the necessary measures to take back WEEE and dispose of it in an environmentally sound manner. This situation drives the electric and electronic sector to approach legal compliance through the design, implementation and maintenance of a collection and recycle program that requires the cooperative efforts of the whole industry sector (including from raw materials vendors, OEMs, retailers and the key participation of the final consumer). Any effort to perform on an individual grounds will most probably, be destined to financial failure; unless again, that a sole player has an outstanding share of the market. Compliance to waste legislation under these market conditions can only be achieved cost effectively by individual means. But specific case of OEM's Vendors are of special interest because of the intrinsic OEM's reliance on their vendors' infrastructure, the need to build their capacity to operate within legislative compliance is crucial for OEM's operation and liability. In many cases vendors' infrastructure will also have the requirement to comply with the waste legislation. This situation will push OEMs to seek a sector solution over an individual one. In addition, within the Mexican context, the intensive competition that exists on the electric and electronic manufacturing market to lure OEM's investment into the country has been intensified in recent years, due to Asian economies development. Decisions on the sitting of new manufacturing sites, and decisions on whether a specific product or subassembly will be manufactured -or not- in a certain facility, are made based on manufacturing and distribution costs of the different company's manufacturing sites. The need to deplete, to its maximum, the cost of compliance to environmental legislations is thus considered essential to the development of the Mexican electric and electronic industry[88]. The aforementioned reasons support a collective approach to collection and recycle initiatives for the spent batteries and obsolete computers in Mexico.

What has generally been the experience and approach of such collective efforts around the world?

World joint battery collection programs:

Such collective efforts, especially for spent batteries, have been preferred in many countries, some of them only after individual implementation efforts failed. The case of spent batteries is worthy of special consideration. The following factors affect collection rates:

1. Willingness by the consumer to introduce spent batteries –due to the lack of information from producers and scarcity of incentives to the consumer- into the MSW.
2. Batteries in the market are found in diverse chemistries and made also by a number of producers, making segregation by the consumer difficult at collection points.
3. 95% of secondary batteries are placed into the market via its inclusion on EEE, these are the only ones made of materials that are cost effective to recover and

[88] An industry that has already been affected by the lower labor cost and the existing "environmental dumping" that exist in Asian trade markets due to the lax environmental health and safety regulations and lack of monitoring and compliance enforcement.

recycle, and thus general collection programs that incorporate EEE as well as primary battery systems are needed.

In the world, there are some examples that have been successful at addressing these issues[89]:

United Kingdom: In 1996, a group of cellular cell manufacturers organized a two year pilot collection program to collect end-of-life cellular phones and their batteries in the UK and Sweden. The effort operated under the auspices of the European Trade Organization for the Telecommunications and Professional Electronics Industry (ECTEL), in conjunction with British Telecom outlets. Reverse distribution channels were designed using retail or distribution outlets and the use of a reverse distribution company. At the end, in September 1996, new special waste regulations took effect with respect to used NI-Cd batteries which from that point on had to be managed as HWs. Reverse distribution channels were destroyed as no retail outlet wanted to participate because of the costs and administrative burden they had to go through.

Sweden: ECTEL participants also established a two year pilot program in Sweden. The difference was that in this case batteries were collected through five major retail chains and, notwithstanding the cadmium content of NI-Cd batteries, end of life electronic products were not considered HWs. Therefore batteries could be transported from the collection points to consolidation points via common carriers. Additionally, as Sweden has its own recycling facility, no transboundary movements –regulated by OECD- were needed.

[89] Sources: G. Pistoia, et al. (2001), Ibid and U.S. EPA Product Stewardship web page accessed on April 08, 2004, www.epa.gov/epr/products/eindust.html

Australia: Federal regulations prohibit the disposal of Ni-Cd batteries in landfills but no collection programs are mandated. The Australian Mobile Telecommunications Association (AMTA) completed a 6 month pilot program to collect Ni-Cd Batteries. The effort involved 140 retail stores in South Wales. Over 100,000 batteries were collected of the different types of chemistries. As in Sweden, the collected batteries were sent to a local recycling facility. The pilot was funded by a $0.1017 per NI-Cd battery sold fee, which in turn was used to fund all types of batteries collected and today it is being expanded nation wide with the participation of 600 stores.

There are few collective collection programs design specifically for computers, in this case –the one of spent computers- collection programs that exist are either managed by the OEM through the use of recycling companies or are collected along with other waste electric and electronic equipments (WEEE) through programs implemented by Producer Responsibility Organizations (PROs) created by OEMs in coordination with recyclers or other Electric and Electronic Equipment Original Manufacturers (EEEOM); here are some examples[90]:

Best Buy was the first electronics retailer in the U.S. to offer recycling collection services to consumers. During the first phase of its electronics recycling program, in the summer and fall of 2001, Best buy held two-day collection events at ten sites in seven states of the Country. Best Buy accepted old electronics equipment from consumers free of charge and in some specific cases for a small fee, depending on the item, Participating stores collected more than 113.4 MT of equipment and nearly 3,000 people took advantage of the events.

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[90] www.epa.gov/epr/products/eindust.html

Compaq, in a collective effort with a Midwest electronics recycling firm launched the United Recycling Industries' (URI's) Electronics Take Back Program, offering customers a 6 to 9% discount on Compaq products if consumers return used electronics equipment. URI provides shipping boxes and labels, while customers pay URI $27.99 to process up to 32 Kg of returned computers, monitors and peripherals.

Dell Computer Corp. is holding a 15 city recycling tour in 2003, permitting consumers to donate or recycle unwanted computer equipment free of charge. Dell's collection event in Denver, Co. set a national record for tonnage collected at a 1 day event as more than 2,000 people dropped 200 MT of unwanted equipment for conation or recycling.

Dell has also developed an online system through which provides consumers with three options for dealing with end-of-life computers: 1) pay Dell $15 to pick up end-of-life equipment from consumers homes for shipping and recycling. 2) Donate the equipment through a non-profit organization that provides equipment and training to people with disabilities, students at risk and economically disadvantage persons, or 3) auction through www.dellauction.com. The program accepts non-Dell computers as well.

Gateway offers customers a $50 rebate after they purchase a new Gateway computer and then donate or recycle their old system. Customers are responsible for finding a recycler or receiving organization for their computer, after which they submit the confirmation to Gateway to receive the rebate.

Hewlett Packard takes back computer hardware from any manufacturer. The cost of its service ranges from $13 to $34 per item depending on the type and quantity of hardware to be returned. HP is in partnership with Noranda, Inc.

International Business Machines (IBM) recycles any manufacturers' end-of-life computers, including peripherals, for a $30 fee. The consumer receives a prepaid mailing label and ships the end-of-life equipment via UPS to Envirocyle, an electronics recycler in Pennsylvania. Donation is also available, depending on the end-of-life computers characteristics, through Gifts In Kind International, in which case the donor receives a receipt to be used for tax deduction purposes.

Staples is developing initiatives to encourage consumers to recycle their old computers. In 2002, Staples stores across the U.S. accepted old computers during a two-day trade in event. Customers exchanged CPUs, Monitors, Keyboards and other peripherals for store credit. "Gifts in Kind International" was in charge of refurbishment, donation and recycling.

In *Mexico*, some examples of collective collection programs have been negotiated between producer associations and governmental authorities (as voluntary) to collect and recycle waste materials from the MSW stream[91]. Activities under this type of agreement have already started in larger metropolitan areas such as Mexico City, Monterrey, Guadalajara, Cancun, Veracruz and San Luis Potosi[92]. This is an example of the required mechanisms needed to achieve same type of agreements in the WEEE context where the HW condition of these wastes needs to be negotiated.

[91] Polyethylene terephthalate (PET) bottles, based on the principle of shared responsibility. The agreement is aimed at integrated municipal waste management and encourages the recycling industry to invest $87 million between 2003 and 2006. The target is to recover and recycle 2,610 million PET bottles annually by 2006.

[92] Environmental Performance Review – Mexico, OECD (2003).

Lessons learned:

First of all, for both products being assessed in the present work – end-of-life computers and spent battery systems-, general collection schemes serve better than those designed to collect only one type of product. Increasing collection rates are obtained if general collection systems are implemented. It is also true that collaborative participation between government and industry associations have proved to have positive results. CANIETI counterparts from Australia and Sweden, for example have lead to successful industry-government relationships.

It is clear that implementation of effective and cost-effective collection programs relies heavily on the regulatory requirements for the materials that are desirable for recovery and recycling. With this in mind we should learn from the European experiences and adjust our regulatory system to promote recycling of mercury, cadmium and lead by its categorization as non-regulated special wastes. To do otherwise is a disincentive for retailers' participation and barrier to use carriers as a way to efficiently transport collected WEEE and Battery systems.

There are many different mechanisms that are being used worldwide to collect desirable materials, all of which can be implemented in different regions of the country. Its design and implementation, as it will be referred in Chapter 6 will have to reflect the countries intrinsic differences, not only of income levels, but in infrastructure and cultural background of its populations.

It has been learned that different collection schemes could be used in same communities in order to create easy access to the collection system. Reverse distribution logistics serves this purpose very well. OEMs have already design their distribution logistics in order to reach the populations that will consume their products, the same way these distribution system logistics can work backwards to collect these spent products.

Governmental entities have played key roles in the aforementioned enterprises, not only as a regulator but as a facilitator. Building local capacity not only benefits the municipalities, but supports governmental efforts to change deeply rooted behaviors.

As Mexico does not have recycling facilities, collection programs need to consider the OECD transboundary movement regulations and guidelines. Negotiations should follow in order to ensure reduced costs at the recycling stage. It is already known that the transportation costs to facilities abroad will be high.

6. Proposal for Program Implementation in Mexico:

The main objective of any collection and recycling program is to reduce population's exposure to hazardous materials that can cause an impact to their health and to the environment. Taking into consideration that past international experiences have failed to conduct successful dedicated collection programs for specific battery systems, such as Ni-Cd; acknowledging that Ni-Cd battery systems, which are regulated by Mexican legislation as hazardous, represent only 20% of the total amount of batteries in the market, and that of this amount, 95% is sold incorporated in EEE (computers included) and only a minor fraction (<5%) is sold individually as replacement batteries; and finally, knowing that this (<5%) fraction of the market is the most attractive for recycling because of its cadmium content, **The Objective** of the present proposal is to avoid public exposure to WEEE's hazardous materials that can be introduced into the environment through the MSW stream. Special attention should be given to waste volume and toxicity reduction of end-of-life computers and battery-containing EEE.

MSW is to be understood as that generated by households, commercial businesses and private and governmental offices.

Scope: Even when the new Mexican General Law for the Prevention and Integrated Waste Management classifies mercury, cadmium and lead containing-equipment, and spent battery systems containing mercury and Ni-Cd, as HWs, and in order to achieve high collection rates in spite of existing hoarding practices within society, WEEE is contemplated within the scope of this collection program in addition to individual spent battery systems and end-of-life computers.

In the geographical context, and in order to have a normative coherence between the different collection efforts to be implemented at state level and avoid concentration of collection and recycling activities within a few states, the program should have national scope.

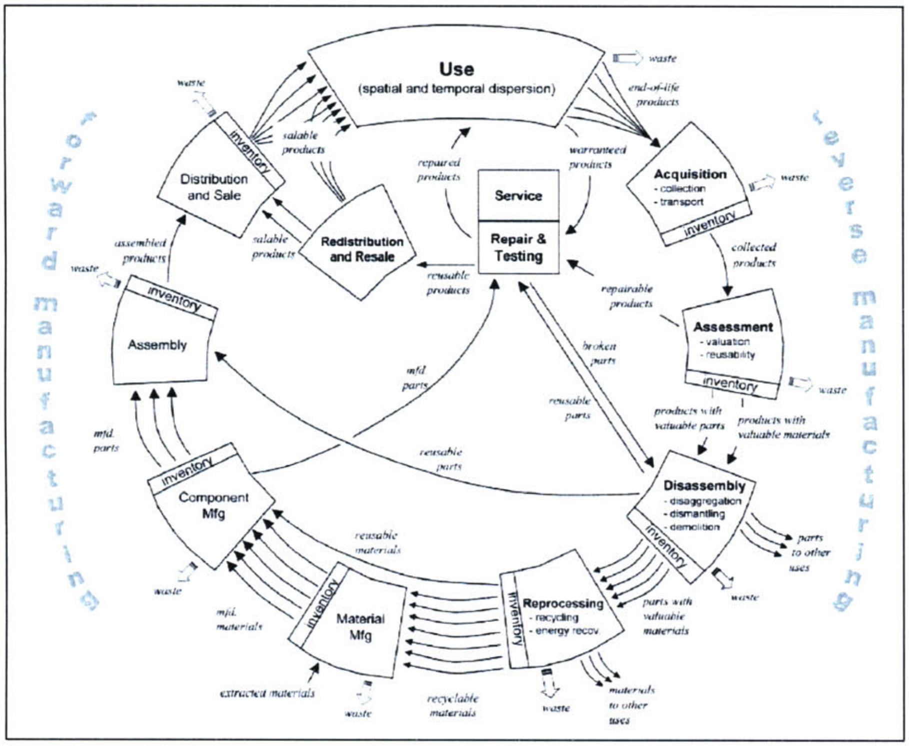
Collection schemes:

Collection and recycling operations under the present proposal are conceptualized within Reverse Manufacturing (RM). The term RM is used to refer to activities designed to reuse, recover, refurbish, remanufacture, demanufacture, or recycle durable product assets at the end of a product life-cycle. RM is considered to be complementary to forward manufacturing, which describes the activities traditionally used to bring a product to market. Thus RM is a multi-stage process that is often used as a concept to close the loop of forward manufacturing of EEE and battery systems production. Generic stages incorporated in forward manufacturing are shown along the left side of the circular diagram shown in Figure 10: material manufacturing, component manufacturing, product assembly, distribution and sale. On the other side, reverse manufacturing stages include: Acquisition (collection and transportation from consumers drop off stations to transfer stations), Assessment (characteristic determination of WEEE and spent battery systems), Demanufacturing or Remanufacturing[93] (determined by assessment results on case by case basis), In the case of Demanufacturing,

[93] Remanufacturing is a recovery strategy that focuses on refurbishing WEEE or reconditioning WEEE's components to rebuild products in their original design. Demanufacturing, as a different and complementary strategy, focuses on reclamation of product assets as a way to avoid WEEE disposal in landfills or incineration facilities. Assets are recovered and reused wherever possible without the explicit intention of rebuilding products in their original design, but to resale individual components or recover the valued materials embedded in them. Charles David White, et al. (2003), Ibid.

disassembly and reprocessing stages are included. In the case of Remanufacturing, two additional stages are needed, Repair and Testing, and Redistribution and / or Resale. These two additional stages may be confluent with forward distribution and sale[94].

Figure 10 Forward and reverse manufacturing diagram for WEEE



Source: Charles David White, et al. (2003)[95]

Collection and recycling schemes, proposed on the present work, will be supported by these basic concepts of RM and will be aimed to the collection and recycling of spent computers and primary and secondary battery systems. In order to have increased

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[94] Charles David White, et al. (2003), Ibid.

[95] Product recovery with some byte: an overview of management challenges and environmental consequences in reverse manufacturing for the computer industry, Journal of Cleaner Production 11 (2003) 445–458.

collection rates, WEEE will also be collected through the program to recover spent batteries that are sold with EEE.

In general, three distinct modes of collection and transportation have emerged in RM: curbside pick-up by municipal governments, customer drop-off stations and producer or reverse manufacturer retrieval. No universally dominant paradigm has emerged and the tendency toward each appears to depend on the assignment of responsibility for end-of-life disposition to the government, the consumer of the producer[96]. The responsibility assignment in Mexico has been done through the publication of the General Law for the Prevention and Integrated Waste Management. The law specifically assigns responsibility for product take back and final disposal of mercury, lead and cadmium-containing WEEE and spent battery systems with mercury and nickel-cadmium chemistries to the OEM. But responsibility to collect and dispose of MSW (mixed with E-waste) has also been allocated on the municipalities by the constitution[97]. Therefore, the proposed collection and transportation modes for the present proposal will be done through the use of reverse distribution chains used by OEMs, and courier services and transportation haulers, depending on the type of scheme being used and municipalities' basic characteristics and demographics. Acknowledging that municipalities are the responsible entity for the collection and final disposal of E-waste-containing MSW, any collection mechanism to segregate E-waste from MSW will have to be conducted in collaboration with local authorities. The need to negotiate a cooperation agreement

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[96] Charles David White, et al. (2003) Ibid.

[97] The United Mexican States' Political Constitution Art. 115 (III) (c). Accessed through the World Wide Web: www.cddhcu.gob.mx on April 22, 2004.

between EEE industrial sector and the three levels of government –federal, state and municipal- is essential.[98]

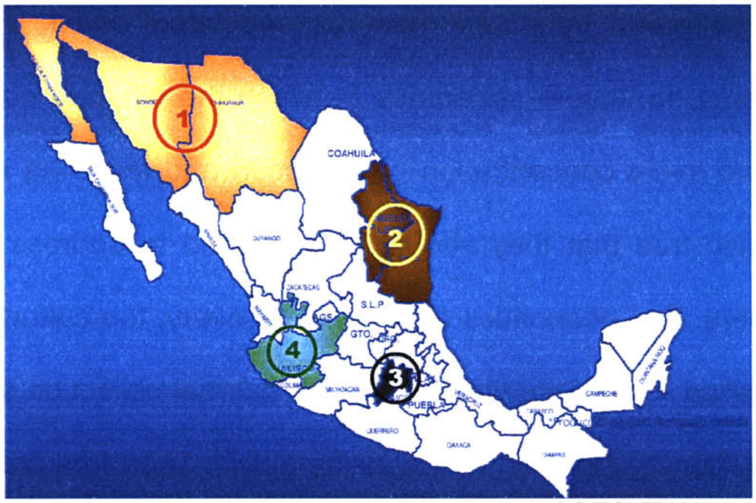
Recognizing that collection schemes must be regulated under a single body of legislative instruments -to ensure coherence between the different collection efforts to be implemented and avoid concentration of collection and recycling activities within a few states-, it is also true that they should be designed to address a highly diverse number of consumers. The economics of material recovery, the cultural attitudes of the population being asked to recycle, the logistics of material collection and the efficiency of various transportation options can vary considerably[99]. Therefore enhancement of the particular collection schemes to be applied in the 2451 localities of the country should take into consideration cultural and economic realities of the marketplace. Public participation is the primary tool to comply with such locality-specific adaptation of the overall program.

The detailed design, planning, monitoring and coordination operations to the initial and continual operation of the collection program, for the purposes of this proposal, are to be executed by the National Electronics, Telecommunications, and Data Processing Industries Chamber (CANIETI) through a Producer's Responsibility Organization (PRO). There are several reasons supporting this decision; the first being that CANIETI is the amalgamating body of the electric and electronic national industry.

[98] It is acknowledged that most of the products that will be entering the RM system will be originated from commercial contracts or from the OEM operations, including leased goods, defective product, excess inventory, production rejects or scrap, in-house equipment upgrades and market protection strategies to avoid black market sales of their product.

[99] "Environmentally Sound Recycling of Nickel cadmium Batteries" Portable Rechargeable Battery Association. G. Pistoia, et al. 2001, Ibid.

Figure 11: Electronic industry major production centers, 1 northwest (Baja California, Sonora & Chihuahua) 2 (Nuevo Leon & Tamaulipas), 3 (Mexico City), 4 (Jalisco).



Source: Diagnostico de la Industria Electronica, COECYTJAL, 2003

According to its stated Mission, Vision, Objectives and Purposes of operation CANIETI is to ensure the joint responsible and competitive development of its associates and it is required to do so under a socially responsible context; it has national presence with operations in Monterrey (NL), Ciudad Juarez (Ch), Tijuana (BC), Guadalajara (Jal) and Mexico (FD), all of them considered core regions for the electric and electronic manufacturing operations in the country (See Figure 11). CANIETI gathers main OEMs operating in Mexico as associates[100] fortifying the operating network among all OEMs and providing an important opportunity to use reverse distribution channels and reverse manufacturing as collection and recycling schemes. In addition CANIETI's stated Mission[101], Vision, Objectives and Purposes are aligned with the objectives and

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[100] International Business Machines (IBM de Mexico), Hewlett Packard (Hp de Mexico), Kodak de Mexico, Arrow Electronics, Jabil Circuit, Sanmina SCI, Siemens VDO, Konica Minolta Business Solutions de Mexico, Lucent Technologies de Mexico, Avaya Communications de Mexico, Motorola de Mexico, Sony de Mexico, Daewoo Electronics Corporation, and Hitachi de Mexico. The list is intended to provide a view of some OEMs that are actually associates of CANIETI and is obviously not conclusive. CANIETI web page: www.canieti.net/home/ accessed on April 18, 2004.

[101] CANIETI's Mission: Achieve competitive development of the national industry with unified sense of solidarity and social responsibility.

purposes of the present proposed scheme, as it is assumed that it is of its associate's interest to comply with the legislative statutes governing its operations.

At the program's planning and design stages, the designer of the program needs to consider, the use of Pareto's Principle, to dedicate the most of its efforts to 20% of those localities that will provide 80% of the collection rate. According to the information provided in the Health related Costs estimates of section of Chapter 4 and Figure 12, which provide information on Mexico's Well Being Index (WBI), we can focus the attention of the collection efforts to that 5% of the municipalities (122 municipalities) that represent 80% of WEEE to be collected. In the current proposal collection programs designs should be able to address these differences found in populations' income levels. High WBI implies a better quality of life, including the usage of electricity in its various forms (Alternate current and battery driven devices).

With the aforementioned in mind, and taking into consideration municipality's specific necessities and the localities population specific characteristics, five RM schemes are proposed for either spent batteries or end-of-use computers and WEEE:

One to One, Introduction levies / tax, Municipalities Collection Days, Retailers Collection Days, and Internet supported collection

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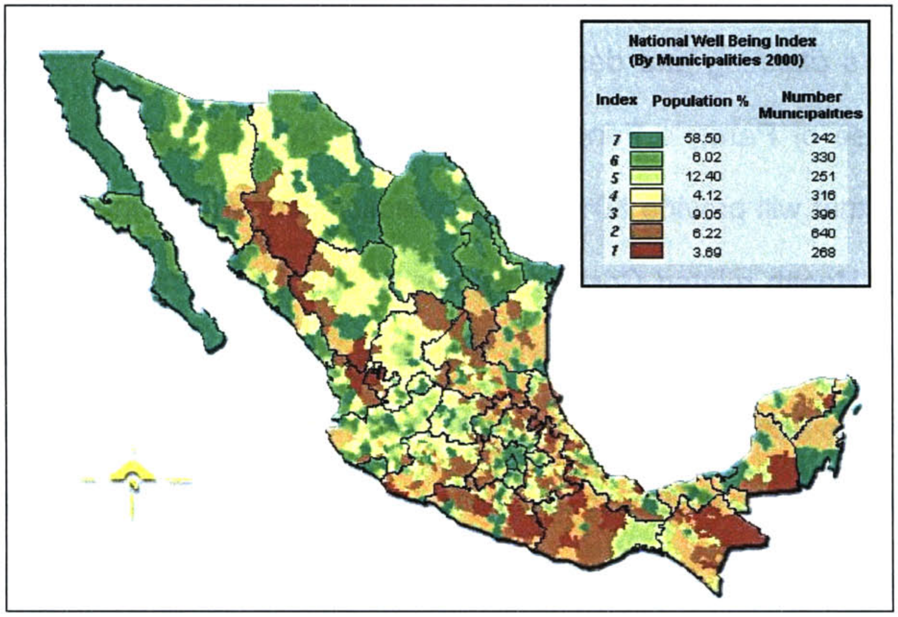
Vision: To be the utmost representative body for the electronic, telecommunication and data processing sectors, that promotes joint responsible development in a global environment, and providing high quality services.
Objective: Give global presence to CANIETI and to its associates in institutional form, by means of the production and distribution of an annual directory that includes its associate's commercial information, its products and the services that the chamber provides.
Promote business development for the associates by introducing the companies and its products in a worldwide scale.
Purposes:
Represent and defend affiliates' interests.
Seek its economic development.
Provide affiliates with services orientated to comply with the aforementioned purposes.
CANIETI web page: www.canieti.net/home/ accessed on April 18, 2004.

Figure 12. Well being National Index



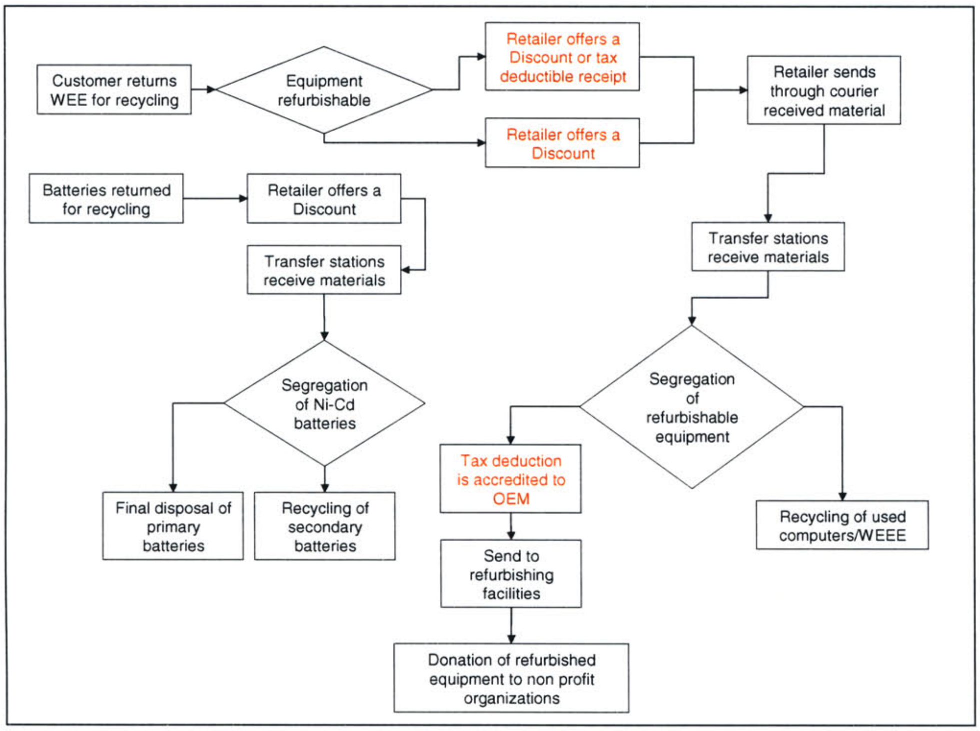
Source: INEGI web page: www.inegi.gob.mx

One to One: it's a scheme similar to those used for automotive batteries' collection programs, where the customers, who return spent batteries for recycling, are given a discount on the purchase price of the new replacement batteries. Players involved in this scheme are; PRO, the customers, the retailers, transportation couriers -assuming that de-regulation has occurred or an exemption has been given by environmental authorities-, transfer stations, large scale haulers and finally the recycling facilities. Also Government officers from the three levels of government are involved.

Due to the fact that Mexico still does not have a batteries recycling facility, collected batteries should be exported to a final destination outside Mexico (INMETCO facility in Pennsylvania is considered the most feasible option due to its proximity to Mexico).

PRO is entitled with the management of the over all collection and recycling program independently of the different schemes being used.

Figure 13. One To One Scheme flowchart diagram



In this specific case, PRO support is specially required for the financial record keeping, communication with communities and general monitoring of the One to One scheme's efficiency.

Mechanics on the Battery collection and recycling in the context of One-to-One scheme are driven by offering, in the acquisition stage, a discount on the purchase price of new replacement batteries as an incentive to customers that return used batteries to retailers for recycling. The scheme has been used successfully in a pilot program executed in Mexico by Motorola. The results and barriers for commercial implementation are described in Chapter 4 of this document.

In the case of the acquisition of computers and WEEE, the mechanics of the collection scheme are basically the same as those used for the collection of spent batteries, but an additional step needs to be included. A segregation step in which computer characteristics are to be assessed and, depending on the result, its final destination is defined. If the collected end-of-use computer has characteristics that would make it feasible to refurbish it and donate it (Initially Pentium PC type and higher are the ones being donated in other experiences worldwide), then the retailer extends either a tax deductible receipt or a discount on the purchase of a new equipment, to the consumer, The consumer has the right to decide either to receive a tax deductible receipt or a discount on the customer's next buy. The decision will be made by the customer, at the moment of transaction; if the end-of-use EEE is too obsolete and the remanufacturing option is not longer attractive, then the customer receives a discount on the purchase of new equipment, being this, its only incentive alternative.

Under the one to one scheme, capacity building would take the form of educational programs focused to final users and customers. Priority should be assign adequately to this effort if high collection rates are pursued, Mexico's general population's educational levels are low[102] and specific guidance as to how the program is intended to operate, its objectives, goals an targets, need to effectively communicated to the general population in diverse and custom-specific ways. Compliance of program objectives will be diminished proportionally with less efficient communication programs. Diffusion of the basic operating characteristics is essential. It would be done by massive communication campaigns funded by OEMs. It could be also expected that government, through the

[102] Average years of schooling in Mexico is 7.5 years. Source INEGI, www.inegi.gob.mx

environmental ministry's Sustainable Development Training and Educational Office[103] (CECADESU), be a part of this effort. On the other hand, capacity building and training of retailers should be performed to learn the specifics of segregation for the different incoming materials. Aside from these two areas, no additional capacity building is foreseen during the implementations and maintenance of the One to One scheme.

Levies / Taxes: Introduction of levies is expected to be used by OEMs to fund the overall collection program. This scheme is thought to be more democratic because the price internalizes the product's specific environmental impacts -includes a charge for the collection and recycling activities needed to adequately treat and dispose, recycle or reuse E-waste- and thus whoever purchases the product, will proportionally bare the cost of final disposal processes. It is through this mechanism that the final user or consumer takes on his shared responsibility for the quality of its decision making process and its consequences on the environment The creation of a multidisciplinary body (MB) within the CANIETI's PRO will be required to determine the magnitude of such levy to be applied to the product. Basic considerations to determine it include all the environmental impacts associated with every stage of the product's life cycle. In order to determine those environmental pressures, an assessment is required to be performed and subsequently published to the public. The costs associated with the assessment are to be borne by the OEM; and its methodology should is to be standardized and negotiated among CANIETI's associates and the environmental authorities. Public participation will be used as a guiding tool to tailor the program specific needs of local communities.

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[103] http://cecadesu.semarnat.gob.mx/

The case of the tax implementation scheme is not too different, the multidisciplinary body needed to design the tax scheme must incorporate a member from the Finance and Public Credit Ministry (SHCP), in order to provide guidance on governmental procedures regarding to tax ruling and application of national tax schemes. This measure will create the necessary incentives for the OEMs to design environmentally friendly EEE and Batteries as this environmental condition of their product will be reflected in their product's market price. The more the OEM deviates from this environmentally driven objective, the higher the levy that will be attributed and consequently, the market price of the product will have inherent limitations to compete among other products with better environmental proprieties and lower levies attributed to them.

Players involved in the present scheme are; PRO-MB, customers, retailers, transportation couriers, transfer stations, large scale haulers, non-profit organizations, the three levels of Government from the Environmental and Finance Ministries, and last but not least, the final disposal facilities. Like in the case of spent batteries in the One to One scheme, collected spent batteries would have to be sent abroad for recycling (INMETCO facility in Pennsylvania is considered the most feasible option due to its proximity to Mexico).

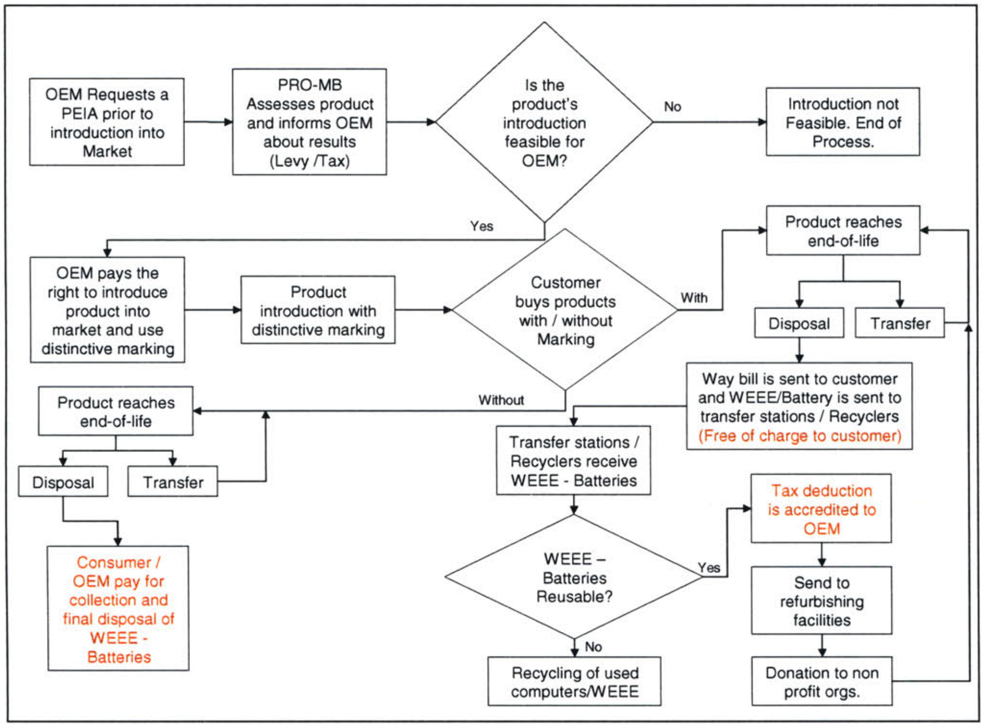
The mechanics of the collection system under the Levy / Tax scheme described in Figure 14 requires any OEM (National or International) that is interested in the introduction of a new EEE, computer or Battery system into the Mexican market), to petition PRO for the Environmental Impact Assessment of its product (PEIA) as an initial step to the estimation of the corresponding levy or tax to be attributed to the OEM's new product. For the purposes of the present scheme, the levy option is preferred in cases where EEE, computers and Batteries will be accessible and primarily sold in the low WBI populations. It is expected that political pressures will stand against any Tax allocation in these municipalities, thus funding for the operation of the collection and recycling of WEEE and spent batteries in these localities should be done by both, the municipality –who has shared responsibility for the collection- and the OEM.

The main differentiation between the different conditions under which a levy scheme is preferable over the tax scheme are; the state's infrastructure to treat the E-waste generated from the use of specific EEE, Computers and Batteries; EEE, Computers and Batteries' specific environmental impacts; and the state's WBI condition. The use of a tax scheme will be used in order to create enough disincentives to consumption-oriented markets of high WBI populations and consequently the development of extended-life-cycle design and environmentally friendly manufacture of EEE, Computers and batteries.

Once the MB has determined the levy's magnitude, the OEM must pay, in advanced, the amount equivalent to the number of products that it is expected to be introducing into the Mexican market. Emphasis is made on advanced payment because the money is required to fund the collection and recycling activities, especially at the introductory stages of the program. A balance for each OEM will be performed on annual basis, in order to determine how much OEM's funds are required for next year's operation.

Products participating under this scheme, will obtain a distinctive marking that will differentiate it from the rest of the products offered in the market.

Figure 14. Levy / Tax Scheme flow chart diagram



It gives the customer the opportunity to distinguish and privilege those products that are designed and manufactured with environment in mind. It also gives them the freedom of choice and responsibility they will face when the disposal of the product occurs. Products with the distinctive mark are entitled to be safely disposed of in specific collection points in participating municipalities; those without the distinctive marking will have to be collected and recycle by the non-participating OEM using its own means. A disincentive is thus placed to the consumer as she or he will have to also deal with the non participating OEM to dispose of its E-waste. This scheme requires, then, a ban on the final disposal of E-waste through the MSW stream.

Customer incentives are created by the use of a distinctive marking on the product that will allow the user to send the WEEE, end-of-use computers and spent batteries directly to the program's transfer stations / recyclers free of charge, providing easy access and use of the program's infrastructure. Other incentives could be created to allow households or businesses to be subject of tax relieves when computer donations are made.

In the U.S. the 21st Century Classrooms Act for private technology investment encourages large companies to donate computer equipment to public and private schools. When donating equipment to a non-profit organization, companies can apply toward an income tax return[104].

Incentives are also created for OEMs to initially be part of the program and maintaining them in the program. These incentives are created in the form of Tax reductions that are accredited to the OEM, every time a WEEE, end-of-life computer or battery system is sent to refurbishment. The tax deduction is given to OEMs that embrace Design for the Environment (DfE) as a philosophy to extend its products life cycle and they do it in a way that makes upgrading economically feasible

Municipalities / Retailers Collection Events: The proposed scheme is based on one-day events held by either, independent efforts by municipalities and retailers, or in joint efforts between these. Players involved under this scheme are; PRO, customers, retailers, three levels of government[105], large scale haulers[106], transfer stations and recyclers.

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[104] Tax Payers Relief Act of 1997, which provides tax incentives for companies that donate technology equipment to schools.

[105] The Finance and Public Credit Ministry as well as the Environmental and Health Ministries are considered.

The Mechanics of the scheme are straightforward and incorporate the public by allowing them to bring their WEEE, end-of-use computers and spent batteries to a specified location for free disposal. Licensed HW handlers that are contracted to receive, sort, pack and transport the collected E-waste to a transfer station or directly to a recycling facility. It is acknowledge that community participation rates are low in these types of schemes, but we also take into consideration that rates can effectively be increased through the continual implementation of such programs in the community and a continual community communication and education effort. Most of the programs today have developed diffusion material that is used prior and during the execution of the collection events, but they are diluted when the collection event is over. And what is more important, these participation rates can be boosted if tax relief incentives are created. As it was stated before, in the U.S. the 21st Century Classrooms Act for private technology investment encourages large companies to donate computer equipment to public and private schools. When donating equipment to a non-profit organization, companies can apply toward an income tax return[107].

Municipalities' collection days are thought to be more suitable for full implementation in low income and for partially implementation in medium income municipalities (low and medium WBI). Incentives in the form of food aid have proven successful in other recycling programs implemented in Jalisco and are believed to be useful for the

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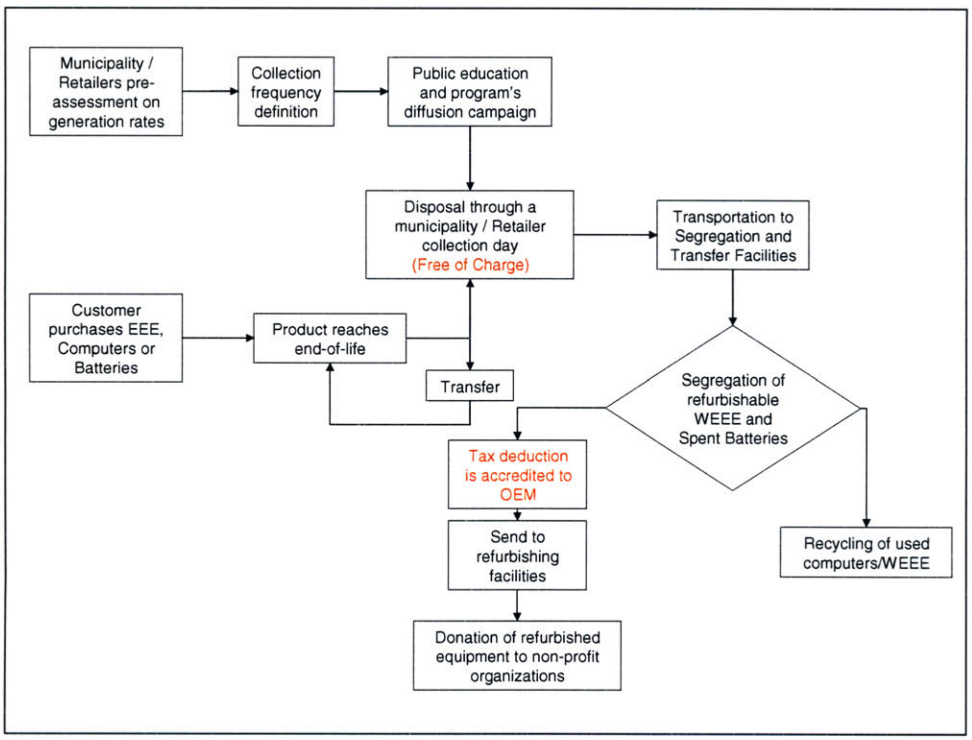
[106] In this specific case, the use of special waste handlers could be contracted as there are companies that provide such service. In the U.S. for instance, Clenaharbors Environmental Services, Inc. provides household HW collection days for individual localities that pay for the service, avoiding the investment on the basic infrastructure that would be needed to perform the operation by themselves.

[107] Tax Payers Relief Act of 1997, which provides tax incentives for companies that donate technology equipment to schools. Incentives used to increase participation in similar schemes applied to used motor oil recycling have included community education, curbside collections, establishment of permanent drop-off centers, and enforcement of motor oil dumping ordinances. "A report on household HW management" Marie Steinwachs, Resource Recycling (1989).

implementation of present scheme. The low and medium income municipalities of Tlaquepaque and Tonala schedule collection days in a monthly basis, people gather to trade segregated materials from MSW (glass bottles, paper, plastics, cardboard etc.) for food coupons accepted in specific government stores. Retailer collection days are thought to be more effective when fully applied in medium and high income municipalities.

Figure 15. Municipality / Retailers Collection Day Scheme



Once the WEEE and Spent Batteries reach transference stations, these are segregated, and those that comply with remanufacturing ability characteristics are sent to refurbish facilities and then subject to donation to non-profit organizations. The remaining WEEE and spent batteries not complying with such remanufacturing characteristics are the sent to demanufacturing and recycle.

This scheme is thought to provide the municipalities with a quick and less expensive way to comply with the new waste statutory requirements. It is considered less expensive. Under outsourcing contracted schemes, municipalities do not have to make the initial investment in collection and transportation infrastructure and personnel. Municipalities would be responsible for paying for the collection costs from the households and their transportation to the transference stations. OEMs will pay for the transportation from this transfer stations to the recycling facilities and will also bared the costs of the recycling operation.

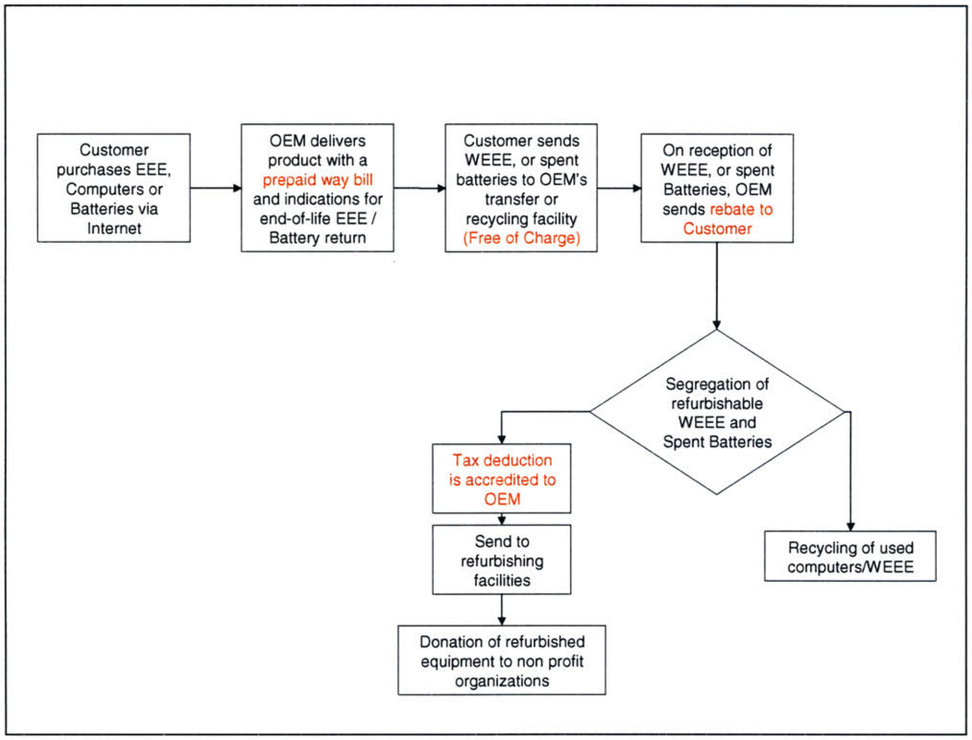
Incentives are also created for OEM in the form of tax reductions that are accredited to the OEM, every time a WEEE, end-of-life computer or battery system is sent to refurbishment. The tax deduction is given to OEMs that embrace Design for the Environment (DfE) as a philosophy to extend its products life cycle and they do it in a way that makes upgrading cost effective.

Internet supported collection: The present collection scheme is proposed to cover for the ever increasing electronic sales of EEE, computers and replacement batteries through the World Wide Web. Recognizing that even when internet usage in Mexico is growing rapidly, the current number of internet users is quite small when compared to other developed nations, such as U.S. Germany and Japan[108]. Efforts to avoid WEEE and spent batteries hoarding effect are needed. The early implementation of the present proposal for the collection of WEEE and spent batteries that are to be generated by the

[108] In 2001, Mexico had 1.3 million Internet users (only 1.3% of the country's population of 97 million), in 2002 it had 3.5 million and was expected to grow to 7.5 million by 2003. "The world Fact Book" Accessed through : www.cia.gov/publications/factbook on April 22, 2004

easy access to web-based retailers is essential to provide a way to comply with current waste legislation of the country.

Figure 16. Internet Purchases Collection Scheme



Its mechanics are also straightforward, every time a customer buys an EEE, computer or battery system through the Internet, the OEM delivers the product along with a prepaid way bill and proper indications for the consumer to send the end-of-life computer, obsolete EEE or spent battery system back to the recycling facilities free of charge. It is expected that the same packaging that is used for product delivery would be reused to make the return. Incentives in the form of rebates are used to encourage customers to send back WEEE, and spent batteries to OEM's transfer stations. As soon as the WEEE and spent batteries are received in transfer stations for assessment and segregation, a rebate is immediately sent to the customer in return.

As in the other collection schemes, tax deduction incentives will also be offered to OEMs in the form of tax reductions that are accredited to the OEM, every time a WEEE, end-of-life computer or battery system is sent to remanufacturing. The tax deduction is given to OEMs that embrace Design for the Environment (DfE) policies to extend its products life cycle and they do it in a way that makes upgrading cost effective.

The Internet collection scheme is aimed for partial implementation in the medium WBI populations and for full implementation in High WBI populations.

Table 20. Collection scheme implementation feasibility vs. WBI

Scheme	Low WBI (1, 2)*	Medium WBI (3,4,& 5)*	High WBI (6 & 7)*
One to One	F	F	-
Levies / Tax	F / -	F / F	F / F
Municipalities Collection Day	F	P	-
Retailers Collection Day	P	F	F
Internet Supported	-	P	F

F: Full Implementation. , P: Partial Implementation.- : No Implementation.
* See Figure 12

Internet collection scheme is aimed for full implementation in high income municipalities and in partial form in those municipalities whose average level on income is medium (WBI of 3, 4 and 5 according to Table 20).

Tradable Recycling credits programs have been cited by different sources and is an emerging alternative that could be analyzed in future works to propose its implementation in the Mexican context. I just briefly describe in general terms how it could operate:

Every manufacturer or importer is required to meet specific recycling rates for its products. The target could be based on weight or by component material type. OEMs could do the recycling themselves, or they could decide to pay recyclers to take on that operation or they could purchase credits from others who have recycled more than their own obligation. Recyclers would be required to keep track of what they recycle and brands. At the end of the year, producers would have to show that they had meet the recycling target or hold enough credits purchased from other OEMs to comply with the target. Within this system, OEMs that have products difficult to recycle could be positioned in competitive disadvantage from those that invest in R&D and Design for the Environment programs[109].

Collection and recycling costs:

Because it is thought to have an imminent importance to our overall review of the economics involved in the Integrated E-waste management in Mexico, in the following lines I will refer to Margaret Walls and her discussion paper published in Resources for the Future on March of 2003, in which she addresses the costs of collection and recycling obtained from different programs in the U.S.

[109] "The Role of Economics in Extended Producer Responsibility: Making Policy Choices and Setting Policy Goals" Margaret Walls. Resources for the Future (2003).

Transporting and processing WEEE is costly. In a 1999 Minnesota program operated by the Minnesota Office of Environmental Assistance, along with OEMs Sony and Panasonic, the Waste Management's Asset Recovery Group and the American Plastics Council, the costs of collecting, transporting, processing and marketing materials from the WEEE collected in the program averaged $448 per MT (this is roughly 34 end-of-life computers with monitor and peripherals) or $13.17 per end-of-life computer. Collection and transport together accounted for approximately 75% of this cost. A U.S. EPA study of electronic collection efforts in five communities found that costs ranged from $200 to $1,000 per MT ($5.9 to $29.5 per end-of-life computer). The Northeast Recycling Council, in a national survey of municipal electronics collection programs in the U.S. in 2001, found that costs averaged $374 per MT across all locations and all types of programs ($11 per end-of-life computer).

Recycling fees paid by communities to electronics recyclers have also been reported. NERC study finds that fees averaged $330 per MT across the communities in their sample. In Massachusetts the government negotiated a fixed price for all communities. Those communities pay $260 per MT or $300 per MT, depending on the volumes and the community pays for the transportation to the processor. Costs may reach up to $900 per MT in special cases like Hennepin county Minnesota. The American Plastics Council reports that the average cost associated with advance methods to recycle plastic materials from E-waste range from $460 to $1040 per MT. California Integrated Waste Management Board sponsored a survey of electronics waste processors in California in which processors were asked their costs for processing end-of-life computers, (CPU and Monitors) and Televisions. The reported costs, not including the transportation costs, ranged from $613 per MT for a CPU to $963 per MT for monitors and as high as $1,488 per MT for televisions (2006 U.S. currency).

As we are able to see, the cost benefit analysis does not look positive in some of the cases illustrated and suggest that the benefits generated by the implementation of collection and recycling mechanisms need to be great in order to cover for such high operational costs. The need to find cost effective mechanisms to address the E-waste burden is reaffirmed and as any other recycling program the final objective of the recycling efforts should always be kept in mind. This is to reduce the volume and toxicity of generated wastes. Design for the Environment is seen as a key element of any collection and recycling effort and it has been integrated in different stages of the above proposed schemes.

7. Difficulties for implementation and Recommendations:

Some of the many difficulties that suggest a joint approach to the collection and recycling of electronic scrap from spent batteries and obsolete personal computers are:

1. Evaluating the exact quantity of obsolete computers or spent batteries available for collection. Many electric and electronic products are kept in homes or in shops at the end of their lifecycle. The owners of such equipment believe that their obsolete equipment may have additional value to them. Indeed, batteries or obsolete computers that are not available for collection do not represent, yet, a threat to the environment as long as they remain under the control of their owner. The tendency to hoard, however, creates difficulty at the design stage of a collection program when the quantity of electronic waste needs to be defined. European governments have been concerned about heavy metals in household waste for many years and have been the most aggressive in setting stringent waste management policies. Other countries like Japan and France have developed and implemented population behavioral assessments to determine, in their national context, the rate and temporal frame of the hoarding effect. In Mexico, similar studies are needed to enable the project managers to design an appropriate E-waste collection and recycling program.
2. Segregating the many different products that can be collected. It has been proven that the more flexible a collection program is, the higher the collection rate that can be achieved. Many different product collection and recycle schemes involving the many different manufacturing sectors must be developed as new legislation in Mexico is implemented. If too many programs are in place, the

population will be confused, especially if many programs are developed within one industrial sector such as the electronics industry. The simpler a collection program is, the better it will work.

3. A highly integrated sector. Today's computers when manufactured, integrate many different subassemblies manufactured by many different companies. The responsibility to collect and recycle electric and electronic products at the end of their lifecycle, for many of the manufacturers of computer subassemblies, can only be meet through a joint collection program.
4. Keeping costs manageable. Costs can become prohibitive for a single OEM trying to run a collection and recycling program. Costs can be reduced through joint efforts in which operational costs are allocated according to market share or the number of electric and/or electronic products introduced.
5. Designing a collection scheme: Three main collection systems were developed in the 1990's to recover rechargeable batteries in the European market: a dedicated collection scheme aimed at a specific type of battery, a general collection scheme for all types of batteries (primary and rechargeable) and the collection of portable electrical and electronic equipment associated with de-manufacturing (in order to recover all valuable components such as batteries). The operation of dedicated collection schemes for the recovery of each type of battery face major barriers that diminish collection rates:
    a. For portable rechargeable batteries that are incorporated into pieces of equipment, the consumer is often unwilling to separate the rechargeable battery from the equipment. Thus, if the owner of the equipment does not

introduce the equipment into the waste stream, the number of batteries available for collection will be low.

b. The financing of dedicated collection schemes is supported by less than ten percent of the portable battery market (rechargeable batteries, Ni-Cd especially) that will not be available for recovery, free from other types of battery chemistries. If high collection rates are required, general collection schemes must be designed.

c. With the elimination of mercury from all primary consumer dry cell batteries, a less complex and less costly recycling route became available[110]. Today, mercury–free batteries, when collected through any type of collection scheme, can be sent to electric industrial furnaces for metal recovery, or following a less desirable, but still environmentally safe scenario, to sanitary landfills for final disposal. In Mexico the use of mercury in the fabrication of batteries (and the introduction of mercury containing batteries into the Mexican market) has not been constrained by legislation thus, the use of dedicated collection systems for batteries is questionable. Dedicated collection systems are aimed to the types of batteries for which recycling is cost effective, leaving the primary mercury-containing batteries unattended. A general collection scheme overcomes this problem because, as consumers' demand is in favor of the collection

[110] With mercury content , primary dry cell batteries' metals are not cost effective to recover and recycle as in order to recycle the materials contained in them (20% Zinc, 30% manganese dioxide and 20% iron on average) efficiently and economically, it is necessary to treat them without consuming too much energy or increasing the environmental pollution in the process. Recycling of spent dry cells is under research and development in various countries, but a technique fully complying with the above requirements has yet to be found. (G. Pistoia et al. 2001. Ibid.

of any type of batteries regardless of its chemical nature, the volume of collected rechargeable batteries obtained through the dedicated battery collection scheme is equivalent to that of the primary batteries that are also present in the mix.

6. Classifying waste: Spent battery systems and end-of-life EEE need to be regulated differently in order to facilitate the implementation of collection and recycling programs and have high collection rates. If the current classification of these potentially hazardous products is maintained as is, poor participation from retailers and transfer stations is likely and the operational and administrative costs of the program will be prohibitively high. An exemption to the waste rules is required to overcome this potential barrier to a successful program. Collaboration covenants between private and governmental sectors could be useful to this purpose.
7. Coping with historical waste: Important volumes of E-waste are already present in MSW landfills. Historical waste is a issue that needs to be addressed by policy makers in Mexico. Current regulations do not contemplate this problem. Who will pay for the segregation and final disposal of historical waste? Different options exist to address the problem, but they need to be specified in a new set of regulations.
8. Capacity building: It will be necessary to strengthen industry's ability to provide the necessary infrastructure to implement producer-extended responsibility. It will also be necessary for government to provide leadership in promoting practices of product stewardship through government *procurement* policy, technical

assistance, program evaluation, education, market development, agency coordination (collaboration agreements), and by fashioning additional regulatory barriers (i.e., for instance, bans on the introduction of special industrial "non-hazardous" wastes into MSW stream), and by providing incentives including recycling subsidies. It important to say that capacity building is also required on the side of information knowledge management and epidemiological research. Efforts should be directed at studying the population exposures and pathways of such exposures. Epidemiological capacity building at the university research level is considered key in order to overcome the increasing amount of research work needed is the field.

9. Recommendations for implementation:
    a. CANIETI, in order to achieve compliance with new regulations by 2006, cannot afford to lose time trying to delay the enforcement of existing regulations. Instead, it needs to immediately show leadership and organize an integrated response through its different core operational regions. Holding regional meetings to address region-specific concerns is important, but for the reasons already mentioned, both the design of the program and general aspects of its implementation need to be addressed simultaneously.
    b. The search for a Cooperative Agreement with the Environment and Natural Resources Ministry (SEMARNAT) is considered to be critical. This is the only way to achieve compliance through cost-effective collection and recycling. As stated before, as long as HW regulations are applicable to

waste electric and electronic equipment, no incentives for cooperation from retailers will be in place and transportation and administrative costs will remain a heavy burden for the sector.

c. Reverse manufacturing schemes need to be reviewed with potential retailers that might serve as collection sites in different communities.

d. A meeting addressing the creation of Producer Responsibility Organization (PRO) and the allocation operational and administrative costs responsibilities is needed.

10. Finally, governmental intervention, as was already mentioned, is required in several areas and time frames. Additional effort should be devoted at studying population exposure to toxics released by E-waste as well as pathways of such exposures.

Today important international efforts are being made to address the electronic waste problem and its associated health and environmental impacts. Through the present work, some of the core questions to this problem were addressed and prescriptions were developed for implementation in the countries' specific context. I believe Mexico is, today, in an advantageous situation to deal with the E-waste problem at an early stage of development. It is hoped that the present work is used as a tool to develop solutions to some of the key aspects of the E-waste burden and what is most important, to avoid public health impacts on the Mexican population.

APPENDIX A

Table A1. Population Distribution by Income Level and Municipalities (Mexico 2000)

State ID	Municipal ID	Municicpality	Population Density (inhabitants per SqKm)	Total de la población ocupada que recibe ingresos de más de 5 hasta 10 salario mínimo del año 2000	Total de la población ocupada que recibe ingresos de más de 10 salario mínimo del año 2000	Total	Total Acumm.	%	% Acumm.	% Adjusted	% Adjusted Acumm.
2	4	Tijuana	35	68,672	38,076	106,748	106,748	2.67%	2.67%	3.34%	3.34%
14	39	Guadalajara	80	75,965	30,046	106,011	212,759	2.65%	5.32%	3.31%	6.65%
19	39	Monterrey	60	51,878	39,476	91,354	304,113	2.28%	7.61%	2.85%	9.50%
14	120	Zapopan	80	53,711	31,414	85,125	389,238	2.13%	9.73%	2.66%	12.16%
21	114	Puebla	148	54,439	27,442	81,881	471,119	2.05%	11.78%	2.56%	14.72%
9	7	Iztapalapa	5799	58,591	20,016	78,607	549,726	1.97%	13.75%	2.46%	17.18%
8	37	Juárez	12	51,052	26,778	77,830	627,556	1.95%	15.69%	2.43%	19.61%
9	3	Coyoacán	5799	45,907	31,866	77,773	705,329	1.94%	17.64%	2.43%	22.04%
9	5	Gustavo A. Madero	5799	54,408	20,173	74,581	779,910	1.87%	19.50%	2.33%	24.37%
9	14	Benito Juárez	5799	40,241	32,308	72,549	852,459	1.81%	21.32%	2.27%	26.63%
2	2	Mexicali	35	43,583	20,058	63,641	916,100	1.59%	22.91%	1.99%	28.62%
11	20	León	152	39,105	21,120	60,225	976,325	1.51%	24.42%	1.88%	30.50%
8	19	Chihuahua	12	38,639	21,439	60,078	1,036,403	1.50%	25.92%	1.88%	32.38%
22	14	Querétaro	120	33,712	21,993	55,705	1,092,108	1.39%	27.31%	1.74%	34.12%
15	58	Nezahualcóyotl	586	39,258	13,943	53,201	1,145,309	1.33%	28.64%	1.66%	35.78%
9	12	Tlalpan	5799	30,859	22,333	53,192	1,198,501	1.33%	29.97%	1.66%	37.45%
15	57	Naucalpan de Juárez	586	29,526	23,595	53,121	1,251,622	1.33%	31.30%	1.66%	39.11%
15	33	Ecatepec de Morelos	586	41,371	11,354	52,725	1,304,347	1.32%	32.62%	1.65%	40.75%
9	15	Cuauhtémoc	5799	33,737	17,658	51,395	1,355,742	1.29%	33.90%	1.61%	42.36%
19	46	San Nicolás de los Garza	60	32,373	18,613	50,986	1,406,728	1.28%	35.18%	1.59%	43.95%
9	10	Alvaro Obregón	5799	28,914	21,440	50,354	1,457,082	1.26%	36.44%	1.57%	45.53%
19	26	Guadalupe	60	30,416	16,233	46,649	1,503,731	1.17%	37.60%	1.46%	46.98%
24	28	San Luis Potosí	38	30,013	15,560	45,573	1,549,304	1.14%	38.74%	1.42%	48.41%
31	50	Mérida	42	28,811	15,729	44,540	1,593,844	1.11%	39.86%	1.39%	49.80%
15	104	Tlalnepantla de Baz	586	29,821	14,287	44,108	1,637,952	1.10%	40.96%	1.38%	51.18%
25	6	Culiacán	44	28,076	13,569	41,645	1,679,597	1.04%	42.00%	1.30%	52.48%
5	30	Saltillo	15	25,334	16,119	41,453	1,721,050	1.04%	43.04%	1.30%	53.77%
1	1	Aguascalientes	168	27,319	14,129	41,448	1,762,498	1.04%	44.08%	1.30%	55.07%
9	16	Miguel Hidalgo	5799	22,441	18,662	41,103	1,803,601	1.03%	45.10%	1.28%	56.35%
15	106	Toluca	586	25,863	14,774	40,637	1,844,238	1.02%	46.12%	1.27%	57.62%
26	30	Hermosillo	12	27,895	12,634	40,529	1,884,767	1.01%	47.13%	1.27%	58.89%
16	53	Morelia	68	25,347	11,944	37,291	1,922,058	0.93%	48.07%	1.17%	60.05%
23	5	Benito Juárez	5799	24,118	12,733	36,851	1,958,909	0.92%	48.99%	1.15%	61.20%
27	4	Centro	76	24,390	12,447	36,837	1,995,746	0.92%	49.91%	1.15%	62.36%
5	35	Torreón	15	22,411	13,820	36,231	2,031,977	0.91%	50.81%	1.13%	63.49%
9	2	Azcapotzalco	586	24,285	9,601	33,886	2,065,863	0.85%	51.66%	1.06%	64.55%
15	13	Atizapán de Zaragoza	586	18,128	13,843	31,971	2,097,834	0.80%	52.46%	1.00%	65.55%
15	121	Cuautitlán Izcalli	586	20,688	9,287	29,975	2,127,809	0.75%	53.21%	0.94%	66.48%
9	17	Venustiano Carranza	5799	22,517	7,350	29,867	2,157,676	0.75%	53.96%	0.93%	67.42%
30	193	Veracruz	96	20,109	9,042	29,151	2,186,827	0.73%	54.69%	0.91%	68.33%
9	6	Iztacalco	5799	20,064	7,112	27,176	2,214,003	0.68%	55.37%	0.85%	69.18%
28	32	Reynosa	34	17,226	8,062	25,288	2,239,291	0.63%	56.00%	0.79%	69.97%
10	5	Durango	12	17,149	7,983	25,132	2,264,423	0.63%	56.63%	0.79%	70.75%
30	87	Xalapa	96	16,955	7,581	24,536	2,288,959	0.61%	57.24%	0.77%	71.52%
17	7	Cuernavaca	318	13,779	10,316	24,095	2,313,054	0.60%	57.84%	0.75%	72.27%
7	101	Tuxtla Gutiérrez	53	16,899	6,140	23,039	2,336,093	0.58%	58.42%	0.72%	72.99%
25	12	Mazatlán	44	14,995	6,799	21,794	2,357,887	0.55%	58.96%	0.68%	73.67%
9	13	Xochimilco	5799	13,895	7,128	21,023	2,378,910	0.53%	59.49%	0.66%	74.33%
2	1	Ensenada	35	14,657	6,233	20,890	2,399,800	0.52%	60.01%	0.65%	74.98%
28	22	Matamoros	34	14,482	6,396	20,878	2,420,678	0.52%	60.53%	0.65%	75.63%
11	7	Celaya	152	13,163	7,349	20,512	2,441,190	0.51%	61.05%	0.64%	76.27%
28	27	Nuevo Laredo	34	13,558	6,238	19,796	2,460,986	0.50%	61.54%	0.62%	76.89%
28	38	Tampico	34	12,609	5,866	18,475	2,479,461	0.46%	62.00%	0.58%	77.47%
15	54	Metepec	586	10,704	7,605	18,309	2,497,770	0.46%	62.46%	0.57%	78.04%
12	1	Acapulco de Juárez	48	13,397	4,805	18,202	2,515,972	0.46%	62.92%	0.57%	78.61%
19	19	San Pedro Garza García	60	5,509	11,867	17,376	2,533,348	0.43%	63.35%	0.54%	79.15%
18	17	Tepic	33	12,674	4,542	17,216	2,550,564	0.43%	63.78%	0.54%	79.69%
28	9	Ciudad Madero	34	12,305	4,812	17,117	2,567,681	0.43%	64.21%	0.53%	80.23%
26	18	Cajeme	12	11,689	5,285	16,974	2,584,655	0.42%	64.64%	0.53%	80.76%
11	17	Irapuato	152	10,933	5,966	16,899	2,601,554	0.42%	65.06%	0.53%	81.28%

Table A1. Cont. Population Distribution by Income Levels and Municipalities (Mexico 2000)

State ID	Municipal ID	Municicpality	Population Density (inhabitants per SqKm)	Total de la población ocupada que recibe ingresos de más de 5 hasta 10 salario mínimo del año 2000	Total de la población ocupada que recibe ingresos de más de 10 salario mínimo del año 2000	Total	Total Acumm.	%	% Acumm.	% Adjusted	% Adjusted Acumm.
14	98	Tlaquepaque	80	12,274	4,326	16,600	2,618,154	0.42%	65.47%	0.52%	81.80%
13	48	Pachuca de Soto	107	11,038	5,496	16,534	2,634,688	0.41%	65.89%	0.52%	82.32%
28	41	Victoria	34	11,191	5,071	16,262	2,650,950	0.41%	66.29%	0.51%	82.83%
25	1	Ahome	44	11,188	5,010	16,198	2,667,148	0.41%	66.70%	0.51%	83.33%
15	20	Coacalco de Berriozábal	586	12,154	3,888	16,042	2,683,190	0.40%	67.10%	0.50%	83.83%
15	109	Tultitlán	586	12,613	3,364	15,977	2,699,167	0.40%	67.50%	0.50%	84.33%
14	67	Puerto Vallarta	80	10,097	4,816	14,913	2,714,080	0.37%	67.87%	0.47%	84.80%
9	8	Magdalena Contreras, La	5799	7,854	6,438	14,292	2,728,372	0.36%	68.23%	0.45%	85.25%
20	67	Oaxaca de Juárez	37	10,154	3,948	14,102	2,742,474	0.35%	68.58%	0.44%	85.69%
30	39	Coatzacoalcos	96	10,154	3,630	13,784	2,756,258	0.34%	68.93%	0.43%	86.12%
19	6	Apodaca	60	10,392	3,388	13,780	2,770,038	0.34%	69.27%	0.43%	86.55%
5	18	Monclova	15	8,546	4,909	13,455	2,783,493	0.34%	69.61%	0.42%	86.97%
3	3	Paz, La	6	9,648	3,679	13,327	2,796,820	0.33%	69.94%	0.42%	87.38%
10	7	Gómez Palacio	12	8,600	3,729	12,329	2,809,149	0.31%	70.25%	0.39%	87.77%
15	37	Huixquilucan	586	5,012	6,979	11,991	2,821,140	0.30%	70.55%	0.37%	88.14%
4	3	Carmen	12	6,724	4,686	11,410	2,832,550	0.29%	70.83%	0.36%	88.50%
26	55	San Luis Río Colorado	12	7,558	3,610	11,168	2,843,718	0.28%	71.11%	0.35%	88.85%
9	11	Tláhuac	5799	8,804	2,354	11,158	2,854,876	0.28%	71.39%	0.35%	89.20%
26	43	Nogales	12	7,481	3,546	11,027	2,865,903	0.28%	71.67%	0.34%	89.54%
14	101	Tonalá	80	8,370	2,497	10,867	2,876,770	0.27%	71.94%	0.34%	89.88%
15	39	Ixtapaluca	586	8,441	2,390	10,831	2,887,601	0.27%	72.21%	0.34%	90.22%
9	4	Cuajimalpa de Morelos	5799	4,858	5,329	10,187	2,897,788	0.25%	72.47%	0.32%	90.54%
11	27	Salamanca	152	7,657	2,483	10,140	2,907,928	0.25%	72.72%	0.32%	90.86%
4	2	Campeche	12	7,070	2,781	9,851	2,917,779	0.25%	72.97%	0.31%	91.16%
19	48	Santa Catarina	60	7,264	2,574	9,838	2,927,617	0.25%	73.21%	0.31%	91.47%
30	28	Boca del Río	96	5,484	4,118	9,602	2,937,219	0.24%	73.45%	0.30%	91.77%
16	52	Lázaro Cárdenas	68	7,202	2,290	9,492	2,946,711	0.24%	73.69%	0.30%	92.07%
19	21	General Escobedo	60	6,834	2,447	9,281	2,955,992	0.23%	73.92%	0.29%	92.36%
16	102	Uruapan	68	6,109	2,978	9,087	2,965,079	0.23%	74.15%	0.28%	92.64%
3	8	Cabos, Los	6	6,516	2,570	9,086	2,974,165	0.23%	74.38%	0.28%	92.93%
5	25	Piedras Negras	15	5,625	3,378	9,003	2,983,168	0.23%	74.60%	0.28%	93.21%
30	131	Poza Rica de Hidalgo	96	6,681	2,285	8,966	2,992,134	0.22%	74.83%	0.28%	93.49%
6	2	Colima	96	5,706	3,151	8,857	3,000,991	0.22%	75.05%	0.28%	93.76%
7	89	Tapachula	53	6,519	2,320	8,839	3,009,830	0.22%	75.27%	0.28%	94.04%
15	99	Texcoco	586	5,904	2,709	8,613	3,018,443	0.22%	75.48%	0.27%	94.31%
23	4	Othón P. Blanco	21	5,913	2,418	8,331	3,026,774	0.21%	75.69%	0.26%	94.57%
32	56	Zacatecas	18	5,759	2,485	8,244	3,035,018	0.21%	75.90%	0.26%	94.83%
19	9	Cadereyta Jiménez	60	6,068	1,994	8,062	3,043,080	0.20%	76.10%	0.25%	95.08%
17	11	Jiutepec	318	5,527	2,339	7,866	3,050,946	0.20%	76.30%	0.25%	95.32%
22	16	San Juan del Río	120	5,162	2,600	7,762	3,058,708	0.19%	76.49%	0.24%	95.57%
12	29	Chilpancingo de los Bravo	48	5,636	1,866	7,502	3,066,210	0.19%	76.68%	0.23%	95.80%
15	60	Nicolás Romero	586	5,520	1,731	7,251	3,073,461	0.18%	76.86%	0.23%	96.03%
21	156	Tehuacán	148	5,041	2,120	7,161	3,080,622	0.18%	77.04%	0.22%	96.25%
15	31	Chimalhuacán	586	5,504	1,479	6,983	3,087,605	0.17%	77.21%	0.22%	96.47%
8	21	Delicias	12	4,669	2,147	6,816	3,094,421	0.17%	77.38%	0.21%	96.68%
30	44	Córdoba	96	4,583	2,185	6,768	3,101,189	0.17%	77.55%	0.21%	96.89%
25	11	Guasave	44	4,890	1,877	6,767	3,107,956	0.17%	77.72%	0.21%	97.11%
11	15	Guanajuato	152	4,315	2,410	6,725	3,114,681	0.17%	77.89%	0.21%	97.32%
8	17	Cuauhtémoc	12	4,563	2,126	6,689	3,121,370	0.17%	78.06%	0.21%	97.53%
24	35	Soledad de Graciano Sánchez	38	5,252	1,434	6,686	3,128,056	0.17%	78.22%	0.21%	97.73%
15	70	Paz, La	586	5,041	1,590	6,631	3,134,687	0.17%	78.39%	0.21%	97.94%
30	108	Minatitlán	96	5,180	1,349	6,529	3,141,216	0.16%	78.55%	0.20%	98.15%
15	81	Tecámac	586	4,469	2,011	6,480	3,147,696	0.16%	78.72%	0.20%	98.35%
32	17	Guadalupe	18	4,533	1,758	6,291	3,153,987	0.16%	78.87%	0.20%	98.54%
6	7	Manzanillo	96	4,440	1,743	6,183	3,160,170	0.15%	79.03%	0.19%	98.74%
30	118	Orizaba	96	4,274	1,894	6,168	3,166,338	0.15%	79.18%	0.19%	98.93%
26	29	Guaymas	12	4,372	1,730	6,102	3,172,440	0.15%	79.33%	0.19%	99.12%
16	108	Zamora	68	3,891	1,957	5,848	3,178,288	0.15%	79.48%	0.18%	99.30%
27	2	Cárdenas	76	4,385	1,441	5,826	3,184,114	0.15%	79.63%	0.18%	99.49%
17	6	Cuautla	318	4,032	1,611	5,643	3,189,757	0.14%	79.77%	0.18%	99.66%
6	10	Villa de Alvarez	96	4,103	1,318	5,421	3,195,178	0.14%	79.90%	0.17%	99.83%
8	32	Hidalgo del Parral	12	3,747	1,651	5,398	3,200,576	0.13%	80.04%	0.17%	100.00%
		Adjusted Total		**2,119,156**	**1,081,420**	**3,200,576**					

Table A2. End-of-Life Computers Available for Collection (allocation in National Territory by Year)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total Units	Total MT
2	4	Tijuana	**76,068**	17,794	14,843	17,422	24,038	31,026	32,375	35,452	36,823	39,023	324,861	9,583,402.08
14	39	Guadalajara	**75,543**	17,671	14,741	17,301	23,872	30,812	32,151	35,207	36,568	38,753	322,618	9,517,237.21
19	39	Monterrey	**65,098**	15,228	12,703	14,909	20,571	26,552	27,706	30,339	31,512	33,395	278,013	8,201,391.25
14	120	Zapopan	**60,659**	14,189	11,837	13,893	19,169	24,741	25,817	28,270	29,364	31,118	259,057	7,642,176.92
21	114	Puebla	**58,348**	13,649	11,385	13,363	18,438	23,798	24,833	27,193	28,245	29,932	249,185	7,350,943.77
9	7	Iztapalapa	**56,015**	13,103	10,930	12,829	17,701	22,847	23,840	26,106	27,115	28,735	239,221	7,057,017.34
8	37	Juárez	**55,461**	12,973	10,822	12,702	17,526	22,621	23,604	25,848	26,847	28,451	236,856	6,987,261.44
9	3	Coyoacán	**55,420**	12,964	10,814	12,693	17,513	22,604	23,587	25,829	26,828	28,431	236,683	6,982,144.21
9	5	Gustavo A. Madero	**53,146**	12,432	10,370	12,172	16,794	21,677	22,619	24,769	25,727	27,264	226,969	6,695,579.41
9	14	Benito Juárez	**51,698**	12,093	10,088	11,840	16,337	21,086	22,003	24,094	25,026	26,521	220,785	6,513,154.70
2	2	Mexicali	**45,350**	10,608	8,849	10,386	14,331	18,497	19,301	21,135	21,953	23,264	193,676	5,713,430.62
11	20	León	**42,916**	10,039	8,374	9,829	13,562	17,504	18,265	20,001	20,775	22,016	183,280	5,406,756.01
8	19	Chihuahua	**42,811**	10,014	8,354	9,805	13,528	17,461	18,221	19,952	20,724	21,962	182,833	5,393,558.94
22	14	Querétaro	**39,695**	9,285	7,746	9,091	12,544	16,190	16,894	18,500	19,215	20,363	169,524	5,000,968.76
15	58	Nezahualcóyotl	**37,911**	8,868	7,398	8,683	11,980	15,463	16,135	17,668	18,352	19,448	161,904	4,776,169.80
9	12	Tlalpan	**37,904**	8,867	7,396	8,681	11,978	15,460	16,132	17,665	18,349	19,445	161,877	4,775,361.82
15	57	Naucalpan de Juárez	**37,854**	8,855	7,386	8,670	11,962	15,439	16,111	17,642	18,324	19,419	161,661	4,768,987.73
15	33	Ecatepec de Morelos	**37,571**	8,789	7,331	8,605	11,873	15,324	15,991	17,510	18,187	19,274	160,455	4,733,436.45
9	15	Cuauhtémoc	**36,624**	8,567	7,146	8,388	11,573	14,938	15,587	17,069	17,729	18,788	156,408	4,614,034.45
19	46	San Nicolás de los Garza	**36,332**	8,499	7,090	8,321	11,481	14,819	15,463	16,933	17,588	18,638	155,163	4,577,316.09
9	10	Alvaro Obregón	**35,882**	8,393	7,002	8,218	11,339	14,635	15,271	16,723	17,370	18,407	153,240	4,520,577.70
19	26	Guadalupe	**33,242**	7,776	6,486	7,613	10,504	13,558	14,148	15,492	16,092	17,053	141,965	4,187,957.84
24	28	San Luis Potosí	**32,475**	7,597	6,337	7,438	10,262	13,246	13,821	15,135	15,720	16,660	138,690	4,091,358.93
31	50	Mérida	**31,739**	7,424	6,193	7,269	10,030	12,945	13,508	14,792	15,364	16,282	135,546	3,998,620.38
15	104	Tlalnepantla de Baz	**31,431**	7,352	6,133	7,199	9,932	12,820	13,377	14,648	15,215	16,124	134,232	3,959,837.18
25	6	Culiacán	**29,676**	6,942	5,791	6,797	9,378	12,104	12,630	13,830	14,365	15,224	126,736	3,738,719.04
5	30	Saltillo	**29,539**	6,910	5,764	6,765	9,334	12,048	12,572	13,767	14,299	15,153	126,152	3,721,482.05
1	1	Aguascalientes	**29,536**	6,909	5,763	6,764	9,333	12,047	12,570	13,765	14,297	15,152	126,137	3,721,033.17
9	16	Miguel Hidalgo	**29,290**	6,851	5,715	6,708	9,256	11,946	12,466	13,650	14,178	15,026	125,087	3,690,060.48
15	106	Toluca	**28,958**	6,774	5,651	6,632	9,151	11,811	12,324	13,496	14,018	14,855	123,669	3,648,224.89
26	30	Hermosillo	**28,881**	6,756	5,636	6,614	9,126	11,780	12,292	13,460	13,980	14,816	123,340	3,638,529.09
16	53	Morelia	**26,573**	6,216	5,185	6,086	8,397	10,838	11,310	12,385	12,863	13,632	113,486	3,347,834.59
23	5	Benito Juárez	**26,260**	6,143	5,124	6,014	8,298	10,711	11,176	12,238	12,712	13,471	112,147	3,308,333.18
27	4	Centro	**26,250**	6,140	5,122	6,012	8,295	10,706	11,172	12,234	12,707	13,466	112,104	3,307,076.31
5	35	Torreón	**25,818**	6,039	5,038	5,913	8,159	10,530	10,988	12,032	12,498	13,245	110,260	3,252,672.09
9	2	Azcapotzalco	**24,147**	5,648	4,712	5,530	7,630	9,849	10,277	11,254	11,689	12,387	103,124	3,042,147.51
15	13	Atizapán de Zaragoza	**22,782**	5,329	4,446	5,218	7,199	9,292	9,696	10,618	11,028	11,687	97,296	2,870,226.59
15	121	Cuautitlán Izcalli	**21,360**	4,996	4,168	4,892	6,750	8,712	9,091	9,955	10,340	10,958	91,221	2,691,033.81
9	17	Venustiano Carranza	**21,283**	4,978	4,153	4,874	6,725	8,681	9,058	9,919	10,303	10,918	90,893	2,681,338.01
30	193	Veracruz	**20,773**	4,859	4,053	4,758	6,564	8,473	8,841	9,681	10,056	10,656	88,714	2,617,058.44
9	6	Iztacalco	**19,365**	4,530	3,779	4,435	6,120	7,899	8,242	9,025	9,374	9,934	82,703	2,439,750.95
28	32	Reynosa	**18,020**	4,215	3,516	4,127	5,694	7,350	7,669	8,398	8,723	9,244	76,958	2,270,253.98
10	5	Durango	**17,909**	4,189	3,495	4,102	5,659	7,304	7,622	8,346	8,669	9,187	76,483	2,256,248.93
30	87	Xalapa	**17,484**	4,090	3,412	4,004	5,525	7,131	7,441	8,149	8,464	8,969	74,669	2,202,742.47
17	7	Cuernavaca	**17,170**	4,016	3,350	3,932	5,426	7,003	7,308	8,002	8,312	8,808	73,327	2,163,151.28
7	101	Tuxtla Gutiérrez	**16,417**	3,840	3,204	3,760	5,188	6,696	6,987	7,651	7,947	8,422	70,113	2,068,347.89
25	12	Mazatlán	**15,530**	3,633	3,030	3,557	4,908	6,334	6,610	7,238	7,518	7,967	66,325	1,956,576.84
9	13	Xochimilco	**14,981**	3,504	2,923	3,431	4,734	6,110	6,376	6,982	7,252	7,685	63,978	1,887,359.59
2	1	Ensenada	**14,886**	3,482	2,905	3,409	4,704	6,072	6,336	6,938	7,206	7,636	63,574	1,875,419.39
28	22	Matamoros	**14,877**	3,480	2,903	3,407	4,701	6,068	6,332	6,934	7,202	7,632	63,537	1,874,342.08
11	7	Celaya	**14,617**	3,419	2,852	3,348	4,619	5,962	6,221	6,812	7,076	7,498	62,423	1,841,484.09
28	27	Nuevo Laredo	**14,106**	3,300	2,753	3,231	4,458	5,754	6,004	6,574	6,829	7,237	60,244	1,777,204.51
28	38	Tampico	**13,165**	3,080	2,569	3,015	4,160	5,370	5,603	6,136	6,373	6,754	56,224	1,658,610.50
15	54	Metepec	**13,047**	3,052	2,546	2,988	4,123	5,321	5,553	6,081	6,316	6,693	55,719	1,643,707.69
12	1	Acapulco de Juárez	**12,971**	3,034	2,531	2,971	4,099	5,290	5,520	6,045	6,279	6,654	55,393	1,634,101.67
19	19	San Pedro Garza García	**12,382**	2,896	2,416	2,836	3,913	5,050	5,270	5,771	5,994	6,352	52,880	1,559,946.74
18	17	Tepic	**12,268**	2,870	2,394	2,810	3,877	5,004	5,221	5,718	5,939	6,293	52,393	1,545,582.59
28	9	Ciudad Madero	**12,197**	2,853	2,380	2,794	3,854	4,975	5,191	5,685	5,904	6,257	52,091	1,536,694.77
26	18	Cajeme	**12,096**	2,829	2,360	2,770	3,822	4,933	5,148	5,637	5,855	6,205	51,656	1,523,856.81
11	17	Irapuato	**12,042**	2,817	2,350	2,758	3,805	4,912	5,125	5,612	5,829	6,178	51,428	1,517,123.62

Table A2. Cont. End-of-Life Computers Available for Collection (allocation in National Territory by Year)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total Units	Total MT
14	98	Tlaquepaque	**11,829**	2,767	2,308	2,709	3,738	4,825	5,034	5,513	5,726	6,068	50,518	1,490,280.61
13	48	Pachuca de Soto	**11,782**	2,756	2,299	2,698	3,723	4,806	5,014	5,491	5,703	6,044	50,317	1,484,355.40
28	41	Victoria	**11,588**	2,711	2,261	2,654	3,662	4,726	4,932	5,401	5,610	5,945	49,489	1,459,936.34
25	1	Ahome	**11,543**	2,700	2,252	2,644	3,647	4,708	4,913	5,379	5,587	5,921	49,295	1,454,190.68
15	20	Coacalco de Berriozábal	**11,431**	2,674	2,231	2,618	3,612	4,663	4,865	5,328	5,534	5,864	48,820	1,440,185.63
15	109	Tultitlán	**11,385**	2,663	2,222	2,608	3,598	4,644	4,846	5,306	5,511	5,841	48,622	1,434,350.20
14	67	Puerto Vallarta	**10,627**	2,486	2,074	2,434	3,358	4,334	4,523	4,953	5,144	5,452	45,384	1,338,828.60
9	8	Magdalena Contreras, La	**10,184**	2,382	1,987	2,333	3,218	4,154	4,335	4,746	4,930	5,225	43,494	1,283,077.74
20	67	Oaxaca de Juárez	**10,049**	2,351	1,961	2,301	3,176	4,099	4,277	4,683	4,864	5,155	42,916	1,266,020.31
30	39	Coatzacoalcos	**9,822**	2,298	1,917	2,250	3,104	4,006	4,180	4,578	4,755	5,039	41,948	1,237,471.56
19	6	Apodaca	**9,820**	2,297	1,916	2,249	3,103	4,005	4,179	4,576	4,753	5,037	41,936	1,237,112.46
5	18	Monclova	**9,588**	2,243	1,871	2,196	3,030	3,911	4,081	4,468	4,641	4,919	40,947	1,207,935.28
3	3	Paz, La	**9,497**	2,221	1,853	2,175	3,001	3,873	4,042	4,426	4,597	4,872	40,557	1,196,443.96
10	7	Gómez Palacio	**8,786**	2,055	1,714	2,012	2,776	3,583	3,739	4,095	4,253	4,507	37,520	1,106,847.57
15	37	Huixquilucan	**8,545**	1,999	1,667	1,957	2,700	3,485	3,637	3,982	4,136	4,383	36,492	1,076,503.30
4	3	Carmen	**8,131**	1,902	1,587	1,862	2,569	3,316	3,460	3,789	3,936	4,171	34,724	1,024,343.48
26	55	San Luis Río Colorado	**7,958**	1,862	1,553	1,823	2,515	3,246	3,387	3,709	3,852	4,083	33,987	1,002,617.70
9	11	Tláhuac	**7,951**	1,860	1,552	1,821	2,513	3,243	3,384	3,706	3,849	4,079	33,957	1,001,719.94
26	43	Nogales	**7,858**	1,838	1,533	1,800	2,483	3,205	3,344	3,662	3,804	4,031	33,558	989,959.29
14	101	Tonalá	**7,744**	1,811	1,511	1,774	2,447	3,158	3,296	3,609	3,749	3,973	33,071	975,595.14
15	39	Ixtapaluca	**7,718**	1,805	1,506	1,768	2,439	3,148	3,285	3,597	3,736	3,959	32,961	972,363.21
9	4	Cuajimalpa de Morelos	**7,259**	1,698	1,416	1,663	2,294	2,961	3,090	3,383	3,514	3,724	31,002	914,547.50
11	27	Salamanca	**7,226**	1,690	1,410	1,655	2,283	2,947	3,075	3,368	3,498	3,707	30,859	910,328.03
4	2	Campeche	**7,020**	1,642	1,370	1,608	2,218	2,863	2,988	3,272	3,398	3,601	29,979	884,382.79
19	48	Santa Catarina	**7,010**	1,640	1,368	1,606	2,215	2,859	2,984	3,267	3,394	3,596	29,940	883,215.70
30	28	Boca del Río	**6,842**	1,601	1,335	1,567	2,162	2,791	2,912	3,189	3,312	3,510	29,221	862,028.58
16	52	Lázaro Cárdenas	**6,764**	1,582	1,320	1,549	2,137	2,759	2,879	3,152	3,274	3,470	28,887	852,153.23
19	21	General Escobedo	**6,614**	1,547	1,291	1,515	2,090	2,697	2,815	3,082	3,201	3,393	28,244	833,210.50
16	102	Uruapan	**6,475**	1,515	1,264	1,483	2,046	2,641	2,756	3,018	3,135	3,322	27,654	815,793.97
3	8	Cabos, Los	**6,475**	1,515	1,263	1,483	2,046	2,641	2,756	3,018	3,134	3,321	27,651	815,704.19
5	25	Piedras Negras	**6,415**	1,501	1,252	1,469	2,027	2,617	2,730	2,990	3,106	3,291	27,398	808,252.79
30	131	Poza Rica de Hidalgo	**6,389**	1,495	1,247	1,463	2,019	2,606	2,719	2,978	3,093	3,278	27,286	804,931.08
6	2	Colima	**6,311**	1,476	1,232	1,445	1,994	2,574	2,686	2,941	3,055	3,238	26,954	795,145.50
7	89	Tapachula	**6,299**	1,473	1,229	1,443	1,990	2,569	2,681	2,935	3,049	3,231	26,899	793,529.54
15	99	Texcoco	**6,138**	1,436	1,198	1,406	1,939	2,503	2,612	2,860	2,971	3,149	26,212	773,240.17
23	4	Othón P. Blanco	**5,937**	1,389	1,158	1,360	1,876	2,421	2,527	2,767	2,874	3,045	25,353	747,923.36
32	56	Zacatecas	**5,875**	1,374	1,146	1,345	1,856	2,396	2,500	2,738	2,844	3,014	25,089	740,112.85
19	9	Cadereyta Jiménez	**5,745**	1,344	1,121	1,316	1,815	2,343	2,445	2,677	2,781	2,947	24,535	723,773.63
17	11	Jiutepec	**5,605**	1,311	1,094	1,284	1,771	2,286	2,386	2,612	2,713	2,875	23,938	706,177.55
22	16	San Juan del Río	**5,531**	1,294	1,079	1,267	1,748	2,256	2,354	2,578	2,677	2,837	23,622	696,840.85
12	29	Chilpancingo de los Bravo	**5,346**	1,250	1,043	1,224	1,689	2,180	2,275	2,491	2,588	2,742	22,830	673,499.10
15	60	Nicolás Romero	**5,167**	1,209	1,008	1,183	1,633	2,107	2,199	2,408	2,501	2,651	22,067	650,965.34
21	156	Tehuacán	**5,103**	1,194	996	1,169	1,613	2,081	2,172	2,378	2,470	2,618	21,793	642,885.51
15	31	Chimalhuacán	**4,976**	1,164	971	1,140	1,572	2,030	2,118	2,319	2,409	2,553	21,251	626,905.39
8	21	Delicias	**4,857**	1,136	948	1,112	1,535	1,981	2,067	2,264	2,351	2,492	20,743	611,912.81
30	44	Córdoba	**4,823**	1,128	941	1,105	1,524	1,967	2,053	2,248	2,335	2,474	20,597	607,603.56
25	11	Guasave	**4,822**	1,128	941	1,104	1,524	1,967	2,052	2,247	2,334	2,474	20,594	607,513.79
11	15	Guanajuato	**4,792**	1,121	935	1,098	1,514	1,955	2,040	2,233	2,320	2,458	20,466	603,743.20
8	17	Cuauhtémoc	**4,767**	1,115	930	1,092	1,506	1,944	2,029	2,221	2,307	2,445	20,356	600,511.26
24	35	Soledad de Graciano Sánch	**4,764**	1,114	930	1,091	1,506	1,943	2,028	2,220	2,306	2,444	20,347	600,241.94
15	70	Paz, La	**4,725**	1,105	922	1,082	1,493	1,927	2,011	2,202	2,287	2,424	20,180	595,304.26
30	108	Minatitlán	**4,653**	1,088	908	1,066	1,470	1,898	1,980	2,168	2,252	2,387	19,869	586,147.11
15	81	Tecámac	**4,618**	1,080	901	1,058	1,459	1,883	1,965	2,152	2,235	2,369	19,720	581,748.09
32	17	Guadalupe	**4,483**	1,049	875	1,027	1,417	1,828	1,908	2,089	2,170	2,300	19,145	564,780.44
6	7	Manzanillo	**4,406**	1,031	860	1,009	1,392	1,797	1,875	2,053	2,133	2,260	18,816	555,084.64
30	118	Orizaba	**4,395**	1,028	858	1,007	1,389	1,793	1,871	2,048	2,128	2,255	18,771	553,738.00
26	29	Guaymas	**4,348**	1,017	848	996	1,374	1,774	1,851	2,027	2,105	2,231	18,570	547,812.79
16	108	Zamora	**4,167**	975	813	954	1,317	1,700	1,774	1,942	2,017	2,138	17,797	525,009.70
27	2	Cárdenas	**4,152**	971	810	951	1,312	1,693	1,767	1,935	2,010	2,130	17,730	523,034.63
17	6	Cuautla	**4,021**	941	785	921	1,271	1,640	1,711	1,874	1,947	2,063	17,173	506,605.63
6	10	Villa de Alvarez	**3,863**	904	754	885	1,221	1,576	1,644	1,800	1,870	1,982	16,497	486,675.37
8	32	Hidalgo del Parral	**3,847**	900	751	881	1,216	1,569	1,637	1,793	1,862	1,973	16,427	484,610.53
		Adjusted Total	**2,280,705**	533,500	445,036	522,345	720,710	930,230	970,679	1,062,926	1,104,035	1,169,995	9,740,160	
			67,280,791.60	15,738,250.00	13,128,562.00	15,409,177.50	21,260,945.00	27,441,785.00	28,635,030.50	31,356,317.00	32,569,020.70	34,514,840.70	287,334,720.00	**287,334,720.00**

2.00% EOL Computers and CRTs Incinerated

Table A3. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
2	4	Tijuana	$1,977.76	$462.64	$385.92	$452.96	$624.98	$806.67	$841.75	$921.74	$957.39	$1,014.59	$8,446.39
14	39	Guadalajara	$1,964.11	$459.44	$383.26	$449.84	$620.66	$801.10	$835.93	$915.38	$950.78	$1,007.58	$8,388.07
19	39	Monterrey	$1,692.55	$395.92	$330.27	$387.64	$534.85	$690.34	$720.36	$788.82	$819.32	$868.27	$7,228.34
14	120	Zapopan	$1,577.14	$368.92	$307.75	$361.21	$498.38	$643.27	$671.24	$735.03	$763.46	$809.07	$6,735.48
21	114	Puebla	$1,517.04	$354.86	$296.02	$347.44	$479.39	$618.75	$645.66	$707.02	$734.36	$778.24	$6,478.80
9	7	Iztapalapa	$1,456.38	$340.68	$284.19	$333.55	$460.22	$594.01	$619.84	$678.75	$705.00	$747.12	$6,219.74
8	37	Juárez	$1,441.99	$337.31	$281.38	$330.26	$455.67	$588.14	$613.72	$672.04	$698.03	$739.73	$6,158.26
9	3	Coyoacán	$1,440.93	$337.06	$281.17	$330.01	$455.34	$587.71	$613.27	$671.55	$697.52	$739.19	$6,153.75
9	5	Gustavo A. Madero	$1,381.79	$323.23	$269.63	$316.47	$436.65	$563.59	$588.10	$643.99	$668.89	$708.85	$5,901.19
9	14	Benito Juárez	$1,344.14	$314.42	$262.28	$307.85	$424.75	$548.24	$572.07	$626.44	$650.67	$689.54	$5,740.41
2	2	Mexicali	$1,179.10	$275.81	$230.08	$270.05	$372.60	$480.92	$501.83	$549.52	$570.77	$604.88	$5,035.57
11	20	León	$1,115.81	$261.01	$217.73	$255.55	$352.60	$455.11	$474.90	$520.03	$540.14	$572.41	$4,765.28
8	19	Chihuahua	$1,113.09	$260.37	$217.20	$254.93	$351.74	$453.99	$473.74	$518.76	$538.82	$571.01	$4,753.65
22	14	Querétaro	$1,032.07	$241.42	$201.39	$236.37	$326.14	$420.95	$439.25	$481.00	$499.60	$529.45	$4,407.63
15	58	Nezahualcóyotl	$985.68	$230.57	$192.34	$225.75	$311.48	$402.03	$419.51	$459.38	$477.14	$505.65	$4,209.51
9	12	Tlalpan	$985.51	$230.53	$192.30	$225.71	$311.42	$401.96	$419.44	$459.30	$477.06	$505.56	$4,208.79
15	57	Naucalpan de Juárez	$984.19	$230.22	$192.05	$225.41	$311.01	$401.42	$418.88	$458.68	$476.42	$504.89	$4,203.18
15	33	Ecatepec de Morelos	$976.86	$228.51	$190.61	$223.73	$308.69	$398.43	$415.75	$455.27	$472.87	$501.12	$4,171.84
9	15	Cuauhtémoc	$952.22	$222.74	$185.81	$218.08	$300.90	$388.38	$405.27	$443.78	$460.94	$488.48	$4,066.61
19	46	San Nicolás de los Garza	$944.64	$220.97	$184.33	$216.35	$298.51	$385.29	$402.04	$440.25	$457.28	$484.60	$4,034.24
9	10	Alvaro Obregón	$932.93	$218.23	$182.04	$213.67	$294.81	$380.51	$397.06	$434.79	$451.61	$478.59	$3,984.24
19	26	Guadalupe	$864.28	$202.17	$168.65	$197.95	$273.12	$352.52	$367.84	$402.80	$418.38	$443.38	$3,691.08
24	28	San Luis Potosí	$844.35	$197.51	$164.76	$193.38	$266.82	$344.38	$359.36	$393.51	$408.73	$433.15	$3,605.94
31	50	Mérida	$825.21	$193.03	$161.02	$189.00	$260.77	$336.58	$351.21	$384.59	$399.46	$423.33	$3,524.21
15	104	Tlalnepantla de Baz	$817.21	$191.16	$159.46	$187.16	$258.24	$333.31	$347.81	$380.86	$395.59	$419.22	$3,490.03
25	6	Culiacán	$771.57	$180.49	$150.56	$176.71	$243.82	$314.70	$328.39	$359.59	$373.50	$395.81	$3,295.14
5	30	Saltillo	$768.02	$179.65	$149.86	$175.90	$242.70	$313.25	$326.87	$357.94	$371.78	$393.99	$3,279.95
1	1	Aguascalientes	$767.92	$179.63	$149.85	$175.88	$242.67	$313.21	$326.83	$357.89	$371.73	$393.94	$3,279.55
9	16	Miguel Hidalgo	$761.53	$178.14	$148.60	$174.41	$240.65	$310.61	$324.11	$354.91	$368.64	$390.66	$3,252.26
15	106	Toluca	$752.90	$176.12	$146.91	$172.43	$237.92	$307.08	$320.44	$350.89	$364.46	$386.23	$3,215.38
26	30	Hermosillo	$750.90	$175.65	$146.52	$171.98	$237.29	$306.27	$319.59	$349.96	$363.49	$385.21	$3,206.84
16	53	Morelia	$690.90	$161.62	$134.82	$158.24	$218.33	$281.80	$294.05	$322.00	$334.45	$354.43	$2,950.63
23	5	Benito Juárez	$682.75	$159.71	$133.23	$156.37	$215.75	$278.47	$290.58	$318.20	$330.50	$350.25	$2,915.82
27	4	Centro	$682.49	$159.65	$133.18	$156.31	$215.67	$278.37	$290.47	$318.08	$330.38	$350.12	$2,914.71
5	35	Torreón	$671.27	$157.02	$130.98	$153.74	$212.12	$273.79	$285.69	$312.84	$324.94	$344.36	$2,866.76
9	2	Azcapotzalco	$627.82	$146.86	$122.51	$143.79	$198.39	$256.07	$267.20	$292.60	$303.91	$322.07	$2,681.21
15	13	Atizapán de Zaragoza	$592.34	$138.56	$115.58	$135.66	$187.18	$241.60	$252.10	$276.06	$286.74	$303.87	$2,529.69
15	121	Cuautitlán Izcalli	$555.36	$129.91	$108.37	$127.19	$175.50	$226.51	$236.36	$258.83	$268.84	$284.90	$2,371.76
9	17	Venustiano Carranza	$553.36	$129.44	$107.98	$126.73	$174.86	$225.70	$235.51	$257.89	$267.87	$283.87	$2,363.21
30	193	Veracruz	$540.09	$126.34	$105.39	$123.70	$170.67	$220.29	$229.87	$251.71	$261.45	$277.07	$2,306.56
9	6	Iztacalco	$503.50	$117.78	$98.25	$115.32	$159.11	$205.36	$214.29	$234.66	$243.73	$258.29	$2,150.29
28	32	Reynosa	$468.52	$109.60	$91.42	$107.30	$148.05	$191.10	$199.40	$218.35	$226.80	$240.35	$2,000.90
10	5	Durango	$465.63	$108.92	$90.86	$106.64	$147.14	$189.92	$198.17	$217.01	$225.40	$238.87	$1,988.56
30	87	Xalapa	$454.59	$106.34	$88.70	$104.11	$143.65	$185.41	$193.47	$211.86	$220.06	$233.20	$1,941.40
17	7	Cuernavaca	$446.42	$104.43	$87.11	$102.24	$141.07	$182.08	$190.00	$208.05	$216.10	$229.01	$1,906.51
7	101	Tuxtla Gutiérrez	$426.85	$99.85	$83.29	$97.76	$134.89	$174.10	$181.67	$198.94	$206.63	$218.97	$1,822.95
25	12	Mazatlán	$403.79	$94.45	$78.79	$92.48	$127.60	$164.69	$171.85	$188.19	$195.46	$207.14	$1,724.44
9	13	Xochimilco	$389.50	$91.11	$76.00	$89.21	$123.08	$158.87	$165.77	$181.53	$188.55	$199.81	$1,663.44
2	1	Ensenada	$387.04	$90.54	$75.52	$88.64	$122.30	$157.86	$164.72	$180.38	$187.36	$198.55	$1,652.91
28	22	Matamoros	$386.81	$90.48	$75.48	$88.59	$122.23	$157.77	$164.63	$180.28	$187.25	$198.43	$1,651.96
11	7	Celaya	$380.03	$88.90	$74.16	$87.04	$120.09	$155.00	$161.74	$177.12	$183.97	$194.96	$1,623.00
28	27	Nuevo Laredo	$366.77	$85.79	$71.57	$84.00	$115.90	$149.59	$156.10	$170.93	$177.54	$188.15	$1,566.35
28	38	Tampico	$342.29	$80.07	$66.79	$78.39	$108.17	$139.61	$145.68	$159.53	$165.70	$175.60	$1,461.83
15	54	Metepec	$339.22	$79.35	$66.19	$77.69	$107.19	$138.36	$144.37	$158.09	$164.21	$174.02	$1,448.69
12	1	Acapulco de Juárez	$337.24	$78.89	$65.81	$77.24	$106.57	$137.55	$143.53	$157.17	$163.25	$173.00	$1,440.23
19	19	San Pedro Garza García	$321.93	$75.31	$62.82	$73.73	$101.73	$131.31	$137.02	$150.04	$155.84	$165.15	$1,374.87
18	17	Tepic	$318.97	$74.61	$62.24	$73.05	$100.79	$130.10	$135.75	$148.66	$154.40	$163.63	$1,362.21
28	9	Ciudad Madero	$317.13	$74.18	$61.88	$72.63	$100.22	$129.35	$134.97	$147.80	$153.52	$162.69	$1,354.38
26	18	Cajeme	$314.48	$73.56	$61.37	$72.03	$99.38	$128.27	$133.85	$146.57	$152.23	$161.33	$1,343.06
11	17	Irapuato	$313.09	$73.24	$61.09	$71.71	$98.94	$127.70	$133.25	$145.92	$151.56	$160.62	$1,337.13

2.00% EOL Computers and CRTs Incinerated

Table A.3 Cont. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
14	98	Tlaquepaque	$307.55	$71.94	$60.01	$70.44	$97.19	$125.44	$130.90	$143.34	$148.88	$157.77	$1,313.47
13	48	Pachuca de Soto	$306.33	$71.66	$59.77	$70.16	$96.80	$124.94	$130.38	$142.77	$148.29	$157.15	$1,308.25
28	41	Victoria	$301.29	$70.48	$58.79	$69.00	$95.21	$122.89	$128.23	$140.42	$145.85	$154.56	$1,286.72
25	1	Ahome	$300.11	$70.20	$58.56	$68.73	$94.83	$122.40	$127.73	$139.87	$145.27	$153.95	$1,281.66
15	20	Coacalco de Berriozábal	$297.22	$69.52	$58.00	$68.07	$93.92	$121.23	$126.50	$138.52	$143.88	$152.47	$1,269.32
15	109	Tultitlán	$296.01	$69.24	$57.76	$67.80	$93.54	$120.73	$125.98	$137.96	$143.29	$151.85	$1,264.17
14	67	Puerto Vallarta	$276.30	$64.63	$53.91	$63.28	$87.31	$112.69	$117.59	$128.77	$133.75	$141.74	$1,179.98
9	8	Magdalena Contreras, La	$264.79	$61.94	$51.67	$60.65	$83.68	$108.00	$112.70	$123.41	$128.18	$135.84	$1,130.85
20	67	Oaxaca de Juárez	$261.27	$61.12	$50.98	$59.84	$82.56	$106.57	$111.20	$121.77	$126.48	$134.03	$1,115.81
30	39	Coatzacoalcos	$255.38	$59.74	$49.83	$58.49	$80.70	$104.16	$108.69	$119.02	$123.62	$131.01	$1,090.65
19	6	Apodaca	$255.31	$59.72	$49.82	$58.47	$80.68	$104.13	$108.66	$118.99	$123.59	$130.97	$1,090.34
5	18	Monclova	$249.29	$58.31	$48.64	$57.09	$78.78	$101.68	$106.10	$116.18	$120.67	$127.88	$1,064.62
3	3	Paz, La	$246.91	$57.76	$48.18	$56.55	$78.03	$100.71	$105.09	$115.07	$119.53	$126.67	$1,054.49
10	7	Gómez Palacio	$228.42	$53.43	$44.57	$52.32	$72.18	$93.17	$97.22	$106.46	$110.57	$117.18	$975.53
15	37	Huixquilucan	$222.16	$51.97	$43.35	$50.88	$70.20	$90.61	$94.55	$103.54	$107.54	$113.97	$948.78
4	3	Carmen	$211.40	$49.45	$41.25	$48.42	$66.80	$86.22	$89.97	$98.52	$102.33	$108.45	$902.81
26	55	San Luis Río Colorado	$206.91	$48.40	$40.38	$47.39	$65.39	$84.39	$88.06	$96.43	$100.16	$106.15	$883.66
9	11	Tláhuac	$206.73	$48.36	$40.34	$47.35	$65.33	$84.32	$87.98	$96.35	$100.07	$106.05	$882.87
26	43	Nogales	$204.30	$47.79	$39.87	$46.79	$64.56	$83.33	$86.95	$95.22	$98.90	$104.81	$872.51
14	101	Tonalá	$201.34	$47.10	$39.29	$46.11	$63.62	$82.12	$85.69	$93.83	$97.46	$103.29	$859.85
15	39	Ixtapaluca	$200.67	$46.94	$39.16	$45.96	$63.41	$81.85	$85.41	$93.52	$97.14	$102.94	$857.00
9	4	Cuajimalpa de Morelos	$188.74	$44.15	$36.83	$43.23	$59.64	$76.98	$80.33	$87.96	$91.36	$96.82	$806.04
11	27	Salamanca	$187.87	$43.95	$36.66	$43.03	$59.37	$76.63	$79.96	$87.56	$90.94	$96.38	$802.32
4	2	Campeche	$182.51	$42.69	$35.61	$41.80	$57.67	$74.44	$77.68	$85.06	$88.35	$93.63	$779.46
19	48	Santa Catarina	$182.27	$42.64	$35.57	$41.75	$57.60	$74.34	$77.58	$84.95	$88.23	$93.51	$778.43
30	28	Boca del Río	$177.90	$41.61	$34.71	$40.74	$56.22	$72.56	$75.72	$82.91	$86.12	$91.26	$759.75
16	52	Lázaro Cárdenas	$175.86	$41.14	$34.32	$40.28	$55.57	$71.73	$74.85	$81.96	$85.13	$90.22	$751.05
19	21	General Escobedo	$171.95	$40.22	$33.55	$39.38	$54.34	$70.13	$73.18	$80.14	$83.24	$88.21	$734.36
16	102	Uruapan	$168.36	$39.38	$32.85	$38.56	$53.20	$68.67	$71.65	$78.46	$81.50	$86.37	$719.00
3	8	Cabos, Los	$168.34	$39.38	$32.85	$38.55	$53.20	$68.66	$71.65	$78.46	$81.49	$86.36	$718.93
5	25	Piedras Negras	$166.80	$39.02	$32.55	$38.20	$52.71	$68.03	$70.99	$77.74	$80.74	$85.57	$712.36
30	131	Poza Rica de Hidalgo	$166.12	$38.86	$32.41	$38.05	$52.49	$67.75	$70.70	$77.42	$80.41	$85.22	$709.43
6	2	Colima	$164.10	$38.39	$32.02	$37.58	$51.86	$66.93	$69.84	$76.48	$79.44	$84.18	$700.81
7	89	Tapachula	$163.76	$38.31	$31.96	$37.51	$51.75	$66.79	$69.70	$76.32	$79.27	$84.01	$699.38
15	99	Texcoco	$159.58	$37.33	$31.14	$36.55	$50.43	$65.09	$67.92	$74.37	$77.25	$81.86	$681.50
23	4	Othón P. Blanco	$154.35	$36.11	$30.12	$35.35	$48.78	$62.96	$65.69	$71.94	$74.72	$79.18	$659.19
32	56	Zacatecas	$152.74	$35.73	$29.80	$34.98	$48.27	$62.30	$65.01	$71.18	$73.94	$78.36	$652.30
19	9	Cadereyta Jiménez	$149.37	$34.94	$29.15	$34.21	$47.20	$60.92	$63.57	$69.61	$72.31	$76.63	$637.90
17	11	Jiutepec	$145.74	$34.09	$28.44	$33.38	$46.05	$59.44	$62.03	$67.92	$70.55	$74.76	$622.39
22	16	San Juan del Río	$143.81	$33.64	$28.06	$32.94	$45.44	$58.66	$61.21	$67.02	$69.61	$73.77	$614.16
12	29	Chilpancingo de los Bravo	$138.99	$32.51	$27.12	$31.83	$43.92	$56.69	$59.16	$64.78	$67.28	$71.30	$593.59
15	60	Nicolás Romero	$134.34	$31.43	$26.21	$30.77	$42.45	$54.79	$57.18	$62.61	$65.03	$68.92	$573.73
21	156	Tehuacán	$132.67	$31.04	$25.89	$30.39	$41.93	$54.11	$56.47	$61.83	$64.22	$68.06	$566.61
15	31	Chimalhuacán	$129.38	$30.26	$25.25	$29.63	$40.88	$52.77	$55.06	$60.30	$62.63	$66.37	$552.53
8	21	Delicias	$126.28	$29.54	$24.64	$28.92	$39.91	$51.51	$53.75	$58.85	$61.13	$64.78	$539.31
30	44	Córdoba	$125.39	$29.33	$24.47	$28.72	$39.62	$51.14	$53.37	$58.44	$60.70	$64.33	$535.52
25	11	Guasave	$125.37	$29.33	$24.46	$28.71	$39.62	$51.14	$53.36	$58.43	$60.69	$64.32	$535.44
11	15	Guanajuato	$124.60	$29.15	$24.31	$28.54	$39.37	$50.82	$53.03	$58.07	$60.31	$63.92	$532.11
8	17	Cuauhtémoc	$123.93	$28.99	$24.18	$28.38	$39.16	$50.55	$52.75	$57.76	$59.99	$63.58	$529.26
24	35	Soledad de Graciano Sánchez	$123.87	$28.98	$24.17	$28.37	$39.14	$50.52	$52.72	$57.73	$59.96	$63.55	$529.03
15	70	Paz, La	$122.86	$28.74	$23.97	$28.14	$38.82	$50.11	$52.29	$57.26	$59.47	$63.02	$524.67
30	108	Minatitlán	$120.97	$28.30	$23.60	$27.70	$38.23	$49.34	$51.48	$56.38	$58.56	$62.05	$516.60
15	81	Tecámac	$120.06	$28.08	$23.43	$27.50	$37.94	$48.97	$51.10	$55.95	$58.12	$61.59	$512.73
32	17	Guadalupe	$116.56	$27.26	$22.74	$26.69	$36.83	$47.54	$49.61	$54.32	$56.42	$59.79	$497.77
6	7	Manzanillo	$114.55	$26.80	$22.35	$26.24	$36.20	$46.72	$48.76	$53.39	$55.45	$58.77	$489.23
30	118	Orizaba	$114.28	$26.73	$22.30	$26.17	$36.11	$46.61	$48.64	$53.26	$55.32	$58.62	$488.04
26	29	Guaymas	$113.05	$26.45	$22.06	$25.89	$35.73	$46.11	$48.12	$52.69	$54.73	$58.00	$482.82
16	108	Zamora	$108.35	$25.34	$21.14	$24.81	$34.24	$44.19	$46.11	$50.50	$52.45	$55.58	$462.72
27	2	Cárdenas	$107.94	$25.25	$21.06	$24.72	$34.11	$44.03	$45.94	$50.31	$52.25	$55.37	$460.98
17	6	Cuautla	$104.55	$24.46	$20.40	$23.94	$33.04	$42.64	$44.50	$48.73	$50.61	$53.63	$446.50
6	10	Villa de Alvarez	$100.44	$23.49	$19.60	$23.00	$31.74	$40.97	$42.75	$46.81	$48.62	$51.52	$428.93
8	32	Hidalgo del Parral	$100.01	$23.39	$19.52	$22.91	$31.60	$40.79	$42.57	$46.61	$48.41	$51.31	$427.11
		Total	$59,298.32	$13,871.00	$11,570.94	$13,580.97	$18,738.46	$24,185.98	$25,237.65	$27,636.08	$28,704.90	$30,419.86	$253,244.16

5.00% EOL Computers and CRTs Incinerated

Table A4. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
2	4	Tijuana	$4,944.40	$1,156.59	$964.81	$1,132.41	$1,562.45	$2,016.67	$2,104.36	$2,304.35	$2,393.47	$2,536.46	$21,115.97
14	39	Guadalajara	$4,910.27	$1,148.60	$958.15	$1,124.59	$1,551.66	$2,002.75	$2,089.83	$2,288.44	$2,376.94	$2,518.95	$20,970.18
19	39	Monterrey	$4,231.38	$989.80	$825.67	$969.10	$1,337.13	$1,725.85	$1,800.90	$1,972.04	$2,048.31	$2,170.68	$18,070.86
14	120	Zapopan	$3,942.86	$922.31	$769.37	$903.03	$1,245.96	$1,608.17	$1,678.10	$1,837.58	$1,908.64	$2,022.68	$16,838.69
21	114	Puebla	$3,792.60	$887.16	$740.05	$868.61	$1,198.47	$1,546.89	$1,614.15	$1,767.55	$1,835.91	$1,945.59	$16,196.99
9	7	Iztapalapa	$3,640.96	$851.69	$710.46	$833.88	$1,150.55	$1,485.04	$1,549.61	$1,696.87	$1,762.50	$1,867.80	$15,549.36
8	37	Juárez	$3,604.97	$843.27	$703.44	$825.64	$1,139.18	$1,470.36	$1,534.29	$1,680.10	$1,745.08	$1,849.34	$15,395.66
9	3	Coyoacán	$3,602.33	$842.65	$702.93	$825.03	$1,138.35	$1,469.28	$1,533.17	$1,678.87	$1,743.80	$1,847.98	$15,384.39
9	5	Gustavo A. Madero	$3,454.48	$808.07	$674.08	$791.17	$1,091.63	$1,408.98	$1,470.24	$1,609.97	$1,672.23	$1,772.14	$14,752.97
9	14	Benito Juárez	$3,360.36	$786.05	$655.71	$769.62	$1,061.88	$1,370.59	$1,430.19	$1,566.10	$1,626.67	$1,723.85	$14,351.02
2	2	Mexicali	$2,947.75	$689.54	$575.20	$675.12	$931.50	$1,202.30	$1,254.58	$1,373.81	$1,426.94	$1,512.19	$12,588.91
11	20	León	$2,789.53	$652.52	$544.32	$638.88	$881.50	$1,137.76	$1,187.24	$1,300.06	$1,350.34	$1,431.02	$11,913.19
8	19	Chihuahua	$2,782.72	$650.93	$542.99	$637.32	$879.35	$1,134.99	$1,184.34	$1,296.89	$1,347.05	$1,427.53	$11,884.11
22	14	Querétaro	$2,580.17	$603.55	$503.47	$590.93	$815.34	$1,052.37	$1,098.13	$1,202.49	$1,249.00	$1,323.62	$11,019.08
15	58	Nezahualcóyotl	$2,464.19	$576.42	$480.84	$564.37	$778.69	$1,005.07	$1,048.77	$1,148.44	$1,192.86	$1,264.12	$10,523.76
9	12	Tlalpan	$2,463.77	$576.32	$480.76	$564.27	$778.56	$1,004.90	$1,048.59	$1,148.24	$1,192.65	$1,263.91	$10,521.98
15	57	Naucalpan de Juárez	$2,460.48	$575.55	$480.12	$563.52	$777.52	$1,003.56	$1,047.19	$1,146.71	$1,191.06	$1,262.22	$10,507.94
15	33	Ecatepec de Morelos	$2,442.14	$571.26	$476.54	$559.32	$771.72	$996.08	$1,039.39	$1,138.16	$1,182.18	$1,252.81	$10,429.61
9	15	Cuauhtémoc	$2,380.54	$556.85	$464.52	$545.21	$752.26	$970.95	$1,013.17	$1,109.45	$1,152.36	$1,221.21	$10,166.52
19	46	San Nicolás de los Garza	$2,361.59	$552.42	$460.82	$540.87	$746.27	$963.22	$1,005.11	$1,100.62	$1,143.19	$1,211.49	$10,085.61
9	10	Alvaro Obregón	$2,332.32	$545.57	$455.11	$534.17	$737.02	$951.28	$992.65	$1,086.98	$1,129.02	$1,196.47	$9,960.59
19	26	Guadalupe	$2,160.71	$505.43	$421.62	$494.86	$682.79	$881.29	$919.61	$1,007.00	$1,045.95	$1,108.44	$9,227.70
24	28	San Luis Potosí	$2,110.87	$493.77	$411.90	$483.45	$667.04	$860.96	$898.40	$983.78	$1,021.82	$1,082.87	$9,014.86
31	50	Mérida	$2,063.03	$482.58	$402.56	$472.49	$651.92	$841.45	$878.03	$961.48	$998.66	$1,058.33	$8,810.52
15	104	Tlalnepantla de Baz	$2,043.02	$477.90	$398.66	$467.91	$645.60	$833.28	$869.52	$952.15	$988.97	$1,048.06	$8,725.06
25	6	Culiacán	$1,928.93	$451.21	$376.39	$441.78	$609.55	$786.75	$820.96	$898.98	$933.75	$989.54	$8,237.86
5	30	Saltillo	$1,920.04	$449.13	$374.66	$439.74	$606.74	$783.13	$817.18	$894.84	$929.45	$984.97	$8,199.88
1	1	Aguascalientes	$1,919.81	$449.08	$374.61	$439.69	$606.67	$783.03	$817.08	$894.73	$929.33	$984.86	$8,198.89
9	16	Miguel Hidalgo	$1,903.83	$445.34	$371.50	$436.03	$601.62	$776.51	$810.28	$887.28	$921.60	$976.66	$8,130.64
15	106	Toluca	$1,882.24	$440.29	$367.28	$431.09	$594.80	$767.71	$801.09	$877.22	$911.15	$965.59	$8,038.46
26	30	Hermosillo	$1,877.24	$439.12	$366.31	$429.94	$593.21	$765.67	$798.96	$874.89	$908.73	$963.02	$8,017.10
16	53	Morelia	$1,727.26	$404.04	$337.04	$395.59	$545.82	$704.50	$735.13	$804.99	$836.13	$886.08	$7,376.58
23	5	Benito Juárez	$1,706.88	$399.27	$333.07	$390.92	$539.38	$696.19	$726.46	$795.50	$826.26	$875.63	$7,289.55
27	4	Centro	$1,706.23	$399.12	$332.94	$390.78	$539.18	$695.92	$726.18	$795.19	$825.95	$875.29	$7,286.78
5	35	Torreón	$1,678.16	$392.55	$327.46	$384.35	$530.31	$684.47	$714.24	$782.11	$812.36	$860.89	$7,166.90
9	2	Azcapotzalco	$1,569.55	$367.15	$306.27	$359.47	$495.98	$640.17	$668.01	$731.49	$759.78	$805.17	$6,703.04
15	13	Atizapán de Zaragoza	$1,480.85	$346.40	$288.96	$339.16	$467.95	$603.99	$630.26	$690.15	$716.84	$759.67	$6,324.23
15	121	Cuautitlán Izcalli	$1,388.40	$324.77	$270.92	$317.98	$438.74	$566.28	$590.91	$647.06	$672.09	$712.24	$5,929.40
9	17	Venustiano Carranza	$1,383.39	$323.60	$269.94	$316.84	$437.16	$564.24	$588.78	$644.73	$669.67	$709.68	$5,908.03
30	193	Veracruz	$1,350.23	$315.84	$263.47	$309.24	$426.68	$550.72	$574.66	$629.28	$653.61	$692.66	$5,766.40
9	6	Iztacalco	$1,258.75	$294.45	$245.62	$288.29	$397.77	$513.41	$535.73	$586.64	$609.33	$645.74	$5,375.72
28	32	Reynosa	$1,171.30	$273.99	$228.56	$268.26	$370.14	$477.74	$498.51	$545.89	$567.00	$600.87	$5,002.25
10	5	Durango	$1,164.08	$272.30	$227.15	$266.61	$367.85	$474.79	$495.44	$542.52	$563.50	$597.17	$4,971.40
30	87	Xalapa	$1,136.47	$265.84	$221.76	$260.28	$359.13	$463.53	$483.69	$529.65	$550.14	$583.01	$4,853.50
17	7	Cuernavaca	$1,116.04	$261.06	$217.77	$255.61	$352.67	$455.20	$474.99	$520.13	$540.25	$572.53	$4,766.27
7	101	Tuxtla Gutiérrez	$1,067.13	$249.62	$208.23	$244.40	$337.22	$435.25	$454.18	$497.34	$516.57	$547.44	$4,557.38
25	12	Mazatlán	$1,009.46	$236.13	$196.98	$231.20	$318.99	$411.73	$429.63	$470.46	$488.66	$517.85	$4,311.10
9	13	Xochimilco	$973.75	$227.78	$190.01	$223.02	$307.71	$397.16	$414.43	$453.82	$471.37	$499.53	$4,158.59
2	1	Ensenada	$967.59	$226.34	$188.81	$221.61	$305.76	$394.65	$411.81	$450.95	$468.39	$496.37	$4,132.28
28	22	Matamoros	$967.04	$226.21	$188.70	$221.48	$305.59	$394.43	$411.58	$450.69	$468.12	$496.09	$4,129.91
11	7	Celaya	$950.08	$222.24	$185.39	$217.60	$300.23	$387.51	$404.36	$442.79	$459.91	$487.39	$4,057.51
28	27	Nuevo Laredo	$916.92	$214.49	$178.92	$210.00	$289.75	$373.98	$390.25	$427.33	$443.86	$470.38	$3,915.87
28	38	Tampico	$855.73	$200.17	$166.98	$195.99	$270.41	$349.03	$364.20	$398.82	$414.24	$438.99	$3,654.57
15	54	Metepec	$848.05	$198.37	$165.48	$194.23	$267.98	$345.89	$360.93	$395.23	$410.52	$435.04	$3,621.73
12	1	Acapulco de Juárez	$843.09	$197.21	$164.51	$193.09	$266.42	$343.87	$358.82	$392.92	$408.12	$432.50	$3,600.56
19	19	San Pedro Garza García	$804.83	$188.26	$157.05	$184.33	$254.33	$328.27	$342.54	$375.09	$389.60	$412.88	$3,437.17
18	17	Tepic	$797.42	$186.53	$155.60	$182.63	$251.99	$325.24	$339.39	$371.64	$386.01	$409.07	$3,405.52
28	9	Ciudad Madero	$792.83	$185.46	$154.71	$181.58	$250.54	$323.37	$337.43	$369.50	$383.79	$406.72	$3,385.94
26	18	Cajeme	$786.21	$183.91	$153.41	$180.06	$248.44	$320.67	$334.61	$366.41	$380.59	$403.32	$3,357.65
11	17	Irapuato	$782.74	$183.10	$152.74	$179.27	$247.35	$319.25	$333.14	$364.80	$378.90	$401.54	$3,342.81

5.00% EOL Computers and CRTs Incinerated

Table A.4 Cont. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
14	98	Tlaquepaque	$768.89	$179.86	$150.03	$176.10	$242.97	$313.61	$327.24	$358.34	$372.20	$394.44	$3,283.67
13	48	Pachuca de Soto	$765.83	$179.14	$149.44	$175.40	$242.00	$312.36	$325.94	$356.92	$370.72	$392.87	$3,270.61
28	41	Victoria	$753.23	$176.20	$146.98	$172.51	$238.02	$307.22	$320.58	$351.04	$364.62	$386.41	$3,216.81
25	1	Ahome	$750.27	$175.50	$146.40	$171.83	$237.09	$306.01	$319.32	$349.66	$363.19	$384.88	$3,204.15
15	20	Coacalco de Berriozábal	$743.04	$173.81	$144.99	$170.18	$234.80	$303.06	$316.24	$346.30	$359.69	$381.18	$3,173.29
15	109	Tultitlán	$740.03	$173.11	$144.40	$169.49	$233.85	$301.84	$314.96	$344.89	$358.23	$379.63	$3,160.43
14	67	Puerto Vallarta	$690.75	$161.58	$134.79	$158.20	$218.28	$281.73	$293.99	$321.92	$334.37	$354.35	$2,949.96
9	8	Magdalena Contreras, La	$661.98	$154.85	$129.17	$151.61	$209.19	$270.00	$281.74	$308.52	$320.45	$339.60	$2,827.12
20	67	Oaxaca de Juárez	$653.18	$152.79	$127.46	$149.60	$206.41	$266.41	$278.00	$304.42	$316.19	$335.08	$2,789.54
30	39	Coatzacoalcos	$638.45	$149.35	$124.58	$146.22	$201.75	$260.41	$271.73	$297.55	$309.06	$327.52	$2,726.63
19	6	Apodaca	$638.27	$149.30	$124.55	$146.18	$201.69	$260.33	$271.65	$297.47	$308.97	$327.43	$2,725.84
5	18	Monclova	$623.22	$145.78	$121.61	$142.73	$196.94	$254.19	$265.24	$290.45	$301.68	$319.71	$2,661.55
3	3	Paz, La	$617.29	$144.39	$120.45	$141.38	$195.06	$251.77	$262.72	$287.69	$298.81	$316.67	$2,636.23
10	7	Gómez Palacio	$571.06	$133.58	$111.43	$130.79	$180.46	$232.92	$243.05	$266.14	$276.44	$292.95	$2,438.82
15	37	Huixquilucan	$555.40	$129.92	$108.38	$127.20	$175.51	$226.53	$236.38	$258.85	$268.86	$284.92	$2,371.96
4	3	Carmen	$528.49	$123.62	$103.13	$121.04	$167.01	$215.56	$224.93	$246.31	$255.83	$271.12	$2,257.03
26	55	San Luis Río Colorado	$517.28	$121.00	$100.94	$118.47	$163.46	$210.98	$220.16	$241.08	$250.41	$265.37	$2,209.16
9	11	Tláhuac	$516.82	$120.89	$100.85	$118.37	$163.32	$210.80	$219.96	$240.87	$250.18	$265.13	$2,207.18
26	43	Nogales	$510.75	$119.47	$99.66	$116.98	$161.40	$208.32	$217.38	$238.04	$247.24	$262.02	$2,181.27
14	101	Tonalá	$503.34	$117.74	$98.22	$115.28	$159.06	$205.30	$214.23	$234.58	$243.66	$258.21	$2,149.62
15	39	Ixtapaluca	$501.68	$117.35	$97.89	$114.90	$158.53	$204.62	$213.52	$233.81	$242.85	$257.36	$2,142.50
9	4	Cuajimalpa de Morelos	$471.85	$110.37	$92.07	$108.07	$149.10	$192.45	$200.82	$219.90	$228.41	$242.06	$2,015.10
11	27	Salamanca	$469.67	$109.86	$91.65	$107.57	$148.42	$191.56	$199.89	$218.89	$227.36	$240.94	$2,005.81
4	2	Campeche	$456.28	$106.73	$89.03	$104.50	$144.19	$186.10	$194.20	$212.65	$220.88	$234.07	$1,948.64
19	48	Santa Catarina	$455.68	$106.59	$88.92	$104.36	$144.00	$185.86	$193.94	$212.37	$220.58	$233.76	$1,946.07
30	28	Boca del Río	$444.75	$104.04	$86.78	$101.86	$140.54	$181.40	$189.29	$207.28	$215.29	$228.16	$1,899.39
16	52	Lázaro Cárdenas	$439.66	$102.84	$85.79	$100.69	$138.93	$179.32	$187.12	$204.90	$212.83	$225.54	$1,877.63
19	21	General Escobedo	$429.88	$100.56	$83.88	$98.45	$135.84	$175.34	$182.96	$200.35	$208.10	$220.53	$1,835.89
16	102	Uruapan	$420.90	$98.46	$82.13	$96.40	$133.00	$171.67	$179.14	$196.16	$203.75	$215.92	$1,797.51
3	8	Cabos, Los	$420.85	$98.44	$82.12	$96.39	$132.99	$171.65	$179.12	$196.14	$203.72	$215.89	$1,797.31
5	25	Piedras Negras	$417.01	$97.55	$81.37	$95.51	$131.77	$170.08	$177.48	$194.35	$201.86	$213.92	$1,780.90
30	131	Poza Rica de Hidalgo	$415.29	$97.14	$81.04	$95.11	$131.23	$169.38	$176.75	$193.55	$201.03	$213.04	$1,773.58
6	2	Colima	$410.24	$95.96	$80.05	$93.96	$129.64	$167.33	$174.60	$191.19	$198.59	$210.45	$1,752.02
7	89	Tapachula	$409.41	$95.77	$79.89	$93.77	$129.37	$166.99	$174.25	$190.81	$198.19	$210.03	$1,748.45
15	99	Texcoco	$398.94	$93.32	$77.85	$91.37	$126.07	$162.72	$169.79	$185.93	$193.12	$204.66	$1,703.75
23	4	Othón P. Blanco	$385.88	$90.26	$75.30	$88.38	$121.94	$157.39	$164.23	$179.84	$186.79	$197.95	$1,647.97
32	56	Zacatecas	$381.85	$89.32	$74.51	$87.45	$120.67	$155.74	$162.52	$177.96	$184.84	$195.89	$1,630.76
19	9	Cadereyta Jiménez	$373.42	$87.35	$72.87	$85.52	$118.00	$152.31	$158.93	$174.03	$180.76	$191.56	$1,594.76
17	11	Jiutepec	$364.34	$85.23	$71.09	$83.44	$115.13	$148.60	$155.07	$169.80	$176.37	$186.91	$1,555.98
22	16	San Juan del Río	$359.52	$84.10	$70.15	$82.34	$113.61	$146.64	$153.02	$167.56	$174.04	$184.43	$1,535.41
12	29	Chilpancingo de los Bravo	$347.48	$81.28	$67.80	$79.58	$109.81	$141.73	$147.89	$161.94	$168.21	$178.26	$1,483.98
15	60	Nicolás Romero	$335.86	$78.56	$65.54	$76.92	$106.13	$136.99	$142.94	$156.53	$162.58	$172.29	$1,434.33
21	156	Tehuacán	$331.69	$77.59	$64.72	$75.97	$104.81	$135.28	$141.17	$154.58	$160.56	$170.15	$1,416.53
15	31	Chimalhuacán	$323.44	$75.66	$63.11	$74.08	$102.21	$131.92	$137.66	$150.74	$156.57	$165.92	$1,381.32
8	21	Delicias	$315.71	$73.85	$61.60	$72.31	$99.76	$128.77	$134.37	$147.14	$152.83	$161.96	$1,348.28
30	44	Córdoba	$313.48	$73.33	$61.17	$71.80	$99.06	$127.86	$133.42	$146.10	$151.75	$160.82	$1,338.79
25	11	Guasave	$313.44	$73.32	$61.16	$71.79	$99.05	$127.84	$133.40	$146.08	$151.73	$160.79	$1,338.59
11	15	Guanajuato	$311.49	$72.86	$60.78	$71.34	$98.43	$127.05	$132.57	$145.17	$150.79	$159.79	$1,330.28
8	17	Cuauhtémoc	$309.82	$72.47	$60.46	$70.96	$97.91	$126.37	$131.86	$144.39	$149.98	$158.94	$1,323.16
24	35	Soledad de Graciano Sánchez	$309.69	$72.44	$60.43	$70.93	$97.86	$126.31	$131.80	$144.33	$149.91	$158.87	$1,322.57
15	70	Paz, La	$307.14	$71.85	$59.93	$70.34	$97.06	$125.27	$130.72	$143.14	$148.68	$157.56	$1,311.69
30	108	Minatitlán	$302.41	$70.74	$59.01	$69.26	$95.56	$123.35	$128.71	$140.94	$146.39	$155.14	$1,291.51
15	81	Tecámac	$300.14	$70.21	$58.57	$68.74	$94.85	$122.42	$127.74	$139.88	$145.29	$153.97	$1,281.82
32	17	Guadalupe	$291.39	$68.16	$56.86	$66.74	$92.08	$118.85	$124.02	$135.80	$141.05	$149.48	$1,244.43
6	7	Manzanillo	$286.39	$66.99	$55.88	$65.59	$90.50	$116.81	$121.89	$133.47	$138.63	$146.92	$1,223.07
30	118	Orizaba	$285.69	$66.83	$55.75	$65.43	$90.28	$116.53	$121.59	$133.15	$138.30	$146.56	$1,220.10
26	29	Guaymas	$282.64	$66.11	$55.15	$64.73	$89.31	$115.28	$120.29	$131.72	$136.82	$144.99	$1,207.05
16	108	Zamora	$270.87	$63.36	$52.86	$62.04	$85.60	$110.48	$115.28	$126.24	$131.12	$138.96	$1,156.80
27	2	Cárdenas	$269.85	$63.12	$52.66	$61.80	$85.27	$110.06	$114.85	$125.76	$130.63	$138.43	$1,152.45
17	6	Cuautla	$261.38	$61.14	$51.00	$59.86	$82.60	$106.61	$111.24	$121.81	$126.53	$134.08	$1,116.25
6	10	Villa de Alvarez	$251.09	$58.74	$49.00	$57.51	$79.35	$102.41	$106.87	$117.02	$121.55	$128.81	$1,072.34
8	32	Hidalgo del Parral	$250.03	$58.49	$48.79	$57.26	$79.01	$101.98	$106.41	$116.53	$121.03	$128.26	$1,067.79
		Total	$148,245.81	$34,677.50	$28,927.34	$33,952.43	$46,846.15	$60,464.95	$63,094.14	$69,090.19	$71,762.25	$76,049.65	$633,110.40

10.00% EOL Computers and CRTs Incinerated

Table A5. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
2	4	Tijuana	$9,888.81	$2,313.18	$1,929.61	$2,264.81	$3,124.90	$4,033.34	$4,208.73	$4,608.70	$4,786.94	$5,072.93	$42,231.94
14	39	Guadalajara	$9,820.54	$2,297.21	$1,916.29	$2,249.18	$3,103.32	$4,005.50	$4,179.67	$4,576.88	$4,753.89	$5,037.91	$41,940.37
19	39	Monterrey	$8,462.76	$1,979.60	$1,651.35	$1,938.21	$2,674.26	$3,451.70	$3,601.79	$3,944.08	$4,096.62	$4,341.37	$36,141.72
14	120	Zapopan	$7,885.72	$1,844.62	$1,538.75	$1,806.05	$2,491.91	$3,216.35	$3,356.20	$3,675.15	$3,817.29	$4,045.35	$33,677.39
21	114	Puebla	$7,585.21	$1,774.32	$1,480.11	$1,737.22	$2,396.95	$3,093.77	$3,228.30	$3,535.10	$3,671.82	$3,891.19	$32,393.99
9	7	Iztapalapa	$7,281.91	$1,703.38	$1,420.93	$1,667.76	$2,301.11	$2,970.07	$3,099.22	$3,393.75	$3,525.00	$3,735.60	$31,098.72
8	37	Juárez	$7,209.93	$1,686.54	$1,406.88	$1,651.28	$2,278.36	$2,940.71	$3,068.58	$3,360.20	$3,490.16	$3,698.67	$30,791.32
9	3	Coyoacán	$7,204.65	$1,685.30	$1,405.85	$1,650.07	$2,276.69	$2,938.56	$3,066.34	$3,357.74	$3,487.60	$3,695.97	$30,768.77
9	5	Gustavo A. Madero	$6,908.96	$1,616.14	$1,348.15	$1,582.34	$2,183.25	$2,817.95	$2,940.49	$3,219.93	$3,344.46	$3,544.27	$29,505.94
9	14	Benito Juárez	$6,720.72	$1,572.10	$1,311.42	$1,539.23	$2,123.77	$2,741.18	$2,860.37	$3,132.20	$3,253.34	$3,447.71	$28,702.04
2	2	Mexicali	$5,895.51	$1,379.07	$1,150.40	$1,350.24	$1,863.00	$2,404.60	$2,509.16	$2,747.61	$2,853.87	$3,024.38	$25,177.83
11	20	León	$5,579.06	$1,305.05	$1,088.65	$1,277.76	$1,763.00	$2,275.53	$2,374.48	$2,600.13	$2,700.69	$2,862.04	$23,826.38
8	19	Chihuahua	$5,565.44	$1,301.86	$1,085.99	$1,274.64	$1,758.70	$2,269.97	$2,368.68	$2,593.78	$2,694.10	$2,855.06	$23,768.23
22	14	Querétaro	$5,160.34	$1,207.10	$1,006.94	$1,181.86	$1,630.68	$2,104.75	$2,196.27	$2,404.99	$2,498.00	$2,647.24	$22,038.17
15	58	Nezahualcóyotl	$4,928.38	$1,152.84	$961.68	$1,128.74	$1,557.38	$2,010.14	$2,097.54	$2,296.88	$2,385.71	$2,528.24	$21,047.53
9	12	Tlalpan	$4,927.55	$1,152.65	$961.52	$1,128.55	$1,557.12	$2,009.80	$2,097.19	$2,296.49	$2,385.31	$2,527.82	$21,043.97
15	57	Naucalpan de Juárez	$4,920.97	$1,151.11	$960.23	$1,127.04	$1,555.04	$2,007.11	$2,094.39	$2,293.42	$2,382.12	$2,524.44	$21,015.88
15	33	Ecatepec de Morelos	$4,884.28	$1,142.53	$953.07	$1,118.64	$1,543.45	$1,992.15	$2,078.77	$2,276.33	$2,364.36	$2,505.62	$20,859.21
9	15	Cuauhtémoc	$4,761.08	$1,113.71	$929.03	$1,090.42	$1,504.52	$1,941.90	$2,026.34	$2,218.91	$2,304.72	$2,442.42	$20,333.03
19	46	San Nicolás de los Garza	$4,723.19	$1,104.84	$921.64	$1,081.74	$1,492.54	$1,926.44	$2,010.21	$2,201.25	$2,286.38	$2,422.98	$20,171.22
9	10	Alvaro Obregón	$4,664.64	$1,091.15	$910.22	$1,068.33	$1,474.04	$1,902.57	$1,985.29	$2,173.96	$2,258.04	$2,392.95	$19,921.19
19	26	Guadalupe	$4,321.42	$1,010.86	$843.24	$989.73	$1,365.58	$1,762.58	$1,839.22	$2,014.01	$2,091.90	$2,216.88	$18,455.41
24	28	San Luis Potosí	$4,221.74	$987.55	$823.79	$966.90	$1,334.08	$1,721.92	$1,796.79	$1,967.55	$2,043.65	$2,165.74	$18,029.72
31	50	Mérida	$4,126.05	$965.16	$805.12	$944.98	$1,303.85	$1,682.89	$1,756.07	$1,922.95	$1,997.32	$2,116.65	$17,621.04
15	104	Tlalnepantla de Baz	$4,086.03	$955.80	$797.31	$935.82	$1,291.20	$1,666.57	$1,739.03	$1,904.30	$1,977.95	$2,096.12	$17,450.13
25	6	Culiacán	$3,857.87	$902.43	$752.79	$883.56	$1,219.10	$1,573.51	$1,641.93	$1,797.96	$1,867.50	$1,979.07	$16,475.71
5	30	Saltillo	$3,840.08	$898.27	$749.32	$879.49	$1,213.48	$1,566.25	$1,634.36	$1,789.68	$1,858.89	$1,969.95	$16,399.75
1	1	Aguascalientes	$3,839.62	$898.16	$749.23	$879.38	$1,213.33	$1,566.06	$1,634.16	$1,789.46	$1,858.67	$1,969.71	$16,397.77
9	16	Miguel Hidalgo	$3,807.66	$890.68	$742.99	$872.06	$1,203.23	$1,553.03	$1,620.56	$1,774.56	$1,843.20	$1,953.32	$16,261.28
15	106	Toluca	$3,764.49	$880.58	$734.57	$862.17	$1,189.59	$1,535.42	$1,602.18	$1,754.45	$1,822.30	$1,931.17	$16,076.92
26	30	Hermosillo	$3,754.48	$878.24	$732.62	$859.88	$1,186.43	$1,531.34	$1,597.93	$1,749.78	$1,817.46	$1,926.04	$16,034.20
16	53	Morelia	$3,454.52	$808.08	$674.08	$791.18	$1,091.64	$1,409.00	$1,470.26	$1,609.99	$1,672.25	$1,772.16	$14,753.17
23	5	Benito Juárez	$3,413.76	$798.54	$666.13	$781.85	$1,078.76	$1,392.37	$1,452.91	$1,590.99	$1,652.52	$1,751.25	$14,579.10
27	4	Centro	$3,412.47	$798.24	$665.88	$781.55	$1,078.35	$1,391.84	$1,452.36	$1,590.39	$1,651.89	$1,750.59	$14,573.56
5	35	Torreón	$3,356.33	$785.11	$654.92	$768.69	$1,060.61	$1,368.94	$1,428.47	$1,564.22	$1,624.72	$1,721.79	$14,333.81
9	2	Azcapotzalco	$3,139.10	$734.29	$612.53	$718.94	$991.96	$1,280.34	$1,336.01	$1,462.98	$1,519.56	$1,610.35	$13,406.07
15	13	Atizapán de Zaragoza	$2,961.70	$692.80	$577.92	$678.31	$935.91	$1,207.99	$1,260.51	$1,380.30	$1,433.69	$1,519.34	$12,648.46
15	121	Cuautitlán Izcalli	$2,776.79	$649.54	$541.84	$635.96	$877.48	$1,132.57	$1,181.82	$1,294.13	$1,344.18	$1,424.49	$11,858.79
9	17	Venustiano Carranza	$2,766.79	$647.20	$539.89	$633.67	$874.31	$1,128.49	$1,177.56	$1,289.47	$1,339.34	$1,419.35	$11,816.07
30	193	Veracruz	$2,700.46	$631.69	$526.94	$618.48	$853.35	$1,101.44	$1,149.33	$1,258.55	$1,307.23	$1,385.33	$11,532.80
9	6	Iztacalco	$2,517.50	$588.89	$491.24	$576.58	$795.54	$1,026.81	$1,071.46	$1,173.29	$1,218.66	$1,291.47	$10,751.44
28	32	Reynosa	$2,342.60	$547.98	$457.11	$536.52	$740.27	$955.48	$997.02	$1,091.77	$1,134.00	$1,201.75	$10,004.51
10	5	Durango	$2,328.15	$544.60	$454.29	$533.21	$735.70	$949.58	$990.87	$1,085.04	$1,127.00	$1,194.33	$9,942.79
30	87	Xalapa	$2,272.94	$531.68	$443.52	$520.57	$718.26	$927.06	$967.37	$1,059.31	$1,100.28	$1,166.01	$9,707.00
17	7	Cuernavaca	$2,232.09	$522.13	$435.55	$511.21	$705.35	$910.40	$949.99	$1,040.27	$1,080.50	$1,145.05	$9,532.53
7	101	Tuxtla Gutiérrez	$2,134.26	$499.24	$416.46	$488.81	$674.43	$870.50	$908.35	$994.68	$1,033.15	$1,094.87	$9,114.75
25	12	Mazatlán	$2,018.93	$472.27	$393.96	$462.39	$637.99	$823.46	$859.27	$940.93	$977.32	$1,035.70	$8,622.20
9	13	Xochimilco	$1,947.51	$455.56	$380.02	$446.03	$615.42	$794.33	$828.87	$907.64	$942.74	$999.07	$8,317.18
2	1	Ensenada	$1,935.19	$452.68	$377.61	$443.21	$611.52	$789.30	$823.62	$901.90	$936.78	$992.74	$8,264.56
28	22	Matamoros	$1,934.07	$452.42	$377.40	$442.96	$611.17	$788.85	$823.15	$901.38	$936.24	$992.17	$8,259.81
11	7	Celaya	$1,900.17	$444.49	$370.78	$435.19	$600.46	$775.02	$808.72	$885.58	$919.83	$974.78	$8,115.01
28	27	Nuevo Laredo	$1,833.84	$428.97	$357.84	$420.00	$579.50	$747.97	$780.49	$854.66	$887.72	$940.75	$7,831.75
28	38	Tampico	$1,711.47	$400.34	$333.96	$391.97	$540.83	$698.06	$728.41	$797.63	$828.48	$877.98	$7,309.13
15	54	Metepec	$1,696.09	$396.75	$330.96	$388.45	$535.97	$691.78	$721.86	$790.47	$821.04	$870.09	$7,243.46
12	1	Acapulco de Juárez	$1,686.18	$394.43	$329.03	$386.18	$532.84	$687.74	$717.65	$785.85	$816.24	$865.00	$7,201.13
19	19	San Pedro Garza García	$1,609.66	$376.53	$314.09	$368.66	$508.66	$656.53	$685.08	$750.18	$779.20	$825.75	$6,874.34
18	17	Tepic	$1,594.84	$373.06	$311.20	$365.26	$503.97	$650.49	$678.77	$743.28	$772.02	$818.15	$6,811.04
28	9	Ciudad Madero	$1,585.67	$370.92	$309.41	$363.16	$501.08	$646.75	$674.87	$739.00	$767.58	$813.44	$6,771.88
26	18	Cajeme	$1,572.42	$367.82	$306.83	$360.13	$496.89	$641.34	$669.23	$732.83	$761.17	$806.65	$6,715.30
11	17	Irapuato	$1,565.47	$366.19	$305.47	$358.54	$494.69	$638.51	$666.27	$729.59	$757.81	$803.08	$6,685.63

10.00% EOL Computers and CRTs Incinerated

Table A.5 Cont. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
14	98	Tlaquepaque	$1,537.77	$359.71	$300.07	$352.19	$485.94	$627.21	$654.48	$716.68	$744.40	$788.87	$6,567.34
13	48	Pachuca de Soto	$1,531.66	$358.28	$298.87	$350.79	$484.01	$624.72	$651.88	$713.83	$741.44	$785.74	$6,541.23
28	41	Victoria	$1,506.46	$352.39	$293.96	$345.02	$476.05	$614.44	$641.16	$702.09	$729.24	$772.81	$6,433.62
25	1	Ahome	$1,500.53	$351.00	$292.80	$343.66	$474.17	$612.02	$638.63	$699.33	$726.37	$769.77	$6,408.30
15	20	Coacalco de Berriozábal	$1,486.08	$347.62	$289.98	$340.35	$469.61	$606.13	$632.48	$692.59	$719.38	$762.36	$6,346.58
15	109	Tultitlán	$1,480.06	$346.21	$288.81	$338.98	$467.70	$603.67	$629.92	$689.78	$716.46	$759.27	$6,320.87
14	67	Puerto Vallarta	$1,381.49	$323.16	$269.57	$316.40	$436.56	$563.47	$587.97	$643.85	$668.75	$708.70	$5,899.92
9	8	Magdalena Contreras, La	$1,323.97	$309.70	$258.35	$303.23	$418.38	$540.01	$563.49	$617.04	$640.90	$679.19	$5,654.24
20	67	Oaxaca de Juárez	$1,306.37	$305.58	$254.91	$299.19	$412.82	$532.83	$556.00	$608.83	$632.38	$670.16	$5,579.07
30	39	Coatzacoalcos	$1,276.91	$298.69	$249.16	$292.45	$403.51	$520.81	$543.46	$595.10	$618.12	$655.05	$5,453.26
19	6	Apodaca	$1,276.54	$298.61	$249.09	$292.36	$403.39	$520.66	$543.30	$594.93	$617.94	$654.86	$5,451.68
5	18	Monclova	$1,246.43	$291.56	$243.22	$285.47	$393.88	$508.38	$530.49	$580.90	$603.37	$639.41	$5,323.10
3	3	Paz, La	$1,234.57	$288.79	$240.90	$282.75	$390.13	$503.54	$525.44	$575.37	$597.63	$633.33	$5,272.46
10	7	Gómez Palacio	$1,142.12	$267.16	$222.86	$261.58	$360.91	$465.84	$486.09	$532.29	$552.87	$585.90	$4,877.63
15	37	Huixquilucan	$1,110.81	$259.84	$216.75	$254.41	$351.02	$453.07	$472.77	$517.69	$537.72	$569.84	$4,743.91
4	3	Carmen	$1,056.99	$247.25	$206.25	$242.08	$334.01	$431.11	$449.86	$492.61	$511.66	$542.23	$4,514.06
26	55	San Luis Río Colorado	$1,034.57	$242.01	$201.88	$236.95	$326.93	$421.97	$440.32	$482.16	$500.81	$530.73	$4,418.32
9	11	Tláhuac	$1,033.64	$241.79	$201.70	$236.73	$326.63	$421.59	$439.92	$481.73	$500.36	$530.26	$4,414.36
26	43	Nogales	$1,021.51	$238.95	$199.33	$233.95	$322.80	$416.64	$434.76	$476.08	$494.49	$524.03	$4,362.53
14	101	Tonalá	$1,006.69	$235.48	$196.44	$230.56	$318.12	$410.60	$428.45	$469.17	$487.31	$516.43	$4,299.23
15	39	Ixtapaluca	$1,003.35	$234.70	$195.78	$229.80	$317.06	$409.24	$427.03	$467.61	$485.70	$514.72	$4,284.99
9	4	Cuajimalpa de Morelos	$943.69	$220.75	$184.14	$216.13	$298.21	$384.90	$401.64	$439.81	$456.82	$484.11	$4,030.21
11	27	Salamanca	$939.34	$219.73	$183.29	$215.13	$296.83	$383.13	$399.79	$437.78	$454.71	$481.88	$4,011.62
4	2	Campeche	$912.57	$213.47	$178.07	$209.00	$288.37	$372.21	$388.39	$425.30	$441.75	$468.14	$3,897.28
19	48	Santa Catarina	$911.36	$213.18	$177.83	$208.73	$287.99	$371.72	$387.88	$424.74	$441.17	$467.53	$3,892.14
30	28	Boca del Río	$889.50	$208.07	$173.57	$203.72	$281.08	$362.80	$378.58	$414.55	$430.59	$456.31	$3,798.77
16	52	Lázaro Cárdenas	$879.31	$205.69	$171.58	$201.39	$277.86	$358.64	$374.24	$409.80	$425.65	$451.08	$3,755.25
19	21	General Escobedo	$859.76	$201.11	$167.77	$196.91	$271.69	$350.67	$365.92	$400.69	$416.19	$441.06	$3,671.78
16	102	Uruapan	$841.79	$196.91	$164.26	$192.79	$266.01	$343.34	$358.27	$392.32	$407.49	$431.84	$3,595.02
3	8	Cabos, Los	$841.70	$196.89	$164.24	$192.77	$265.98	$343.30	$358.23	$392.28	$407.45	$431.79	$3,594.63
5	25	Piedras Negras	$834.01	$195.09	$162.74	$191.01	$263.55	$340.17	$354.96	$388.69	$403.72	$427.84	$3,561.79
30	131	Poza Rica de Hidalgo	$830.58	$194.29	$162.07	$190.23	$262.47	$338.77	$353.50	$387.09	$402.07	$426.09	$3,547.15
6	2	Colima	$820.49	$191.93	$160.10	$187.91	$259.28	$334.65	$349.20	$382.39	$397.18	$420.91	$3,504.03
7	89	Tapachula	$818.82	$191.54	$159.78	$187.53	$258.75	$333.97	$348.49	$381.61	$396.37	$420.05	$3,496.91
15	99	Texcoco	$797.88	$186.64	$155.69	$182.74	$252.13	$325.43	$339.58	$371.85	$386.24	$409.31	$3,407.50
23	4	Othón P. Blanco	$771.76	$180.53	$150.59	$176.75	$243.88	$314.78	$328.46	$359.68	$373.59	$395.91	$3,295.93
32	56	Zacatecas	$763.70	$178.64	$149.02	$174.91	$241.33	$311.49	$325.03	$355.92	$369.69	$391.78	$3,261.51
19	9	Cadereyta Jiménez	$746.84	$174.70	$145.73	$171.05	$236.00	$304.61	$317.86	$348.07	$361.53	$383.13	$3,189.51
17	11	Jiutepec	$728.68	$170.45	$142.19	$166.89	$230.27	$297.21	$310.13	$339.60	$352.74	$373.81	$3,111.97
22	16	San Juan del Río	$719.05	$168.20	$140.31	$164.68	$227.22	$293.28	$306.03	$335.11	$348.07	$368.87	$3,070.82
12	29	Chilpancingo de los Bravo	$694.96	$162.56	$135.61	$159.17	$219.61	$283.45	$295.78	$323.89	$336.41	$356.51	$2,967.96
15	60	Nicolás Romero	$671.71	$157.13	$131.07	$153.84	$212.26	$273.97	$285.88	$313.05	$325.16	$344.59	$2,868.66
21	156	Tehuacán	$663.37	$155.18	$129.44	$151.93	$209.63	$270.57	$282.33	$309.17	$321.12	$340.31	$2,833.05
15	31	Chimalhuacán	$646.88	$151.32	$126.23	$148.15	$204.42	$263.84	$275.32	$301.48	$313.14	$331.85	$2,762.63
8	21	Delicias	$631.41	$147.70	$123.21	$144.61	$199.53	$257.53	$268.73	$294.27	$305.65	$323.91	$2,696.56
30	44	Córdoba	$626.97	$146.66	$122.34	$143.59	$198.12	$255.72	$266.84	$292.20	$303.50	$321.63	$2,677.58
25	11	Guasave	$626.87	$146.64	$122.32	$143.57	$198.09	$255.68	$266.80	$292.16	$303.45	$321.58	$2,677.18
11	15	Guanajuato	$622.98	$145.73	$121.56	$142.68	$196.86	$254.10	$265.14	$290.34	$301.57	$319.59	$2,660.56
8	17	Cuauhtémoc	$619.65	$144.95	$120.91	$141.92	$195.81	$252.74	$263.73	$288.79	$299.96	$317.88	$2,646.32
24	35	Soledad de Graciano Sánchez	$619.37	$144.88	$120.86	$141.85	$195.72	$252.62	$263.61	$288.66	$299.82	$317.74	$2,645.13
15	70	Paz, La	$614.28	$143.69	$119.86	$140.69	$194.11	$250.54	$261.44	$286.28	$297.36	$315.12	$2,623.37
30	108	Minatitlán	$604.83	$141.48	$118.02	$138.52	$191.13	$246.69	$257.42	$281.88	$292.78	$310.27	$2,583.02
15	81	Tecámac	$600.29	$140.42	$117.13	$137.48	$189.69	$244.84	$255.49	$279.76	$290.58	$307.95	$2,563.64
32	17	Guadalupe	$582.78	$136.32	$113.72	$133.47	$184.16	$237.70	$248.03	$271.61	$282.11	$298.96	$2,488.86
6	7	Manzanillo	$572.77	$133.98	$111.77	$131.18	$181.00	$233.62	$243.78	$266.94	$277.27	$293.83	$2,446.14
30	118	Orizaba	$571.38	$133.66	$111.49	$130.86	$180.56	$233.05	$243.18	$266.29	$276.59	$293.12	$2,440.20
26	29	Guaymas	$565.27	$132.23	$110.30	$129.46	$178.63	$230.56	$240.58	$263.45	$273.63	$289.98	$2,414.09
16	108	Zamora	$541.74	$126.72	$105.71	$124.07	$171.19	$220.96	$230.57	$252.48	$262.24	$277.91	$2,313.60
27	2	Cárdenas	$539.70	$126.25	$105.31	$123.61	$170.55	$220.13	$229.70	$251.53	$261.26	$276.87	$2,304.90
17	6	Cuautla	$522.75	$122.28	$102.00	$119.72	$165.19	$213.21	$222.49	$243.63	$253.05	$268.17	$2,232.50
6	10	Villa de Alvarez	$502.18	$117.47	$97.99	$115.01	$158.69	$204.83	$213.73	$234.04	$243.10	$257.62	$2,144.67
8	32	Hidalgo del Parral	$500.05	$116.97	$97.58	$114.53	$158.02	$203.96	$212.83	$233.05	$242.06	$256.53	$2,135.57
		Total	**$296,491.62**	**$69,355.00**	**$57,854.68**	**$67,904.85**	**$93,692.30**	**$120,929.90**	**$126,188.27**	**$138,180.38**	**$143,524.50**	**$152,099.30**	**$1,266,220.80**

20.00% EOL Computers and CRTs Incinerated

Table A6. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
2	4	Tijuana	$19,777.62	$4,626.36	$3,859.22	$4,529.63	$6,249.79	$8,066.69	$8,417.45	$9,217.39	$9,573.87	$10,145.86	$84,463.88
14	39	Guadalajara	$19,641.07	$4,594.42	$3,832.58	$4,498.35	$6,206.64	$8,011.00	$8,359.34	$9,153.75	$9,507.77	$10,075.81	$83,880.73
19	39	Monterrey	$16,925.51	$3,959.20	$3,302.69	$3,876.41	$5,348.52	$6,903.40	$7,203.58	$7,888.16	$8,193.24	$8,682.74	$72,283.45
14	120	Zapopan	$15,771.44	$3,689.24	$3,077.50	$3,612.10	$4,983.83	$6,432.69	$6,712.40	$7,350.30	$7,634.58	$8,090.70	$67,354.78
21	114	Puebla	$15,170.41	$3,548.65	$2,960.22	$3,474.45	$4,793.90	$6,187.55	$6,456.60	$7,070.19	$7,343.63	$7,782.38	$64,787.98
9	7	Iztapalapa	$14,563.83	$3,406.75	$2,841.85	$3,335.52	$4,602.22	$5,940.14	$6,198.44	$6,787.49	$7,050.00	$7,471.20	$62,197.44
8	37	Juárez	$14,419.87	$3,373.08	$2,813.76	$3,302.55	$4,556.72	$5,881.43	$6,137.17	$6,720.40	$6,980.31	$7,397.35	$61,582.64
9	3	Coyoacán	$14,409.31	$3,370.61	$2,811.70	$3,300.13	$4,553.39	$5,877.12	$6,132.67	$6,715.48	$6,975.20	$7,391.93	$61,537.54
9	5	Gustavo A. Madero	$13,817.91	$3,232.27	$2,696.30	$3,164.69	$4,366.50	$5,635.91	$5,880.97	$6,439.86	$6,688.92	$7,088.55	$59,011.89
9	14	Benito Juárez	$13,441.44	$3,144.21	$2,622.84	$3,078.46	$4,247.54	$5,482.35	$5,720.74	$6,264.40	$6,506.68	$6,895.42	$57,404.08
2	2	Mexicali	$11,791.02	$2,758.14	$2,300.79	$2,700.47	$3,726.00	$4,809.20	$5,018.31	$5,495.22	$5,707.75	$6,048.76	$50,355.66
11	20	León	$11,158.12	$2,610.10	$2,177.29	$2,555.52	$3,526.00	$4,551.06	$4,748.95	$5,200.26	$5,401.38	$5,724.08	$47,652.76
8	19	Chihuahua	$11,130.89	$2,603.72	$2,171.98	$2,549.28	$3,517.40	$4,539.95	$4,737.36	$5,187.57	$5,388.20	$5,710.11	$47,536.45
22	14	Querétaro	$10,320.68	$2,414.20	$2,013.88	$2,363.72	$3,261.37	$4,209.49	$4,392.53	$4,809.97	$4,996.00	$5,294.48	$44,076.33
15	58	Nezahualcóyotl	$9,856.76	$2,305.68	$1,923.36	$2,257.47	$3,114.77	$4,020.27	$4,195.08	$4,593.76	$4,771.42	$5,056.49	$42,095.06
9	12	Tlalpan	$9,855.09	$2,305.29	$1,923.03	$2,257.09	$3,114.24	$4,019.59	$4,194.37	$4,592.98	$4,770.61	$5,055.63	$42,087.93
15	57	Naucalpan de Juárez	$9,841.94	$2,302.21	$1,920.47	$2,254.08	$3,110.08	$4,014.23	$4,188.78	$4,586.85	$4,764.25	$5,048.88	$42,031.76
15	33	Ecatepec de Morelos	$9,768.57	$2,285.05	$1,906.15	$2,237.27	$3,086.90	$3,984.30	$4,157.55	$4,552.66	$4,728.73	$5,011.25	$41,718.42
9	15	Cuauhtémoc	$9,522.15	$2,227.41	$1,858.07	$2,180.84	$3,009.03	$3,883.80	$4,052.67	$4,437.81	$4,609.45	$4,884.84	$40,666.07
19	46	San Nicolás de los Garza	$9,446.38	$2,209.69	$1,843.28	$2,163.48	$2,985.08	$3,852.89	$4,020.42	$4,402.50	$4,572.76	$4,845.96	$40,342.45
9	10	Alvaro Obregón	$9,329.28	$2,182.30	$1,820.43	$2,136.67	$2,948.08	$3,805.13	$3,970.59	$4,347.93	$4,516.08	$4,785.89	$39,842.38
19	26	Guadalupe	$8,642.84	$2,021.72	$1,686.49	$1,979.45	$2,731.17	$3,525.15	$3,678.44	$4,028.01	$4,183.79	$4,433.75	$36,910.81
24	28	San Luis Potosí	$8,443.49	$1,975.09	$1,647.59	$1,933.79	$2,668.17	$3,443.84	$3,593.59	$3,935.10	$4,087.29	$4,331.48	$36,059.43
31	50	Mérida	$8,252.10	$1,930.32	$1,610.24	$1,889.96	$2,607.69	$3,365.78	$3,512.13	$3,845.90	$3,994.64	$4,233.30	$35,242.08
15	104	Tlalnepantla de Baz	$8,172.06	$1,911.60	$1,594.62	$1,871.63	$2,582.40	$3,333.14	$3,478.07	$3,808.60	$3,955.90	$4,192.24	$34,900.26
25	6	Culiacán	$7,715.73	$1,804.86	$1,505.58	$1,767.12	$2,438.20	$3,147.01	$3,283.85	$3,595.93	$3,735.00	$3,958.15	$32,951.42
5	30	Saltillo	$7,680.16	$1,796.53	$1,498.64	$1,758.97	$2,426.95	$3,132.50	$3,268.71	$3,579.35	$3,717.78	$3,939.90	$32,799.50
1	1	Aguascalientes	$7,679.23	$1,796.32	$1,498.46	$1,758.76	$2,426.66	$3,132.13	$3,268.32	$3,578.92	$3,717.33	$3,939.42	$32,795.55
9	16	Miguel Hidalgo	$7,615.31	$1,781.37	$1,485.98	$1,744.12	$2,406.46	$3,106.05	$3,241.11	$3,549.13	$3,686.39	$3,906.63	$32,522.57
15	106	Toluca	$7,528.98	$1,761.17	$1,469.14	$1,724.35	$2,379.18	$3,070.84	$3,204.37	$3,508.89	$3,644.60	$3,862.34	$32,153.85
26	30	Hermosillo	$7,508.97	$1,756.49	$1,465.23	$1,719.76	$2,372.86	$3,062.68	$3,195.85	$3,499.57	$3,634.91	$3,852.08	$32,068.39
16	53	Morelia	$6,909.05	$1,616.16	$1,348.17	$1,582.37	$2,183.28	$2,817.99	$2,940.52	$3,219.97	$3,344.51	$3,544.32	$29,506.34
23	5	Benito Juárez	$6,827.53	$1,597.09	$1,332.26	$1,563.69	$2,157.52	$2,784.74	$2,905.83	$3,181.98	$3,305.04	$3,502.50	$29,158.19
27	4	Centro	$6,824.94	$1,596.48	$1,331.76	$1,563.10	$2,156.70	$2,783.68	$2,904.73	$3,180.77	$3,303.79	$3,501.17	$29,147.11
5	35	Torreón	$6,712.66	$1,570.22	$1,309.85	$1,537.39	$2,121.22	$2,737.89	$2,856.94	$3,128.45	$3,249.44	$3,443.57	$28,667.62
9	2	Azcapotzalco	$6,278.19	$1,468.59	$1,225.07	$1,437.88	$1,983.93	$2,560.68	$2,672.03	$2,925.96	$3,039.12	$3,220.69	$26,812.15
15	13	Atizapán de Zaragoza	$5,923.39	$1,385.59	$1,155.84	$1,356.62	$1,871.81	$2,415.97	$2,521.02	$2,760.61	$2,867.37	$3,038.68	$25,296.91
15	121	Cuautitlán Izcalli	$5,553.59	$1,299.09	$1,083.68	$1,271.93	$1,754.95	$2,265.14	$2,363.63	$2,588.26	$2,688.36	$2,848.97	$23,717.59
9	17	Venustiano Carranza	$5,533.58	$1,294.41	$1,079.77	$1,267.34	$1,748.63	$2,256.98	$2,355.12	$2,578.93	$2,678.67	$2,838.71	$23,632.13
30	193	Veracruz	$5,400.92	$1,263.38	$1,053.89	$1,236.96	$1,706.71	$2,202.87	$2,298.66	$2,517.11	$2,614.46	$2,770.66	$23,065.60
9	6	Iztacalco	$5,035.00	$1,177.78	$982.48	$1,153.16	$1,591.08	$2,053.62	$2,142.92	$2,346.57	$2,437.32	$2,582.94	$21,502.89
28	32	Reynosa	$4,685.21	$1,095.96	$914.23	$1,073.04	$1,480.54	$1,910.95	$1,994.05	$2,183.55	$2,268.00	$2,403.50	$20,009.02
10	5	Durango	$4,656.30	$1,089.20	$908.59	$1,066.42	$1,471.41	$1,899.16	$1,981.75	$2,170.08	$2,254.01	$2,388.67	$19,885.58
30	87	Xalapa	$4,545.88	$1,063.37	$887.04	$1,041.13	$1,436.51	$1,854.13	$1,934.75	$2,118.61	$2,200.55	$2,332.02	$19,414.00
17	7	Cuernavaca	$4,464.17	$1,044.25	$871.10	$1,022.42	$1,410.69	$1,820.80	$1,899.97	$2,080.54	$2,161.00	$2,290.11	$19,065.06
7	101	Tuxtla Gutiérrez	$4,268.53	$998.49	$832.92	$977.61	$1,348.87	$1,741.00	$1,816.71	$1,989.35	$2,066.29	$2,189.74	$18,229.51
25	12	Mazatlán	$4,037.86	$944.53	$787.91	$924.78	$1,275.98	$1,646.92	$1,718.53	$1,881.85	$1,954.63	$2,071.41	$17,244.41
9	13	Xochimilco	$3,895.01	$911.12	$760.04	$892.07	$1,230.84	$1,588.66	$1,657.74	$1,815.28	$1,885.48	$1,998.13	$16,634.36
2	1	Ensenada	$3,870.37	$905.35	$755.23	$886.42	$1,223.05	$1,578.61	$1,647.25	$1,803.79	$1,873.55	$1,985.49	$16,529.12
28	22	Matamoros	$3,868.15	$904.83	$754.80	$885.91	$1,222.35	$1,577.70	$1,646.30	$1,802.76	$1,872.48	$1,984.35	$16,519.63
11	7	Celaya	$3,800.34	$888.97	$741.56	$870.38	$1,200.92	$1,550.04	$1,617.44	$1,771.15	$1,839.65	$1,949.56	$16,230.03
28	27	Nuevo Laredo	$3,667.68	$857.94	$715.68	$840.00	$1,159.00	$1,495.94	$1,560.98	$1,709.33	$1,775.44	$1,881.51	$15,663.50
28	38	Tampico	$3,422.94	$800.69	$667.92	$783.95	$1,081.66	$1,396.11	$1,456.82	$1,595.26	$1,656.96	$1,755.96	$14,618.26
15	54	Metepec	$3,392.18	$793.50	$661.92	$776.90	$1,071.94	$1,383.57	$1,443.73	$1,580.93	$1,642.07	$1,740.18	$14,486.92
12	1	Acapulco de Juárez	$3,372.36	$788.86	$658.05	$772.36	$1,065.68	$1,375.48	$1,435.29	$1,571.69	$1,632.48	$1,730.01	$14,402.25
19	19	San Pedro Garza García	$3,219.32	$753.06	$628.19	$737.31	$1,017.32	$1,313.06	$1,370.16	$1,500.37	$1,558.40	$1,651.50	$13,748.68
18	17	Tepic	$3,189.68	$746.13	$622.40	$730.52	$1,007.95	$1,300.97	$1,357.54	$1,486.55	$1,544.05	$1,636.29	$13,622.08
28	9	Ciudad Madero	$3,171.33	$741.83	$618.83	$726.32	$1,002.15	$1,293.49	$1,349.73	$1,478.00	$1,535.17	$1,626.88	$13,543.75
26	18	Cajeme	$3,144.84	$735.64	$613.66	$720.26	$993.78	$1,282.68	$1,338.46	$1,465.66	$1,522.34	$1,613.29	$13,430.60
11	17	Irapuato	$3,130.94	$732.39	$610.94	$717.07	$989.39	$1,277.02	$1,332.54	$1,459.18	$1,515.61	$1,606.16	$13,371.26

20.00% EOL Computers and CRTs Incinerated

Table A.6 Cont. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
14	98	Tlaquepaque	$3,075.55	$719.43	$600.13	$704.39	$971.88	$1,254.42	$1,308.97	$1,433.36	$1,488.80	$1,577.75	$13,134.68
13	48	Pachuca de Soto	$3,063.32	$716.57	$597.75	$701.59	$968.02	$1,249.43	$1,303.76	$1,427.66	$1,482.88	$1,571.47	$13,082.45
28	41	Victoria	$3,012.92	$704.78	$587.91	$690.04	$952.09	$1,228.88	$1,282.32	$1,404.18	$1,458.48	$1,545.62	$12,867.24
25	1	Ahome	$3,001.07	$702.01	$585.60	$687.33	$948.35	$1,224.04	$1,277.27	$1,398.65	$1,452.74	$1,539.54	$12,816.60
15	20	Coacalco de Berriozábal	$2,972.16	$695.25	$579.96	$680.71	$939.21	$1,212.26	$1,264.97	$1,385.18	$1,438.75	$1,524.71	$12,693.16
15	109	Tultitlán	$2,960.12	$692.43	$577.61	$677.95	$935.41	$1,207.34	$1,259.84	$1,379.57	$1,432.92	$1,518.53	$12,641.73
14	67	Puerto Vallarta	$2,762.99	$646.32	$539.14	$632.80	$873.11	$1,126.94	$1,175.94	$1,287.70	$1,337.50	$1,417.41	$11,799.85
9	8	Magdalena Contreras, La	$2,647.93	$619.40	$516.69	$606.45	$836.76	$1,080.01	$1,126.97	$1,234.07	$1,281.80	$1,358.38	$11,308.48
20	67	Oaxaca de Juárez	$2,612.73	$611.17	$509.82	$598.39	$825.63	$1,065.65	$1,111.99	$1,217.67	$1,264.76	$1,340.32	$11,158.15
30	39	Coatzacoalcos	$2,553.82	$597.39	$498.33	$584.90	$807.01	$1,041.62	$1,086.92	$1,190.21	$1,236.24	$1,310.10	$10,906.53
19	6	Apodaca	$2,553.07	$597.21	$498.18	$584.73	$806.78	$1,041.32	$1,086.60	$1,189.86	$1,235.88	$1,309.72	$10,903.36
5	18	Monclova	$2,492.86	$583.13	$486.43	$570.93	$787.75	$1,016.76	$1,060.97	$1,161.80	$1,206.73	$1,278.83	$10,646.21
3	3	Paz, La	$2,469.15	$577.58	$481.81	$565.50	$780.26	$1,007.09	$1,050.88	$1,150.75	$1,195.25	$1,266.66	$10,544.93
10	7	Gómez Palacio	$2,284.24	$534.33	$445.73	$523.16	$721.83	$931.67	$972.18	$1,064.57	$1,105.75	$1,171.81	$9,755.27
15	37	Huixquilucan	$2,221.62	$519.68	$433.51	$508.81	$702.04	$906.13	$945.53	$1,035.39	$1,075.43	$1,139.68	$9,487.83
4	3	Carmen	$2,113.98	$494.50	$412.50	$484.16	$668.02	$862.23	$899.72	$985.22	$1,023.32	$1,084.46	$9,028.11
26	55	San Luis Río Colorado	$2,069.14	$484.01	$403.75	$473.89	$653.85	$843.94	$880.64	$964.33	$1,001.62	$1,061.46	$8,836.63
9	11	Tláhuac	$2,067.29	$483.58	$403.39	$473.47	$653.27	$843.18	$879.85	$963.46	$1,000.72	$1,060.51	$8,828.72
26	43	Nogales	$2,043.02	$477.90	$398.66	$467.91	$645.60	$833.28	$869.52	$952.15	$988.97	$1,048.06	$8,725.06
14	101	Tonalá	$2,013.37	$470.97	$392.87	$461.12	$636.23	$821.19	$856.90	$938.33	$974.63	$1,032.85	$8,598.47
15	39	Ixtapaluca	$2,006.70	$469.41	$391.57	$459.59	$634.12	$818.47	$854.06	$935.23	$971.40	$1,029.43	$8,569.98
9	4	Cuajimalpa de Morelos	$1,887.39	$441.50	$368.29	$432.26	$596.42	$769.81	$803.28	$879.62	$913.64	$968.22	$8,060.42
11	27	Salamanca	$1,878.68	$439.46	$366.59	$430.27	$593.67	$766.26	$799.57	$875.56	$909.42	$963.76	$8,023.23
4	2	Campeche	$1,825.13	$426.93	$356.14	$418.01	$576.75	$744.42	$776.79	$850.61	$883.50	$936.29	$7,794.56
19	48	Santa Catarina	$1,822.72	$426.37	$355.67	$417.45	$575.99	$743.43	$775.76	$849.48	$882.34	$935.05	$7,784.27
30	28	Boca del Río	$1,779.00	$416.14	$347.14	$407.44	$562.17	$725.60	$757.15	$829.11	$861.17	$912.62	$7,597.54
16	52	Lázaro Cárdenas	$1,758.62	$411.37	$343.16	$402.77	$555.73	$717.29	$748.48	$819.61	$851.31	$902.17	$7,510.50
19	21	General Escobedo	$1,719.53	$402.23	$335.53	$393.82	$543.38	$701.34	$731.84	$801.39	$832.38	$882.11	$7,343.55
16	102	Uruapan	$1,683.58	$393.82	$328.52	$385.59	$532.02	$686.68	$716.54	$784.64	$814.98	$863.67	$7,190.05
3	8	Cabos, Los	$1,683.40	$393.78	$328.48	$385.55	$531.96	$686.61	$716.46	$784.55	$814.89	$863.58	$7,189.26
5	25	Piedras Negras	$1,668.02	$390.18	$325.48	$382.02	$527.10	$680.33	$709.92	$777.38	$807.45	$855.69	$7,123.58
30	131	Poza Rica de Hidalgo	$1,661.17	$388.58	$324.14	$380.45	$524.93	$677.54	$707.00	$774.19	$804.13	$852.17	$7,094.31
6	2	Colima	$1,640.97	$383.85	$320.20	$375.83	$518.55	$669.30	$698.41	$764.78	$794.35	$841.81	$7,008.06
7	89	Tapachula	$1,637.64	$383.07	$319.55	$375.06	$517.50	$667.94	$696.99	$763.22	$792.74	$840.10	$6,993.82
15	99	Texcoco	$1,595.76	$373.28	$311.38	$365.47	$504.27	$650.86	$679.16	$743.71	$772.47	$818.62	$6,815.00
23	4	Othón P. Blanco	$1,543.52	$361.06	$301.19	$353.51	$487.76	$629.55	$656.93	$719.36	$747.18	$791.82	$6,591.87
32	56	Zacatecas	$1,527.40	$357.29	$298.04	$349.82	$482.66	$622.98	$650.07	$711.85	$739.38	$783.55	$6,523.03
19	9	Cadereyta Jiménez	$1,493.68	$349.40	$291.46	$342.09	$472.01	$609.23	$635.72	$696.13	$723.05	$766.25	$6,379.02
17	11	Jiutepec	$1,457.36	$340.91	$284.38	$333.78	$460.53	$594.41	$620.26	$679.21	$705.48	$747.62	$6,223.94
22	16	San Juan del Río	$1,438.10	$336.40	$280.62	$329.36	$454.44	$586.56	$612.06	$670.23	$696.15	$737.74	$6,141.65
12	29	Chilpancingo de los Bravo	$1,389.92	$325.13	$271.22	$318.33	$439.22	$566.91	$591.56	$647.78	$672.83	$713.03	$5,935.92
15	60	Nicolás Romero	$1,343.42	$314.25	$262.14	$307.68	$424.53	$547.94	$571.77	$626.10	$650.32	$689.17	$5,737.32
21	156	Tehuacán	$1,326.75	$310.35	$258.89	$303.86	$419.26	$541.14	$564.67	$618.33	$642.25	$680.62	$5,666.11
15	31	Chimalhuacán	$1,293.77	$302.64	$252.45	$296.31	$408.83	$527.69	$550.63	$602.96	$626.28	$663.70	$5,525.27
8	21	Delicias	$1,262.83	$295.40	$246.42	$289.22	$399.06	$515.07	$537.47	$588.54	$611.30	$647.83	$5,393.13
30	44	Córdoba	$1,253.93	$293.32	$244.68	$287.19	$396.25	$511.44	$533.68	$584.40	$607.00	$643.26	$5,355.15
25	11	Guasave	$1,253.75	$293.28	$244.65	$287.14	$396.19	$511.37	$533.60	$584.31	$606.91	$643.17	$5,354.36
11	15	Guanajuato	$1,245.97	$291.46	$243.13	$285.36	$393.73	$508.19	$530.29	$580.68	$603.14	$639.18	$5,321.13
8	17	Cuauhtémoc	$1,239.30	$289.90	$241.83	$283.83	$391.62	$505.47	$527.45	$577.58	$599.91	$635.76	$5,292.64
24	35	Soledad de Graciano Sánchez	$1,238.74	$289.77	$241.72	$283.71	$391.45	$505.24	$527.21	$577.32	$599.65	$635.47	$5,290.27
15	70	Paz, La	$1,228.55	$287.38	$239.73	$281.37	$388.23	$501.09	$522.88	$572.57	$594.71	$630.24	$5,246.75
30	108	Minatitlán	$1,209.65	$282.96	$236.04	$277.04	$382.25	$493.38	$514.83	$563.76	$585.56	$620.55	$5,166.04
15	81	Tecámac	$1,200.57	$280.84	$234.27	$274.97	$379.39	$489.68	$510.97	$559.53	$581.17	$615.89	$5,127.27
32	17	Guadalupe	$1,165.56	$272.65	$227.44	$266.95	$368.32	$475.40	$496.07	$543.21	$564.22	$597.93	$4,977.73
6	7	Manzanillo	$1,145.55	$267.97	$223.53	$262.36	$362.00	$467.23	$487.55	$533.88	$554.53	$587.66	$4,892.27
30	118	Orizaba	$1,142.77	$267.32	$222.99	$261.73	$361.12	$466.10	$486.37	$532.59	$553.19	$586.24	$4,880.40
26	29	Guaymas	$1,130.54	$264.46	$220.60	$258.93	$357.25	$461.11	$481.16	$526.89	$547.27	$579.96	$4,828.18
16	108	Zamora	$1,083.48	$253.45	$211.42	$248.15	$342.38	$441.92	$461.14	$504.96	$524.49	$555.82	$4,627.20
27	2	Cárdenas	$1,079.41	$252.49	$210.63	$247.21	$341.10	$440.26	$459.40	$503.06	$522.51	$553.73	$4,609.80
17	6	Cuautla	$1,045.50	$244.56	$204.01	$239.45	$330.38	$426.43	$444.97	$487.26	$506.10	$536.34	$4,465.00
6	10	Villa de Alvarez	$1,004.37	$234.94	$195.98	$230.03	$317.38	$409.65	$427.46	$468.09	$486.19	$515.24	$4,289.34
8	32	Hidalgo del Parral	$1,000.11	$233.94	$195.15	$229.05	$316.04	$407.91	$425.65	$466.10	$484.13	$513.05	$4,271.14
		Total	$592,983.25	$138,710.00	$115,709.36	$135,809.70	$187,384.60	$241,859.80	$252,376.54	$276,360.76	$287,049.00	$304,198.60	$2,532,441.60

100.00% EOL Computers and CRTs Incinerated

Table A7. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
2	4	Tijuana	$98,888.10	$23,131.80	$19,296.12	$22,648.13	$31,248.96	$40,333.44	$42,087.25	$46,086.95	$47,869.36	$50,729.29	$422,319.41
14	39	Guadalajara	$98,205.37	$22,972.09	$19,162.90	$22,491.77	$31,033.21	$40,054.98	$41,796.68	$45,768.76	$47,538.87	$50,379.05	$419,403.67
19	39	Monterrey	$84,627.57	$19,795.99	$16,513.45	$19,382.07	$26,742.58	$34,517.01	$36,017.90	$39,440.81	$40,966.18	$43,413.68	$361,417.24
14	120	Zapopan	$78,857.21	$18,446.19	$15,387.48	$18,060.50	$24,919.13	$32,163.45	$33,562.01	$36,751.52	$38,172.89	$40,453.51	$336,773.90
21	114	Puebla	$75,852.07	$17,743.23	$14,801.08	$17,372.24	$23,969.50	$30,937.75	$32,283.01	$35,350.97	$36,718.17	$38,911.88	$323,939.89
9	7	Iztapalapa	$72,819.13	$17,033.77	$14,209.26	$16,677.61	$23,011.08	$29,700.71	$30,992.18	$33,937.47	$35,250.00	$37,355.99	$310,987.20
8	37	Juárez	$72,099.34	$16,865.40	$14,068.81	$16,512.76	$22,783.62	$29,407.13	$30,685.83	$33,602.01	$34,901.57	$36,986.74	$307,913.22
9	3	Coyoacán	$72,046.54	$16,853.05	$14,058.51	$16,500.67	$22,766.94	$29,385.59	$30,663.36	$33,577.40	$34,876.01	$36,959.66	$307,687.71
9	5	Gustavo A. Madero	$69,089.57	$16,161.36	$13,481.51	$15,823.44	$21,832.52	$28,179.53	$29,404.86	$32,199.30	$33,444.61	$35,442.74	$295,059.43
9	14	Benito Juárez	$67,207.19	$15,721.03	$13,114.20	$15,392.32	$21,237.69	$27,411.76	$28,603.70	$31,322.01	$32,533.39	$34,477.08	$287,020.38
2	2	Mexicali	$58,955.09	$13,790.71	$11,503.96	$13,502.36	$18,630.00	$24,045.98	$25,091.57	$27,476.11	$28,538.75	$30,243.78	$251,778.30
11	20	León	$55,790.61	$13,050.48	$10,886.47	$12,777.61	$17,630.01	$22,755.29	$23,744.75	$26,001.30	$27,006.90	$28,620.41	$238,263.82
8	19	Chihuahua	$55,654.43	$13,018.62	$10,859.90	$12,746.42	$17,586.98	$22,699.75	$23,686.80	$25,937.83	$26,940.98	$28,550.55	$237,682.26
22	14	Querétaro	$51,603.42	$12,071.02	$10,069.42	$11,818.62	$16,306.84	$21,047.46	$21,962.66	$24,049.85	$24,979.98	$26,472.40	$220,381.67
15	58	Nezahualcóyotl	$49,283.79	$11,528.41	$9,616.79	$11,287.36	$15,573.83	$20,101.36	$20,975.42	$22,968.79	$23,857.10	$25,282.43	$210,475.28
9	12	Tlalpan	$49,275.45	$11,526.46	$9,615.16	$11,285.45	$15,571.20	$20,097.95	$20,971.87	$22,964.90	$23,853.07	$25,278.16	$210,439.67
15	57	Naucalpan de Juárez	$49,209.68	$11,511.07	$9,602.33	$11,270.39	$15,550.42	$20,071.13	$20,943.88	$22,934.25	$23,821.23	$25,244.41	$210,158.78
15	33	Ecatepec de Morelos	$48,842.84	$11,425.26	$9,530.75	$11,186.37	$15,434.49	$19,921.50	$20,787.75	$22,763.28	$23,643.65	$25,056.23	$208,592.11
9	15	Cuauhtémoc	$47,610.76	$11,137.06	$9,290.33	$10,904.19	$15,045.15	$19,418.98	$20,263.37	$22,189.07	$23,047.23	$24,424.18	$203,330.33
19	46	San Nicolás de los Garza	$47,231.88	$11,048.43	$9,216.40	$10,817.42	$14,925.42	$19,264.44	$20,102.12	$22,012.49	$22,863.82	$24,229.81	$201,712.23
9	10	Alvaro Obregón	$46,646.41	$10,911.48	$9,102.16	$10,683.33	$14,740.42	$19,025.65	$19,852.94	$21,739.63	$22,580.41	$23,929.47	$199,211.90
19	26	Guadalupe	$43,214.21	$10,108.62	$8,432.43	$9,897.26	$13,655.83	$17,625.76	$18,392.18	$20,140.05	$20,918.97	$22,168.76	$184,554.07
24	28	San Luis Potosí	$42,217.44	$9,875.46	$8,237.93	$9,668.97	$13,340.85	$17,219.21	$17,967.95	$19,675.50	$20,436.45	$21,657.42	$180,297.17
31	50	Mérida	$41,260.50	$9,651.61	$8,051.20	$9,449.81	$13,038.45	$16,828.90	$17,560.67	$19,229.52	$19,973.22	$21,166.51	$176,210.39
15	104	Tlalnepantla de Baz	$40,860.31	$9,558.00	$7,973.11	$9,358.15	$12,911.99	$16,665.68	$17,390.35	$19,043.01	$19,779.50	$20,961.21	$174,501.30
25	6	Culiacán	$38,578.66	$9,024.28	$7,527.89	$8,835.59	$12,190.98	$15,735.06	$16,419.26	$17,979.64	$18,675.01	$19,790.74	$164,757.11
5	30	Saltillo	$38,400.80	$8,982.67	$7,493.18	$8,794.85	$12,134.77	$15,662.52	$16,343.57	$17,896.75	$18,588.91	$19,699.49	$163,997.51
1	1	Aguascalientes	$38,396.17	$8,981.59	$7,492.28	$8,793.79	$12,133.31	$15,660.63	$16,341.59	$17,894.59	$18,586.67	$19,697.12	$163,977.73
9	16	Miguel Hidalgo	$38,076.57	$8,906.83	$7,429.92	$8,720.60	$12,032.32	$15,530.27	$16,205.57	$17,745.64	$18,431.96	$19,533.16	$162,612.83
15	106	Toluca	$37,644.88	$8,805.85	$7,345.68	$8,621.73	$11,895.90	$15,354.20	$16,021.84	$17,544.45	$18,222.99	$19,311.71	$160,769.23
26	30	Hermosillo	$37,544.83	$8,782.45	$7,326.16	$8,598.81	$11,864.29	$15,313.39	$15,979.26	$17,497.83	$18,174.55	$19,260.38	$160,341.96
16	53	Morelia	$34,545.25	$8,080.79	$6,740.85	$7,911.83	$10,916.41	$14,089.95	$14,702.62	$16,099.87	$16,722.53	$17,721.61	$147,531.69
23	5	Benito Juárez	$34,137.65	$7,985.44	$6,661.31	$7,818.47	$10,787.60	$13,923.71	$14,529.15	$15,909.90	$16,525.22	$17,512.51	$145,790.95
27	4	Centro	$34,124.68	$7,982.41	$6,658.78	$7,815.50	$10,783.51	$13,918.42	$14,523.63	$15,903.86	$16,518.94	$17,505.85	$145,735.57
5	35	Torreón	$33,563.30	$7,851.09	$6,549.24	$7,686.93	$10,606.11	$13,689.45	$14,284.70	$15,642.23	$16,247.19	$17,217.87	$143,338.09
9	2	Azcapotzalco	$31,390.96	$7,342.94	$6,125.35	$7,189.41	$9,919.64	$12,803.42	$13,360.14	$14,629.81	$15,195.61	$16,103.47	$134,060.74
15	13	Atizapán de Zaragoza	$29,616.96	$6,927.97	$5,779.18	$6,783.11	$9,359.05	$12,079.86	$12,605.12	$13,803.03	$14,336.86	$15,193.41	$126,484.56
15	121	Cuautitlán Izcalli	$27,767.93	$6,495.44	$5,418.38	$6,359.63	$8,774.75	$11,325.69	$11,818.16	$12,941.29	$13,441.79	$14,244.86	$118,587.93
9	17	Venustiano Carranza	$27,667.88	$6,472.04	$5,398.86	$6,336.72	$8,743.14	$11,284.89	$11,775.58	$12,894.66	$13,393.36	$14,193.54	$118,160.66
30	193	Veracruz	$27,004.60	$6,316.89	$5,269.43	$6,184.81	$8,533.54	$11,014.35	$11,493.29	$12,585.54	$13,072.28	$13,853.28	$115,328.00
9	6	Iztacalco	$25,175.02	$5,888.91	$4,912.42	$5,765.78	$7,955.39	$10,268.12	$10,714.61	$11,732.86	$12,186.62	$12,914.71	$107,514.45
28	32	Reynosa	$23,426.03	$5,479.79	$4,571.14	$5,365.22	$7,402.70	$9,554.77	$9,970.23	$10,917.74	$11,339.98	$12,017.48	$100,045.09
10	5	Durango	$23,281.52	$5,445.99	$4,542.94	$5,332.12	$7,357.03	$9,495.82	$9,908.73	$10,850.39	$11,270.03	$11,943.35	$99,427.92
30	87	Xalapa	$22,729.40	$5,316.84	$4,435.21	$5,205.67	$7,182.56	$9,270.63	$9,673.74	$10,593.07	$11,002.76	$11,660.11	$97,070.01
17	7	Cuernavaca	$22,320.87	$5,221.27	$4,355.49	$5,112.10	$7,053.47	$9,104.00	$9,499.87	$10,402.68	$10,805.00	$11,450.54	$95,325.31
7	101	Tuxtla Gutiérrez	$21,342.63	$4,992.44	$4,164.61	$4,888.06	$6,744.34	$8,705.01	$9,083.53	$9,946.77	$10,331.46	$10,948.70	$91,147.53
25	12	Mazatlán	$20,189.30	$4,722.66	$3,939.56	$4,623.91	$6,379.88	$8,234.60	$8,592.66	$9,409.25	$9,773.16	$10,357.05	$86,222.03
9	13	Xochimilco	$19,475.07	$4,555.59	$3,800.19	$4,460.33	$6,154.18	$7,943.29	$8,288.68	$9,076.39	$9,427.41	$9,990.65	$83,171.78
2	1	Ensenada	$19,351.86	$4,526.77	$3,776.15	$4,432.12	$6,115.25	$7,893.03	$8,236.25	$9,018.96	$9,367.77	$9,927.45	$82,645.60
28	22	Matamoros	$19,340.74	$4,524.17	$3,773.98	$4,429.57	$6,111.74	$7,888.50	$8,231.51	$9,013.78	$9,362.39	$9,921.74	$82,598.13
11	7	Celaya	$19,001.69	$4,444.86	$3,707.82	$4,351.92	$6,004.60	$7,750.21	$8,087.21	$8,855.77	$9,198.26	$9,747.81	$81,150.15
28	27	Nuevo Laredo	$18,338.41	$4,289.70	$3,578.39	$4,200.01	$5,795.00	$7,479.68	$7,804.92	$8,546.65	$8,877.19	$9,407.55	$78,317.49
28	38	Tampico	$17,114.68	$4,003.45	$3,339.60	$3,919.74	$5,408.29	$6,980.56	$7,284.09	$7,976.32	$8,284.81	$8,779.78	$73,091.31
15	54	Metepec	$16,960.90	$3,967.48	$3,309.60	$3,884.52	$5,359.70	$6,917.83	$7,218.64	$7,904.65	$8,210.37	$8,700.89	$72,434.58
12	1	Acapulco de Juárez	$16,861.78	$3,944.29	$3,290.25	$3,861.82	$5,328.38	$6,877.41	$7,176.45	$7,858.46	$8,162.38	$8,650.04	$72,011.26
19	19	San Pedro Garza García	$16,096.60	$3,765.30	$3,140.94	$3,686.57	$5,086.58	$6,565.31	$6,850.79	$7,501.84	$7,791.98	$8,257.51	$68,743.42
18	17	Tepic	$15,948.38	$3,730.63	$3,112.02	$3,652.62	$5,039.74	$6,504.86	$6,787.71	$7,432.77	$7,720.23	$8,181.47	$68,110.42
28	9	Ciudad Madero	$15,856.67	$3,709.17	$3,094.13	$3,631.62	$5,010.76	$6,467.45	$6,748.67	$7,390.02	$7,675.83	$8,134.42	$67,718.75
26	18	Cajeme	$15,724.20	$3,678.19	$3,068.28	$3,601.28	$4,968.90	$6,413.42	$6,692.29	$7,328.29	$7,611.71	$8,066.47	$67,153.01
11	17	Irapuato	$15,654.72	$3,661.94	$3,054.72	$3,585.37	$4,946.94	$6,385.08	$6,662.72	$7,295.91	$7,578.07	$8,030.82	$66,856.29

100.00% EOL Computers and CRTs Incinerated

Table A.7 Cont. Health Costs Allocation by Municipalities and by Year (U.S. Currency)

State ID	Municipal ID	Municicpality	Subtotal Uptodate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total USD
14	98	Tlaquepaque	$15,377.74	$3,597.14	$3,000.67	$3,521.93	$4,859.41	$6,272.11	$6,544.84	$7,166.82	$7,443.99	$7,888.73	$65,673.38
13	48	Pachuca de Soto	$15,316.59	$3,582.84	$2,988.74	$3,507.93	$4,840.09	$6,247.17	$6,518.82	$7,138.32	$7,414.40	$7,857.37	$65,412.27
28	41	Victoria	$15,064.62	$3,523.90	$2,939.57	$3,450.22	$4,760.47	$6,144.40	$6,411.58	$7,020.89	$7,292.42	$7,728.11	$64,336.18
25	1	Ahome	$15,005.33	$3,510.03	$2,928.00	$3,436.64	$4,741.73	$6,120.22	$6,386.34	$6,993.26	$7,263.72	$7,697.69	$64,082.98
15	20	Coacalco de Berriozábal	$14,860.82	$3,476.23	$2,899.81	$3,403.54	$4,696.07	$6,061.28	$6,324.84	$6,925.91	$7,193.77	$7,623.56	$63,465.81
15	109	Tultitlán	$14,800.61	$3,462.14	$2,888.06	$3,389.75	$4,677.04	$6,036.72	$6,299.21	$6,897.85	$7,164.62	$7,592.67	$63,208.65
14	67	Puerto Vallarta	$13,814.95	$3,231.58	$2,695.72	$3,164.01	$4,365.57	$5,634.70	$5,879.71	$6,438.48	$6,687.49	$7,087.03	$58,999.23
9	8	Magdalena Contreras, La	$13,239.67	$3,097.01	$2,583.47	$3,032.25	$4,183.78	$5,400.06	$5,634.87	$6,170.37	$6,409.01	$6,791.91	$56,542.41
20	67	Oaxaca de Juárez	$13,063.66	$3,055.84	$2,549.12	$2,991.94	$4,128.16	$5,328.27	$5,559.96	$6,088.34	$6,323.81	$6,701.62	$55,790.73
30	39	Coatzacoalcos	$12,769.08	$2,986.93	$2,491.64	$2,924.48	$4,035.07	$5,208.12	$5,434.58	$5,951.05	$6,181.21	$6,550.50	$54,532.65
19	6	Apodaca	$12,765.37	$2,986.06	$2,490.92	$2,923.63	$4,033.90	$5,206.61	$5,433.00	$5,949.32	$6,179.41	$6,548.60	$54,516.82
5	18	Monclova	$12,464.30	$2,915.64	$2,432.17	$2,854.67	$3,938.76	$5,083.81	$5,304.87	$5,809.01	$6,033.67	$6,394.15	$53,231.05
3	3	Paz, La	$12,345.73	$2,887.90	$2,409.03	$2,827.52	$3,901.29	$5,035.45	$5,254.40	$5,753.75	$5,976.27	$6,333.32	$52,724.65
10	7	Gómez Palacio	$11,421.21	$2,671.64	$2,228.63	$2,615.78	$3,609.14	$4,658.36	$4,860.92	$5,322.87	$5,528.73	$5,859.05	$48,776.33
15	37	Huixquilucan	$11,108.10	$2,598.39	$2,167.53	$2,544.06	$3,510.19	$4,530.65	$4,727.66	$5,176.95	$5,377.16	$5,698.42	$47,439.13
4	3	Carmen	$10,569.88	$2,472.49	$2,062.51	$2,420.80	$3,340.11	$4,311.13	$4,498.59	$4,926.11	$5,116.62	$5,422.31	$45,140.56
26	55	San Luis Río Colorado	$10,345.70	$2,420.05	$2,018.76	$2,369.45	$3,269.27	$4,219.69	$4,403.18	$4,821.63	$5,008.10	$5,307.31	$44,183.15
9	11	Tláhuac	$10,336.43	$2,417.89	$2,016.96	$2,367.33	$3,266.35	$4,215.92	$4,399.24	$4,817.31	$5,003.62	$5,302.56	$44,143.59
26	43	Nogales	$10,215.08	$2,389.50	$1,993.28	$2,339.54	$3,228.00	$4,166.42	$4,347.59	$4,760.75	$4,944.87	$5,240.30	$43,625.32
14	101	Tonalá	$10,066.86	$2,354.83	$1,964.36	$2,305.59	$3,181.16	$4,105.96	$4,284.50	$4,691.67	$4,873.13	$5,164.27	$42,992.33
15	39	Ixtapaluca	$10,033.51	$2,347.03	$1,957.85	$2,297.95	$3,170.62	$4,092.36	$4,270.31	$4,676.13	$4,856.98	$5,147.16	$42,849.90
9	4	Cuajimalpa de Morelos	$9,436.93	$2,207.48	$1,841.44	$2,161.32	$2,982.10	$3,849.03	$4,016.40	$4,398.09	$4,568.19	$4,841.11	$40,302.09
11	27	Salamanca	$9,393.39	$2,197.29	$1,832.94	$2,151.35	$2,968.34	$3,831.28	$3,997.87	$4,377.80	$4,547.11	$4,818.78	$40,116.15
4	2	Campeche	$9,125.67	$2,134.67	$1,780.70	$2,090.03	$2,883.74	$3,722.08	$3,883.93	$4,253.03	$4,417.52	$4,681.44	$38,972.80
19	48	Santa Catarina	$9,113.62	$2,131.85	$1,778.35	$2,087.27	$2,879.93	$3,717.17	$3,878.80	$4,247.42	$4,411.69	$4,675.26	$38,921.37
30	28	Boca del Río	$8,895.00	$2,080.71	$1,735.69	$2,037.20	$2,810.85	$3,628.00	$3,785.76	$4,145.53	$4,305.86	$4,563.11	$37,987.70
16	52	Lázaro Cárdenas	$8,793.10	$2,056.87	$1,715.81	$2,013.87	$2,778.65	$3,586.44	$3,742.39	$4,098.04	$4,256.53	$4,510.83	$37,552.52
19	21	General Escobedo	$8,597.64	$2,011.15	$1,677.66	$1,969.10	$2,716.88	$3,506.71	$3,659.20	$4,006.94	$4,161.91	$4,410.56	$36,717.75
16	102	Uruapan	$8,417.92	$1,969.11	$1,642.60	$1,927.94	$2,660.09	$3,433.41	$3,582.71	$3,923.18	$4,074.91	$4,318.37	$35,950.24
3	8	Cabos, Los	$8,416.99	$1,968.89	$1,642.42	$1,927.73	$2,659.80	$3,433.04	$3,582.31	$3,922.75	$4,074.47	$4,317.89	$35,946.29
5	25	Piedras Negras	$8,340.11	$1,950.91	$1,627.41	$1,910.12	$2,635.50	$3,401.67	$3,549.59	$3,886.92	$4,037.25	$4,278.45	$35,617.92
30	131	Poza Rica de Hidalgo	$8,305.83	$1,942.89	$1,620.72	$1,902.27	$2,624.67	$3,387.69	$3,535.00	$3,870.94	$4,020.65	$4,260.87	$35,471.54
6	2	Colima	$8,204.86	$1,919.27	$1,601.02	$1,879.14	$2,592.76	$3,346.51	$3,492.03	$3,823.89	$3,971.77	$4,209.07	$35,040.31
7	89	Tapachula	$8,188.18	$1,915.37	$1,597.77	$1,875.32	$2,587.49	$3,339.71	$3,484.93	$3,816.11	$3,963.70	$4,200.51	$34,969.10
15	99	Texcoco	$7,978.82	$1,866.40	$1,556.91	$1,827.37	$2,521.33	$3,254.32	$3,395.82	$3,718.54	$3,862.36	$4,093.11	$34,074.99
23	4	Othón P. Blanco	$7,717.58	$1,805.29	$1,505.94	$1,767.54	$2,438.78	$3,147.77	$3,284.64	$3,596.79	$3,735.90	$3,959.10	$32,959.33
32	56	Zacatecas	$7,636.99	$1,786.44	$1,490.21	$1,749.08	$2,413.31	$3,114.90	$3,250.34	$3,559.23	$3,696.88	$3,917.75	$32,615.14
19	9	Cadereyta Jiménez	$7,468.39	$1,747.00	$1,457.31	$1,710.47	$2,360.04	$3,046.13	$3,178.58	$3,480.66	$3,615.27	$3,831.26	$31,895.11
17	11	Jiutepec	$7,286.82	$1,704.53	$1,421.88	$1,668.89	$2,302.66	$2,972.07	$3,101.31	$3,396.04	$3,527.38	$3,738.12	$31,119.69
22	16	San Juan del Río	$7,190.48	$1,681.99	$1,403.09	$1,646.82	$2,272.21	$2,932.78	$3,060.30	$3,351.13	$3,480.74	$3,688.69	$30,708.24
12	29	Chilpancingo de los Bravo	$6,949.62	$1,625.65	$1,356.09	$1,591.66	$2,196.10	$2,834.54	$2,957.79	$3,238.88	$3,364.15	$3,565.14	$29,679.62
15	60	Nicolás Romero	$6,717.11	$1,571.26	$1,310.71	$1,538.40	$2,122.63	$2,739.70	$2,858.83	$3,130.52	$3,251.59	$3,445.85	$28,686.61
21	156	Tehuacán	$6,633.73	$1,551.76	$1,294.45	$1,519.31	$2,096.28	$2,705.70	$2,823.35	$3,091.66	$3,211.23	$3,403.08	$28,330.55
15	31	Chimalhuacán	$6,468.84	$1,513.18	$1,262.27	$1,481.54	$2,044.17	$2,638.44	$2,753.17	$3,014.81	$3,131.41	$3,318.49	$27,626.34
8	21	Delicias	$6,314.14	$1,477.00	$1,232.08	$1,446.11	$1,995.29	$2,575.34	$2,687.33	$2,942.71	$3,056.52	$3,239.13	$26,965.65
30	44	Córdoba	$6,269.67	$1,466.59	$1,223.41	$1,435.93	$1,981.24	$2,557.21	$2,668.40	$2,921.99	$3,035.00	$3,216.32	$26,775.75
25	11	Guasave	$6,268.74	$1,466.38	$1,223.23	$1,435.72	$1,980.94	$2,556.83	$2,668.01	$2,921.56	$3,034.55	$3,215.85	$26,771.79
11	15	Guanajuato	$6,229.84	$1,457.28	$1,215.63	$1,426.81	$1,968.65	$2,540.96	$2,651.45	$2,903.42	$3,015.71	$3,195.89	$26,605.63
8	17	Cuauhtémoc	$6,196.49	$1,449.48	$1,209.13	$1,419.17	$1,958.11	$2,527.36	$2,637.25	$2,887.88	$2,999.57	$3,178.78	$26,463.21
24	35	Soledad de Graciano Sánchez	$6,193.71	$1,448.83	$1,208.58	$1,418.53	$1,957.23	$2,526.22	$2,636.07	$2,886.59	$2,998.23	$3,177.35	$26,451.34
15	70	Paz, La	$6,142.76	$1,436.91	$1,198.64	$1,406.86	$1,941.13	$2,505.44	$2,614.39	$2,862.84	$2,973.56	$3,151.22	$26,233.75
30	108	Minatitlán	$6,048.27	$1,414.80	$1,180.20	$1,385.22	$1,911.27	$2,466.90	$2,574.17	$2,818.80	$2,927.82	$3,102.74	$25,830.21
15	81	Tecámac	$6,002.87	$1,404.19	$1,171.35	$1,374.83	$1,896.93	$2,448.39	$2,554.85	$2,797.65	$2,905.85	$3,079.46	$25,636.36
32	17	Guadalupe	$5,827.79	$1,363.23	$1,137.18	$1,334.73	$1,841.60	$2,376.98	$2,480.34	$2,716.05	$2,821.09	$2,989.64	$24,888.63
6	7	Manzanillo	$5,727.74	$1,339.83	$1,117.66	$1,311.81	$1,809.99	$2,336.17	$2,437.76	$2,669.42	$2,772.66	$2,938.31	$24,461.36
30	118	Orizaba	$5,713.85	$1,336.58	$1,114.95	$1,308.63	$1,805.59	$2,330.50	$2,431.84	$2,662.95	$2,765.94	$2,931.19	$24,402.01
26	29	Guaymas	$5,652.71	$1,322.28	$1,103.02	$1,294.63	$1,786.27	$2,305.57	$2,405.82	$2,634.45	$2,736.34	$2,899.82	$24,140.90
16	108	Zamora	$5,417.41	$1,267.23	$1,057.10	$1,240.74	$1,711.92	$2,209.60	$2,305.68	$2,524.79	$2,622.44	$2,779.11	$23,136.02
27	2	Cárdenas	$5,397.03	$1,262.47	$1,053.13	$1,236.07	$1,705.48	$2,201.28	$2,297.00	$2,515.29	$2,612.57	$2,768.66	$23,048.98
17	6	Cuautla	$5,227.50	$1,222.81	$1,020.05	$1,197.24	$1,651.91	$2,132.14	$2,224.85	$2,436.29	$2,530.51	$2,681.69	$22,324.99
6	10	Villa de Alvarez	$5,021.85	$1,174.71	$979.92	$1,150.14	$1,586.92	$2,048.26	$2,137.32	$2,340.44	$2,430.96	$2,576.19	$21,446.71
8	32	Hidalgo del Parral	$5,000.54	$1,169.72	$975.76	$1,145.26	$1,580.19	$2,039.57	$2,128.26	$2,330.51	$2,420.64	$2,565.26	$21,355.72
		Total	$2,964,916.24	$693,550.00	$578,546.80	$679,048.50	$936,923.00	$1,209,299.00	$1,261,882.70	$1,381,803.80	$1,435,244.98	$1,520,992.98	$12,662,208.00

Table A8. Exposed Population and Distribution in National Territory

State ID	Municipal ID	Municicpality	Population Density (inhabitants per Km2)	Number of Landfill Sites			Potentially Exposed Population (Incineration) 4 Km2	Potentially Exposed Population (Incineration) 16 Km2
				Total	Controlled	Uncontrolled		
2	4	Tijuana	35	1	0	1	140	560
14	39	Guadalajara	80	1	1	0	320	1,280
19	39	Monterrey	60	1	1	0	240	960
14	120	Zapopan	80	1	1	0	320	1,280
21	114	Puebla	148	1	1	0	592	2,368
9	7	Iztapalapa	5,799	1	0	1	23,196	92,784
8	37	Juárez	12	1	1	0	48	192
9	3	Coyoacán	5,799	1	0	1	23,196	92,784
9	5	Gustavo A. Madero	5,799	1	0	1	23,196	92,784
9	14	Benito Juárez	5,799	1	0	1	23,196	92,784
2	2	Mexicali	35	1	0	1	140	560
11	20	León	152	1	0	1	608	2,432
8	19	Chihuahua	12	1	0	1	48	192
22	14	Querétaro	120	1	1	0	480	1,920
15	58	Nezahualcóyotl	586	1	0	1	2,344	9,376
9	12	Tlalpan	5,799	1	0	1	23,196	92,784
15	57	Naucalpan de Juárez	586	1	0	1	2,344	9,376
15	33	Ecatepec de Morelos	586	1	0	1	2,344	9,376
9	15	Cuauhtémoc	5,799	1	0	1	23,196	92,784
19	46	San Nicolás de los Garza	60	1	0	1	240	960
9	10	Alvaro Obregón	5,799	1	0	1	23,196	92,784
19	26	Guadalupe	60	1	0	1	240	960
24	28	San Luis Potosí	38	1	0	1	152	608
31	50	Mérida	42	1	1	0	168	672
15	104	Tlalnepantla de Baz	586	1	1	0	2,344	9,376
25	6	Culiacán	44	1	0	1	176	704
5	30	Saltillo	15	1	0	1	60	240
1	1	Aguascalientes	168	1	1	0	672	2,688
9	16	Miguel Hidalgo	5,799	1	1	0	23,196	92,784
15	106	Toluca	586	1	0	1	2,344	9,376
26	30	Hermosillo	12	1	0	1	48	192
16	53	Morelia	68	1	0	1	272	1,088
23	5	Benito Juárez	21	1	1	0	84	336
27	4	Centro	76	1	0	1	304	1,216
5	35	Torreón	15	1	0	1	60	240
9	2	Azcapotzalco	586	1	0	1	2,344	9,376
15	13	Atizapán de Zaragoza	586	1	0	1	2,344	9,376
15	121	Cuautitlán Izcalli	586	1	0	1	2,344	9,376
9	17	Venustiano Carranza	5,799	1	0	1	23,196	92,784
30	193	Veracruz	96	1	0	1	384	1,536
9	6	Iztacalco	5,799	1	0	1	23,196	92,784
28	32	Reynosa	34	1	0	1	136	544
10	5	Durango	12	1	0	1	48	192
30	87	Xalapa	96	1	0	1	384	1,536
17	7	Cuernavaca	318	1	0	1	1,272	5,088
7	101	Tuxtla Gutiérrez	53	1	0	1	212	848
25	12	Mazatlán	44	1	0	1	176	704
9	13	Xochimilco	5,799	1	0	1	23,196	92,784
2	1	Ensenada	35	1	0	1	140	560
28	22	Matamoros	34	1	0	1	136	544
11	7	Celaya	152	1	0	1	608	2,432
28	27	Nuevo Laredo	34	1	0	1	136	544
28	38	Tampico	34	1	0	1	136	544
15	54	Metepec	586	1	0	1	2,344	9,376
12	1	Acapulco de Juárez	48	1	0	1	192	768
19	19	San Pedro Garza García	60	1	0	1	240	960
18	17	Tepic	33	1	0	1	132	528
28	9	Ciudad Madero	34	1	0	1	136	544
26	18	Cajeme	12	1	0	1	48	192
11	17	Irapuato	152	1	0	1	608	2,432

Table A8. Cont. Exposed Population and Distribution in the National Teritorry

State ID	Municipal ID	Municicpality	Population Density (inhabitants per Km 2)	Number of Landfill Sites			Potentially Exposed Population (Incineration) 4 Km 2	Potentially Exposed Population (Incineration) 16 Km 2
				Total	Controlled	Uncontrolled		
14	98	Tlaquepaque	80	1	0	1	320	1,280
13	48	Pachuca de Soto	107	1	0	1	428	1,712
28	41	Victoria	34	1	0	1	136	544
25	1	Ahome	44	1	0	1	176	704
15	20	Coacalco de Berriozábal	586	1	0	1	2,344	9,376
15	109	Tultitlán	586	1	0	1	2,344	9,376
14	67	Puerto Vallarta	80	1	0	1	320	1,280
9	8	Magdalena Contreras, La	5,799	1	0	1	23,196	92,784
20	67	Oaxaca de Juárez	37	1	0	1	148	592
30	39	Coatzacoalcos	96	1	0	1	384	1,536
19	6	Apodaca	60	1	0	1	240	960
5	18	Monclova	15	1	0	1	60	240
3	3	Paz, La	6	1	0	1	24	96
10	7	Gómez Palacio	12	1	0	1	48	192
15	37	Huixquilucan	586	1	0	1	2,344	9,376
4	3	Carmen	12	1	0	1	48	192
26	55	San Luis Río Colorado	12	1	0	1	48	192
9	11	Tláhuac	5,799	1	0	1	23,196	92,784
26	43	Nogales	12	1	0	1	48	192
14	101	Tonalá	80	1	0	1	320	1,280
15	39	Ixtapaluca	586	1	0	1	2,344	9,376
9	4	Cuajimalpa de Morelos	5,799	1	0	1	23,196	92,784
11	27	Salamanca	152	1	0	1	608	2,432
4	2	Campeche	12	1	0	1	48	192
19	48	Santa Catarina	60	1	0	1	240	960
30	28	Boca del Río	96	1	0	1	384	1,536
16	52	Lázaro Cárdenas	68	1	0	1	272	1,088
19	21	General Escobedo	60	1	0	1	240	960
16	102	Uruapan	68	1	0	1	272	1,088
3	8	Cabos, Los	6	1	0	1	24	96
5	25	Piedras Negras	15	1	0	1	60	240
30	131	Poza Rica de Hidalgo	96	1	0	1	384	1,536
6	2	Colima	96	1	0	1	384	1,536
7	89	Tapachula	53	1	0	1	212	848
15	99	Texcoco	586	1	0	1	2,344	9,376
23	4	Othón P. Blanco	21	1	0	1	84	336
32	56	Zacatecas	18	1	0	1	72	288
19	9	Cadereyta Jiménez	60	1	0	1	240	960
17	11	Jiutepec	318	1	0	1	1,272	5,088
22	16	San Juan del Río	120	1	0	1	480	1,920
12	29	Chilpancingo de los Bravo	48	1	0	1	192	768
15	60	Nicolás Romero	586	1	0	1	2,344	9,376
21	156	Tehuacán	148	1	0	1	592	2,368
15	31	Chimalhuacán	586	1	0	1	2,344	9,376
8	21	Delicias	12	1	0	1	48	192
30	44	Córdoba	96	1	0	1	384	1,536
25	11	Guasave	44	1	0	1	176	704
11	15	Guanajuato	152	1	0	1	608	2,432
8	17	Cuauhtémoc	12	1	0	1	48	192
24	35	Soledad de Graciano Sánch	38	1	0	1	152	608
15	70	Paz, La	586	1	0	1	2,344	9,376
30	108	Minatitlán	96	1	0	1	384	1,536
15	81	Tecámac	586	1	0	1	2,344	9,376
32	17	Guadalupe	18	1	0	1	72	288
6	7	Manzanillo	96	1	0	1	384	1,536
30	118	Orizaba	96	1	0	1	384	1,536
26	29	Guaymas	12	1	0	1	48	192
16	108	Zamora	68	1	0	1	272	1,088
27	2	Cárdenas	76	1	0	1	304	1,216
17	6	Cuautla	318	1	0	1	1,272	5,088
6	10	Villa de Alvarez	96	1	0	1	384	1,536
8	32	Hidalgo del Parral	12	1	0	1	48	192
		Total	0	122	11	111	391,248	1,564,992