S 510: Electronic Waste Recycling Promotion and Consumer Protection Act

Final Report

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ACKNOWLEDGEMENT AND DISCLAIMER

EXECUTIVE SUMMARY

The number of obsolete computers, monitors, televisions, and other electronic waste (e-waste) entering the waste stream in the United States is growing at an alarming rate. These products contain toxins that can negatively impact human health and the environment. In order to address this issue, individual states have enacted various pieces of legislation designed to encourage the recycling of e-waste. The differences in these state laws have resulted in a patchwork of regulations which is difficult for national manufacturers, retailers, and recyclers of electronics to comply with. In order to eliminate this lack of uniformity, multiple pieces of national legislation have been proposed, however, at this time, no federal e-waste law has been enacted.

In this report, we assume that one of the proposed pieces of national legislation, **The Electronic Waste Recycling and Consumer Protection Act** (the Act), has been successfully signed into law, and that we must design the first year of a federal program created to implement the requirements of the Act.

This Act aims to reduce e-waste recycling by creating an incentive program involving tax credits for consumers and recyclers. The four primary tasks mandated in the Act are as follows:

- Establish regulations for providing federal tax credits for e-waste recycling and begin issuing these tax credits.
- Create guidelines for certification of recyclers.
- Create a mandatory recycling program for all federal agencies.
- Produce a feasibility study evaluating alternate approaches for nationwide e-waste recycling.

We decided that creating an E-recycling Taskforce, within the EPA's Office of Solid Waste, would be the most effective approach to executing the requirements of this legislation. The Taskforce will consist of eight individuals, the majority of which will be current employees of the Office of Solid Waste, selected for their expertise related to e-waste recycling. The Office of Solid Waste will contract with a consulting firm to conduct the required feasibility study of alternate approaches.

For the first year, this program will require a budget of $1.7 million, including personnel, consulting fees and all other expenditures. The revenue forgone by the federal government as a result of the recycling tax credits issued during the first year of the program is expected to be approximately $150 million. In order to quantify this program's progress, we will monitor seven performance measurements regularly at a frequency appropriate to the requirements of the legislation and reported on a monthly basis using an E-Recycling Scorecard. We have established a timeline for completing all the necessary steps of the first year of the program, including interim goals, specific timeframes, and descriptions of the responsible party for each task.

The main focuses of the program include the rapid creation of a provisional certification system to begin designating approved recyclers and providing tax credits as soon as possible. This will help create an immediate market for e-waste recycling. After the initial certification system is in place, the E-recycling Taskforce will update the certification requirements to make the recycling requirements progressively more environmentally strict. The goals of the first year of the program are increased public awareness of e-waste recycling options and rapid implementation of a basic recycling program, followed by the study and potential implementation of a more rigorous program to improve the effectiveness of removing e-waste from the waste stream.

THE PROBLEM OF ELECTRONIC WASTE

The computer this report was written on is full of toxins. This statement may seem suprising given the ubiquitous nature of computers, but once a computer is placed into the waste stream, those toxins can contaminate the environment and pose serious health risks to humans. The use of computers, monitors, and televisions is rapidly increasing in the United States (see Figure 1). When this growing amount of electronic waste (e-waste) is placed into landfills or incinerated, corresponding increases in the associated environmental hazards occur. The rapid level of obsolescence of these devices magnifies this problem. Furthermore, instead of being immediately disposed of, older computers and televisions are frequently placed into storage. As this stored e-waste enters the waste stream a further escalation of this problem will occur. E-waste constitutes 1.5-8 percent of municipal solid waste [1, 2]; it is accumulating at a rate three times that of other solid waste [1, 3].
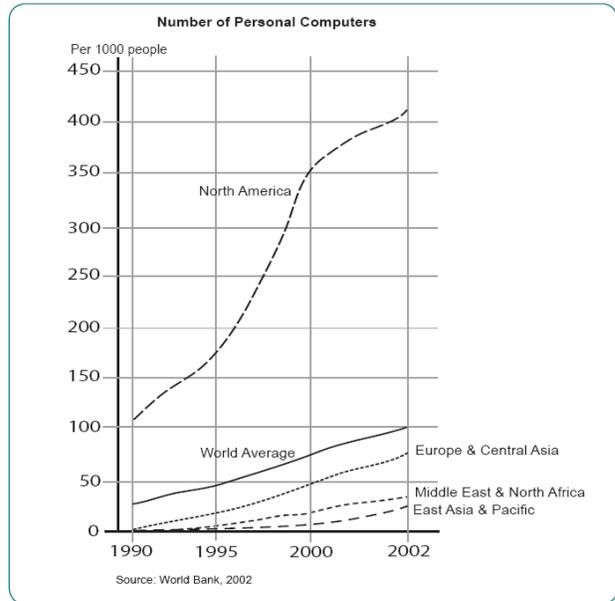
**Figure 1)** This figure from the World Bank (2002) shows the increasing rates of ownership of personal computers.
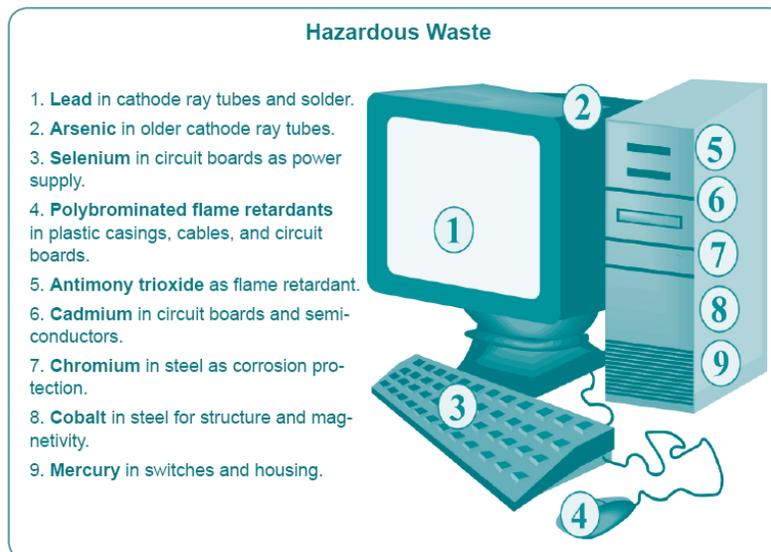

Figure 2) This figure from the Texas Senate Research Center shows the location of contaminants in a standard home computer.

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Disposal Problems and Loss of Resources
Currently, less than 10 percent of e-waste produced is reused or recycled [1]. This means that the majority of the e-waste is disposed of in landfills or incinerated, where it can eventually create health problems through human exposure. Some computer manufacturers intentionally design their products for short life cycles and employ materials and processes that hinder recycling efforts with the objective of requiring consumers to purchase new products [4]. Furthermore, in addition to hazardous materials, e-waste contains valuable resources (such as gold, copper, and aluminum) which are lost if the waste is not recycled [5].

Lack of Domestic Incentives for Recycling/Reuse
E-waste recycling systems are currently scarce in the United States; as a result, businesses and individual consumers experience difficulty when attempting to recycle electronic devices. Consumers often face a lengthy trip to utilize the nearest recycler and a high cost for recycling their e-waste when they arrive. In addition, interstate recycling (made necessary by the scarcity of programs), compounded with unclear regulation, inflates the cost of recycling [4].

As a result of these disincentives to domestic recycling, 50-80% of the e-waste produced in the United States that does not enter landfills is exported to developing countries, where hazardous material regulations are less severe or nonexistent [2]. Unsafe recycling practices in these countries can render the recycling process highly hazardous to workers, and often create even greater health hazards to the general community than disposal in landfills [2].

TOXIC CHEMICALS PRESENT IN E-WASTE

Computers and display units contain significant amounts of material that are hazardous to human health if they are not disposed of properly. Monitors and televisions constitute 40% of all lead and 70% of all heavy metals found in landfills (see Figure 2). These heavy metals and other toxins can leach into the soil from landfills, evaporate into the air, and enter the air through incineration [6].

Toxic Chemicals Present in E-waste: Overview and Uncertainty
Toxins in e-waste include polyvinyl chloride (PVC plastics), copper, lead, mercury, arsenic (in older models), cadmium, manganese, cobalt, gold, and iron [3]. Between 1994 and 2003 [7], disposal of PCs resulted in 718,000 tons of lead, 287 tons of mercury, and 1,363 tons of cadmium being placed in landfills [2]. Mercury, chromium, lead, and brominated flame retardants will be discussed here as they are the greatest in quantity and are likely to cause the most adverse health effects in humans. The effect of toxins on the environment will also be considered.

There is some uncertainty about the intensity of the impact of chemicals in e-waste on human health. Toxicology is not an exact science, and there is rarely universal agreement on how a given chemical substance affects human physiology. This disagreement is compounded by the fact that hazard identification tests are often conducted using mice

and rats, and then extrapolated to identify human carcinogens and toxins [8]. The physical differences between rodents and humans make it difficult to establish acceptable levels of human exposure based solely on these animal studies [8]. Sometimes limited epidemiological case studies do exist, yet these studies usually provide only limited amounts of additional data. Also, it is unclear how much toxic material escapes from e-waste and enters the air, soil, and water.

Toxic Chemicals Present in E-waste: Location of the Chemicals
Flame-retardants containing bromine are used in cables, plastic casing, and circuit boards. Circuit boards in a computer contain lead and cadmium [3]. Switches and flat panel screens contain mercury, and semi-conductors contain cadmium [3].

A major source of hazardous waste in computer and television screens is cathode ray tubes (CRTs). CRTs contain lead and barium, and older CRTs contain arsenic [9]. Figure 3 illustrates a CRT. The CRT contains an electron gun that shoots electrons at high speeds to produce color images on television and computer screens [9]. The acceleration of electrons requires high voltages to accelerate the electrons, and these voltages must be insulated from the external surfaces [9]. The decelerating electrons also produce x-rays, so the casing must absorb these x-rays [9]. Lead is used in the envelope encasing this process, as well as in the panel glass screen [9]. Flat panel monitors and televisions do not use CRTs and thus do not contribute lead to the waste stream; however, these products do contain significant levels of mercury [9].
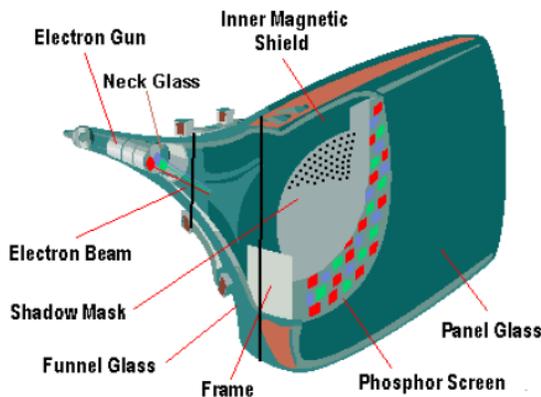
Figure 3) Illustrates a cathode ray tube (CRT), which is in computer and TV monitors. The lead in the monitors is mainly contained in the neck and the funnel glass of the CRT.

Toxic Chemicals Present in E-waste: Mercury
The elemental form of mercury evaporates into the atmosphere and precipitates to the ground when it rains. In the soil, it is processed by bacteria and becomes methylmercury. This new form bioaccumulates, meaning it collects in animals' fatty tissues [10]. It begins collecting at the bottom of the aquatic food chain, and builds up in greater levels the further up the food chain it goes. Depending on levels of exposure, the methylmercury's effects can range from mild to severe. People are most often exposed to

mercury through food, particularly fish and shellfish [10]. In fact, pregnant women are often advised against eating fish that could potentially contain mercury because of potential damage to the developing fetus. Fetuses and small children are highly susceptible to the toxic effects of mercury, particularly the effects of methylmercury on the nervous system [10]. The primary health effect of methylmercury is impaired neurological development, which can lead to reduced cognitive abilities, memory, attention, language ability, and fine motor and spatial skills [10]. Some symptoms are tremors, emotional changes, insomnia, headaches, disturbances in sensations, changes in nerve responses, and performance deficits on tests of cognitive function [3]. At higher exposures, mercury can cause kidney problems, respiratory failure and death [10]. It is important to stress that methylmercury exposure does not require direct exposure to the source of the mercury; eating fish that were exposed to methylmercury during their developmental stage is a sufficient route of exposure [10].

Effects of methylmercury exposure on wildlife can include mortality, reduced fertility, slower growth and development and abnormal behavior that affects survival, depending on the level of exposure [10]. In addition, research indicates that the endocrine system of fish may be altered by methylmercury found in the environment [10]. The endocrine system releases hormones necessary for growth and development; methylmercury may prevent young fish from developing into healthy adult fish [10].

Mercury is not listed by the EPA as a human carcinogen. However, the EPA lists existing studies of the human health effects as "inadequate" [8]. Indeed, many scientists believe current permissible levels of mercury exposure are too high [11]. There are also great controversies about differences in effects of mercury dependent on method of exposure [11].

Toxic Chemicals Present in E-waste: Lead
Lead is one of the most abundant toxic byproducts of e-waste and has many well-documented detrimental human health effects [12]. Exposure to lead can occur from contaminated drinking water and often causes damage to the brain and nervous system [12]. Lead poisoning has the greatest negative health effect on children, and can cause slowed growth, hearing problems, as well as behavioral and learning problems. In adults, lead can cause reproductive problems, high blood pressure, and memory and concentration problems [12].

The environmental effects of lead are also detrimental. Organisms exposed to lead have a lower chance of reproduction due to behavioral changes or physical disorders from the exposure [12].

The toxic properties of lead are well-studied, and there is little controversy associated with the toxicity of this element. The EPA states that, "by comparison to most other environmental toxicants, the degree of uncertainty about the health effects of lead is quite low" [13]. It is classified as a probable human carcinogen, which means that there is no safe level of exposure below which negative health consequences may not occur. Lead is

one of the most studied of the chemicals in e-waste because of the frequency of exposure and the severe negative health effects in children.

Toxic Chemicals Present in E-waste: Chromium
Hexavalent chromium, Cr(VI), can damage DNA and has been linked to asthmatic bronchitis [14]. After entering an organism from the environment, chromium is reduced to trivalent chromium, which then binds to proteins [15]. This triggers an immune system reaction that can have damaging effects on the body. All Cr(VI) compounds are potential carcinogens [14]. Health effects associated with Cr(VI) exposure include skin irritation and ulceration, asthma and respiratory irritation, perforated eardrums, kidney damage, liver damage, pulmonary congestion and edema, epigastric (upper abdomen) pain, and erosion and discoloration of the teeth [15]. The lungs, kidneys, and intestines are especially vulnerable, and if chromium lodges in tissues, its long-term action may lead to cancerous growth [15]. In some studies, chromium was reported as one of the factors of incidence of premature senility [14].

In the environment, chromium can harm aquatic ecosystems, causing negative effects for salmon and amphibian populations [15].

Toxic Chemicals Present in E-waste: Brominated Flame Retardants
Brominated Flame Retardents (BFRs) are added to consumer e-waste products in an effort to reduce the risk of injury or damage from fire [16]. They are found on printed circuit boards, components such as plastic covers and cables as well as plastic covers of televisions [16]. Although less is known about BFRs than many other contaminants, research has shown that one of these flame retardants, Polybrominated Diphenylethers (PDBE) might act as an endocrine disrupter [17]. Flame retardant (Polybrominated Biphenyls or PBB) may increase cancer risk to the digestive and lymph systems [17].

Scientists believe that once BFRs are released into the environment through landfill leachate and incineration they are concentrated in the food chain, accumulating in fatty tissues in a similar fashion to the bioaccumulation of methylmercury described above [17].

Risk analysts are concerned about BFRs because of their persistence, bioaccumulation, and potential for toxicity in humans; however, scientific understanding of the health and environmental effects of BFRs is very limited and results from the current literature are incomplete and often conflicting [18]. Additionally, the major pathway for human BFR exposure is unknown. A report published in *Environmental Health Perspectives* stating that the "toxicology database [for BFRs] is inadequate to truly understand the risk" [19].

E-WASTE IN LANDFILLS

The current methods of disposing of e-waste are imperfect and may result in detrimental effects to the environment and humans. When e-waste is disposed of in landfills, toxins can leach into groundwater or nearby water bodies. For instance, lead and mercury can leach from landfills into drinking water supplies and the surrounding soils [12].

Chromium may contaminate the environment through landfill leachate, and air contamination can occur when materials containing chromium are incinerated. Landfills and incinerators are currently major exposure pathways for humans to the hazardous chemicals found in e-waste [3, 20]. Landfills are of particular concern since land-filling is currently the most widely used method of e-waste disposal. Without access to recycling, the majority of consumers currently face the choice of keeping the old computer indefinitely in a closet, or placing it in a landfill.

While landfills are designed to process toxins and waste, leaking can occur in the lining, or toxins may evaporate off of leachate ponds. Leachate is the liquid formed when water percolates through the waste deposited in landfills and absorbs the toxins which are present. It pools in the bottom of the landfill and is pumped out into a nearby leachate pond. Contaminants may also be released into the air when waste is crushed or incinerated. Municipal solid waste workers also occasionally transport contaminants on their clothing.

The basic parts of a landfill are the bottom liner system, the cells, storm water drainage system, the methane collection system, the covering and the leachate collection system (see Figure 4) [20].

Components of Landfills:
Bottom Liner System
The bottom liner system separates trash and subsequent leachate from groundwater. It is the main defense in municipal waste sites to prevent toxic substances such as e-waste from environmental exposure. Liner systems are designed to be impervious to leaks. However, over time they can deteriorate or tear, allowing the toxins to leak into the surrounding soil and groundwater [20].

Cells (old and new)
Trash is stored in cells within a landfill. After a certain period of time, a cell will be covered over, and new municipal waste will be placed in a new cell above. Precipitation is allowed to percolate between cells to the bottom of a landfill, leaching toxins out of e-waste products as it descends until it reaches the impermeable layer at the bottom [20]. This process is necessary for decomposition of waste.

Storm Water Drainage System
The storm water drainage system is designed to collect rain water that falls on a landfill to prevent flooding and environmental exposure [20].

Leachate Collection System
The leachate collection system collects water that has percolated through the landfill and absorbed toxic contaminants from e-waste and other hazardous materials. The contaminated leachate is then pumped out into a nearby leachate collection pond, where the contaminated water is contained. This water is still able to evaporate, however, which can release toxins into the atmosphere [20].

Methane Collection System

The methane collection system collects methane gas formed during the breakdown of solid waste. Methane is a highly flammable greenhouse gas, and needs to be collected to prevent risk of explosion in the presence of an ignition source. Once collected this gas can be flared off or used as a fuel to generate electrical power [20].

Covering or Cap

A covering component, or cap, seals off the top of the landfill once it has been filled. This prevents atmospheric exposure to hazardous chemicals once the landfill is no longer in use and reduces the leaching of toxins due to precipitation [20]. Some landfills are "wet" landfills that require watering and encourage leachate to facilitate decomposition.

Overall, there are a variety of potential sources of environmental exposure to toxins present in e-waste at each stage of the landfill process. Computer and television technologies are mature, and it is unlikely that new breakthroughs will drastically reduce the likelihood of exposure to contaminants from landfills. With the growing stream of e-waste projected to enter the waste stream, the exposure risks associated with landfills are a major concern.

A- Ground Water
B- Compacted Clay
C- Plastic Layer
D- Leachate Collection Pipe
E- Geotextile Mat
F- Gravel
G- Drainage Layer
H- Soil Layer
I- Old Cell
J- New Cell
K- Leachate Pond
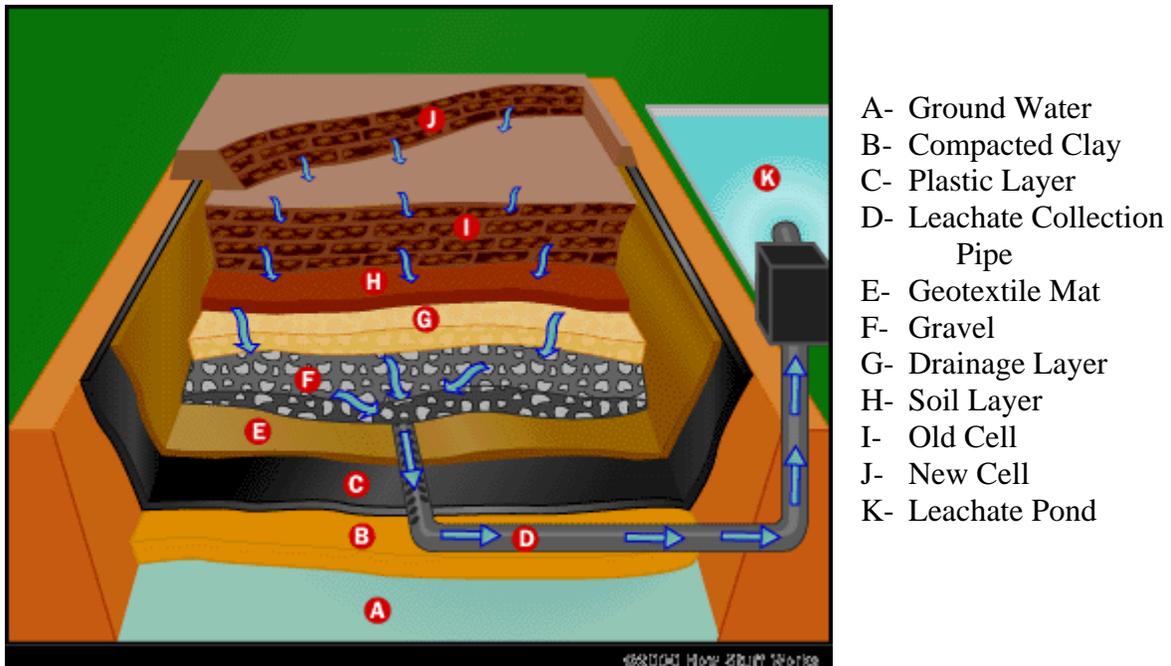
Figure 4) This figure outlines the basic parts of a landfill. Landfills may leak into the environment, and can contaminate nearby water bodies. Source: http://people.howstuffworks.com/landfill6.htm-

BACKGROUND TO THE PROPOSED LEGISLATION

The increasing volume of electronic waste (e-waste) disposed of in the U.S. has attracted the attention of legislatures at both the state and national level. The spread of broadband internet technology, in accordance with the President's target of achieving nationwide connectivity by 2007, has made computers ubiquitous. Experts have predicted the upcoming transition to digital television will also dramatically increase the numbers of televisions discarded. As such, the International Association of Electronics Recyclers estimates that approximately 3 billion units of e-waste will be disposed of before 2010, with an average of about 400 million units per year [21].

In the absence of nationwide legislation, individual states have taken steps to tackle the problem of e-waste. This has resulted in the evolution of a patchwork of laws, placing different requirements on manufacturers, recyclers and retailers:

1. Five states have banned the disposal of CRTs in landfills: California, Maine, Massachusetts, Minnesota, and New Hampshire [22];
2. Four states, California, Maine, Maryland, and Washington, have passed statewide electronics recycling laws [22];
3. California has imposed a fee on the consumer at the time of purchase (called an "Advanced Recycling Fee" or ARF) to finance the recycling [22];
4. Maine and Washington passed legislation that requires the manufacturers to finance the recycling [22];
5. Maryland's legislation puts the responsibility for financing the recycling on the government and the manufacturers [22];
6. In the first half of 2005 alone, 30 state and local legislatures saw more than 50 separate bills introduced on this issue, including an e-waste measure introduced and still active in New York City [22].

PROPOSED LEGISLATION

To address the issue of e-waste on a national level, there are three pieces of legislation that have been introduced in Congress. Although this report will focus on the third, the other two are provided to give a sense of alternate approaches.

The Tax Incentives to Encourage Recycling Act (H.R.320) [22] was introduced by Rep. Duke Cunningham (R-CA) and cosponsored by Reps. Cantor (VA) and Issa (CA). This approach also provides a tax credit to manufacturers of computer, cell phone, and television equipment to operate an environmentally sound recycling program for use by consumers who want to discard the equipment. The tax credits would be as follows:

- $4 for a CPU
- $4 for a monitor
- $4 for a printer
- $1 for a mouse and keyboard (both)
- $4 for TV
- $1 cell phone

The National Computer Recycling Act (H.R. 425) [22] introduced by Rep. Mike Thompson (D-CA) creates a fund generated by the collection of Advanced Recovery Fees (ARFs) to be managed by the Environmental Protection Agency (EPA) in a model similar to legislation enacted in California. The proposed legislation:

- Authorizes the EPA to collect a disposal fee on computers at the point of retail sale. This fee would be applicable on all methods of retail sale, whether Internet, retail outlet, or mail-order. The ceiling on the fee would be $10.
- Authorizes the EPA to provide grants to organizations that collect computers for recycling or reuse and/or extracting and using recovered materials from computers in a manner that minimizes harmful environmental impacts.
- Requires the EPA to consult with environmental groups, manufacturers, recycling industry representatives, state and local governments and consumer groups to determine criteria for administering grants.
- Requires the EPA to issue a report identifying and estimating the quantities of all hazardous waste materials used in computer manufacturing and making recommendations for the management of computer waste one year after enactment and every year for four years thereafter.
- Provides waiver to any fee for manufacturers who already run a recycling program (e.g., Hewlett Packard) and to non-profit organizations.

Senator Thompson has explicitly stated that he is not wedded to this Bill as a resolution of the issue of e-waste [23], however he believes that it is important to focus attention on the subject. Senator Thompson joined together with Senator Cunningham in March, 2005, to request a committee hearing on the issue of e-waste [24]. This display of unity between Senators from opposing parties, with separate Bills proposing different approaches to addressing the issue, indicates cross-party support for some type of resolution on this subject. This suggests that while neither Senator may have particularly strong ties to their specific legislation, there is strong political desire to achieve a workable solution.

The Electronic Waste Recycling Promotion and Consumer Protection Act (the Act) introduced by Senators Wyden (D-ORE) and Talent (R-MO). It is based on the concept that tax-credits should be utilized as an incentive to encourage the building of a recycling infrastructure and motivate consumers to recycle. The key aspects of the legislation are:

- A one-time $15 tax credit to consumers who submit with their tax return proof that a qualified recycling facility took their e-waste.
- An $8 tax credit to manufacturers, retailers and qualified recyclers in a given year (over a 3-year period) provided they recycle a certain amount of e-waste (no less than 5,000 TVs or computers) annually as well as submit with their tax returns record of who recycled the e-waste.
- Directs the EPA to give Congress options for creating a nation-wide recycling program.

In his speech introducing the bill to the Senate, Ron Wyden stressed the importance of national legislation regarding e-waste disposal to assist technology manufacturers and

retailers and to assure that e-waste is disposed of in an environmentally and socially responsible way [22]. He stated that tax credits provide more incentive to recycle e-waste than advanced-fee programs. He stresses that the three-year tax credit program is a means to establish a market for e-waste recycling. In the future he envisions it will be illegal to fail to recycle e-waste, and his legislation requires that the EPA examine the possibility of a take-back program to stimulate the production of more environmentally-friendly technology.

The simulated program design within this report will focus on this third piece of legislation; however, first a brief description of some of the other available options and stakeholder positions will be provided.

SUMMARY OF ALTERNATIVE APPROACHES

Although the Act only promotes e-waste recycling via tax credits, other proposed legislation has included different models to encourage the development of a national recycling program. The following is a summary of all of the general legislative approaches (including tax credits) that have been considered:

Tax Credits: Tax credits are distributed to consumers who bring their electronic waste to be recycled and to entities that collect electronic waste for recycling. This option may encourage the development of an electronic waste recycling market, but may be costly to the federal government and would place no onus on manufacturers to improve products for easier recycling or reclamation. It would also require the government to develop guidelines for the recycling of electronic waste and an identification and certification process for electronic waste recyclers.

Advance Recovery Fee: Consumers pay a tax when they purchase their electronic device that is meant to cover the future cost of recycling. Although consumers pay for the recycling of their electronics, there is no end-of-life incentive to recycle e-waste. It requires the federal government to devise a program for distribution of funds so that an equitable market for electronic recycling is created. Finally, as the recycling fee is fixed, there is no incentive for manufacturers to improve their products for ease of recycling or reclamation.

Producer Responsibility Model: Retailers and manufacturers take back their own products and a percentage of "orphaned" electronic products for recycling. This option provides incentives for manufacturers to improve their technologies, because these firms must cover the cost of recycling, but such an approach may be infeasible for smaller producers, and would require the federal government to create a system for monitoring how companies recycle their products.

Deposit-Refund System: Consumers pay a fee when they purchase an electronic device, which is reimbursed when they return the product to a certified recycler. This option provides end-of-life incentives for consumers to recycle their electronics, but may prove

to be an administrative burden on the federal government and does not induce manufacturers to make their products easier to recycle [25].

STAKEHOLDER POSITIONS

The Subcommittee on Environment and Hazardous Materials of the Committee on Energy and Commerce met in July and September, 2005. At these meetings, industry and EPA representatives discussed their positions with regard to the disposal of e-waste. Members of the House of Representatives also expressed their views. The Department of Commerce then met with stakeholders over the following year and put together the "Overview of E-Waste Policy Issues". Some of these views are set out below:

Manufacturers
- Manufacturers are concerned that the cost of compliance with a patchwork of international and state laws would affect manufacturing, marketing and transaction costs, reducing US companies' ability to compete internationally. Many manufacturers prefer a national system, which would increase recycling and allow inter-state trade [26].
- The Consumer Electronics Retailers Coalition (CERC) and Hewlett Packard (HP) oppose a point-of-sale ARF system.
- However, the Consumer Electronics Association (CEA) and the Panasonic Corporation of North America (PCNA) support a visible ARF as being "convenient and transparent for consumers and the most effective way to handle the large volume of historic product in the market" [27].
- The CEA opposes a take-back approach, which it suggests "can be abused by those companies that enter but do not stay in business for a significant length of time" [27]. The burden of recycling then falls on remaining companies or the government.
- The majority of manufacturers explicitly support the tax credit approach as it places the least cost on industry. It provides incentives to deal with historic e-waste, develop recycling programs and, if coupled with a program encouraging manufacturer responsibility, could lead to maximum efficiency [28].
- Industry has agreed that product stewardship should be a priority. This is a product-centered approach, which requires those involved with the product (manufacturers, retailers, users and disposers) share responsibility for reducing the environmental impact of that product. This includes the raw materials incorporated, the design, production process and disposal.

Retailers
- The Retail Industry Leaders Association (RILA) prefers "a national solution in order to avoid confusion from state to state. Any federal program must pre-empt existing state and local recycling laws" [25].
- Where the recycling program includes retail involvement at the point-of-sale, one plan for all retailers and manufacturers would be the most fair and appropriate.
- RILA continues that "Retailers that operate via internet, catalog and all other non walk-in retailers must not be treated any differently than traditional 'brick and

mortar' retailers and must be required to collect the same ARF (advance recovery fee)" [25].

- Smaller retailers may not have the capacity to inventory and store returned disposable equipment, so a take back scheme may place a disproportionate burden on such stores [28].

Recyclers
- Most recyclers prefer a uniform national approach to recycling as complying with different legislation at the state level leads to increased liability and cost. However, the industry stops short of endorsing federal legislation [25].
- Recyclers would also like electronics to be designed with recycling in mind, as the ability to dismantle, reuse and recycle electronic products is improved when the products are new and specifically designed for recycling [29].
- E-waste is sent overseas for recycling as it is more costly to recycle in the US and most manufacturers that utilize materials recovered from recycled electronics are located overseas. A 2002 report estimated that up to 80% of wastes collected for recycling are exported [30]. Recyclers argue that cost effectiveness requires the flexibility to send e-waste overseas where there may be larger markets, particularly for older technology and materials [25].
- Allowing recyclers flexibility by exempting e-waste from the prescriptive hazardous and solid waste regulations would reduce costs.
- Many recyclers believe costs would be reduced if national and international standards were harmonized [22].
- Recyclers would like recycling by prison labor to be outlawed or require the minimum wage to be paid, as it is perceived to be unfair competition. The Federal Prison industry claims to be the largest US CRT recycler, recycling 4.8 million pounds of CRTs in 2004 [25].

Local government
- Local governments express a desire for an outside financing mechanism for recycling e-waste because, at present, local governments take responsibility for the cost of e-waste disposal. For example, the City of Cambridge, Massachusetts, had to pay $70,000 in 2003 to handle electronic waste [25].
- 20 local governments would like to see responsible parties such as producers and consumers pay for recycling and associated costs [22].
- The Federal Government is a large purchaser of IT products and as such has strong purchasing power. This could be used to influence manufacturers to develop more easily recycled products and also provide business to recyclers.

Environmental groups
- Environmental groups believe that efforts to regulate the disposal of electronics are undermined if e-waste can be exported to countries that do not enforce environmentally-sound waste management [25].
- In general, environmental groups support efforts to "green" the design of electronics through a variety of approaches, for example, Design of Electronics (DfE), a process to change product design in order to make it more

environmentally friendly, and Design of Recycling, a process to make products more easily recyclable [22].

- Environmental groups emphasize encouraging reuse as well as recycling, rather than disposal.

Consumers
- The consumer is likely to pay for the recycling of e-waste independent of the type of legislative solution chosen, because taxes, mandated fees or recycling costs are internalized into product costs.
- When disposing of e-waste, current alternatives include donations to charities and recycling locations, but most Americans do not have the information or ability to access these options, and there is a lack of infrastructure to handle the overall demand for these alternatives [22].
- Consumers agree that electronics should be as easy and convenient to recycle as they are to buy [25].

ISSUES TO BE RESOLVED BEFORE LEGISLATION IS ENACTED

Due to the large numbers of stakeholders involved and their competing priorities, it is apparent that there is no consensus as to the best approach for nation-wide e-waste recycling. Two primary issues are yet to be resolved:

1. Product Coverage – it is necessary to identify products defined as e-waste clearly to eliminate guesswork and lengthy negotiations between producers and retailers.
2. Financing – the cost of transportation, labor of dismantling, and collection of e-waste far exceed the value of the recycled product, so debate continues on how to manage these costs.

Following the publication of the Overview of E-Waste Policy Issues mentioned above, discussions have continued between stakeholders to reach a consensus on the approach taken. When this is achieved, it is suggested that the agreed approach will be incorporated into a new piece of legislation, which will be put before Congress [31].

SUMMARY OF THE ACT

The following is a more in-depth summary of the Electronic Waste Recycling and Consumer Protection Act (S. 510). The program design simulation (described in forthcoming sections) assumes this act was made into law.

The rationale behind the Act is provided by using statistics to quantify the amount of electronic waste, its contribution to total waste produced, and the scientific evidence of the threat that toxic materials pose to human health and the environment when released. The section concludes with a call for a nationwide infrastructure for e-waste recycling to facilitate public access to services and improve the efficiency and use of e-waste recycling.

Key statistics cited include:

- 500 million computers will be discarded in the United States between 1997 and 2007 containing 6.3 billion pounds of plastic and 1.6 billion pounds of lead.

- Monitors and televisions constitute 40% of all lead and 70% of all heavy metals found in landfills.

Definitions
The Act defines e-waste as two sets of devices:

- **Display screen** is a TV or computer display greater than four inches, measured diagonally.
- **System unit** is the portion of the computer that contains the central processing unit.

Recycler Credit for Recycling Electronic Waste
An $8 per unit tax credit is proposed for recycling companies that collect and recycle 5,000 or more units of 'qualified e-waste' (any display screen or system unit). Credit would not be allowed in any state that has an existing program providing incentives for e-waste recycling.

Within six months of enactment, final regulations would be issued for certifying recyclers, ensuring safe and environmentally-sound recycling and enabling the tax credit to be split between two or more recyclers. The tax credit would be effective for three years after these final regulations take effect.

Consumer Credit for Recycling Electronic Waste
A $15 tax credit is proposed for all individuals (consumers) who recycle one or more units of qualified e-waste per year for three years after final regulations take effect.

Prohibitions of Disposal without Recycling
Within six months of enactment, the Environmental Protection Agency (EPA) must issue guidelines for waste handlers to assist in the development of recycling procedures. Guidelines must include the reclassification of display screens and system units from 'solid' waste to 'universal' waste.

Three years after enactment, if the EPA determines that a majority of households have sufficient access to recycling, it would be unlawful for any waste handler to accept qualified e-waste without recycling it. Violators will be subject to enforcement of the Solid Waste Disposal Act.

Recycling of Display Screens and System Units Procured by the Federal Government
All federal executive agencies would be required to recover and recycle qualified e-waste they create through a certified recycler.

Nationwide Recycling Program
EPA would conduct a feasibility study for a federal e-waste program that considers four approaches: collecting advance recycling fees; collecting end-of-life fees; requiring manufacturers to assume the responsibility and cost of recycling; and extending the tax credits.

Within one year of enactment, a report would be issued to Congress, including:

- Results of the study.
- Cost-benefit analysis of one or more prospective programs addressing:
  - Costs of each program to all stakeholders (consumers, manufacturers, retailers, recyclers, and administration).
  - Projected quantities to be recycled under each program.
- Benefits of a take-back provision by manufacturers and the projected quantities of recycled e-waste.
- Emerging e-waste streams and cost-benefit of inclusion in the recycling program.
- Progress on the enforcement of the prohibition and increase of recycling as a result.

PROGRAM DESIGN

The rest of this paper will discuss a simulated program design implemented by a newly created E-Recycling Taskforce within the EPA's Office of Solid Waste (OSW). In order to create the program design, we will assume that the stakeholders have reached a consensus and that S. 510 has been passed into law.

Mandatory Requirements

By design, the Act requires certain aspects of the program to be implemented within a certain timeframe. These are the elements that are required to promote the recycling program and analyze the feasibility of various options to promote the recycling of e-waste and reduce the amount entering landfills. The following chart contains the required actions and the timeframe in which they must be achieved.

TIMING	ACTION
After Enactment	Recycle across all federal agencies.
Within 6 Months	Issue regulations to facilitate tax credits.
	Issue guidelines for recyclers.
Within 1 Year	Conduct feasibility study and report to Congress.
For 3 Years	Provide tax credits.

Table 1) Timing of actions required by the Act

The Act outlines specific requirements for each of these actions in greater detail. First, the Act requires national guidelines to be issued to facilitate recycling and certify recyclers eligible to receive the tax credit. Second, the Act requires the creation of the tax credits previously outlined. Third, the Act requires all federal agencies to recycle e-waste. Fourth, the Act requires a feasibility study on a nationwide recycling program to be included in a report to Congress.

Discretionary Requirements

Many of the mandatory requirements can be divided into discretionary components during program implementation. Our analysis has identified four major areas of discretion and potential approaches within those areas. First, the strictness of the certification requirements and recycling guidelines is left up to the program design.

Second, either the consumer or recycler tax credits can be given extra emphasis depending on which is deemed the greater focus. Third, a new program could be created to promote e-waste recycling in the federal government, or the existing Recycling Electronics and Asset Disposition (READ) program could simply be expanded. Fourth, the Act does not identify which component should be given the greatest priority during the program development process.

The following section summarizes our recommended approach to creating a program that addresses each of the above components.

Feasibility Study
This task addresses the necessity of creating a feasibility study of potential national e-waste recycling programs. The objective of this task is to ensure that the problem of e-waste is effectively addressed on a national scale. In order to accomplish this, a consulting firm will be used to conduct the study under careful direction by EPA officials. The consulting firm will be responsible for the study in order to meet the one year deadline. A national electronics meeting held in 2005 can be reconvened to bring together stakeholders (including recyclers, state and local governments, consumer interest groups, and manufacturers) in an effort to get their views on the best approach to create a recycling program. This feasibility study should compile and review existing studies in addition to analyzing the results of state and local recycling programs already in existence.

Federal E-waste Recycling
This task requires the creation of a federal e-waste recycling program across all federal agencies. The goal is to divert a large amount of e-waste from landfilling and incineration and provide an example to the rest of the nation. In order to accomplish this, the E-Recycling Taskforce will partner with the existing Federal Electronic Challenge (FEC) and the READ programs. In the end, READ compliances will be promoted across all federal agencies.

Tax Credits
This part of the program will require working with the IRS to provide tax credits to consumers and recycling companies who recycle e-waste. The goal is to provide a financial incentive to promote e-waste recycling. The E-Recycling Taskforce will focus mainly on promoting the recycler tax credits since the recyclers will have the most to gain from participation in this program. The Taskforce will also coordinate with the EPA's existing Plug-In to eCycling program to promote consumer tax credits to ensure individual consumers are aware of the options available to them.

Guidelines and Certification
A principle focus of the Taskforce will be to develop and implement recycling guidelines and certification requirements. This is a prerequisite for other elements of the program, especially the federal recycling campaign and the tax credit provision. It also encourages safe and environmentally sound practices, and will require the greatest focus from the Taskforce. The Taskforce will initially adapt guidelines from the EPA's Plug-In to

eCycling program and existing state programs. Since tax credits cannot be issued until a set of guidelines is in place, this will serve as a way to rapidly create an initial set of guidelines that can be implemented early in the program. In addition, a provisionary certification system can be created to certify recyclers that will then be subject to annual review. Once again, the goal is to begin the incentive program to promote e-waste recycling rapidly while providing a mechanism to update the system if necessary.

FIRST YEAR PROGRAM RESPONSIBILITIES

The Environmental Protection Agency (EPA) has worked to protect human health and maintain a clean environment in the United States since 1970. The EPA is headquartered in Washington, DC, has 10 regional offices, and employs over 18,000 people across the country. An Administrator who is appointed by the President of the United States and confirmed by the U.S. Senate leads the agency. Figure 5 represents the organization chart of the EPA and highlights the Assistant Administrator for Solid Waste and Emergency Response [32].
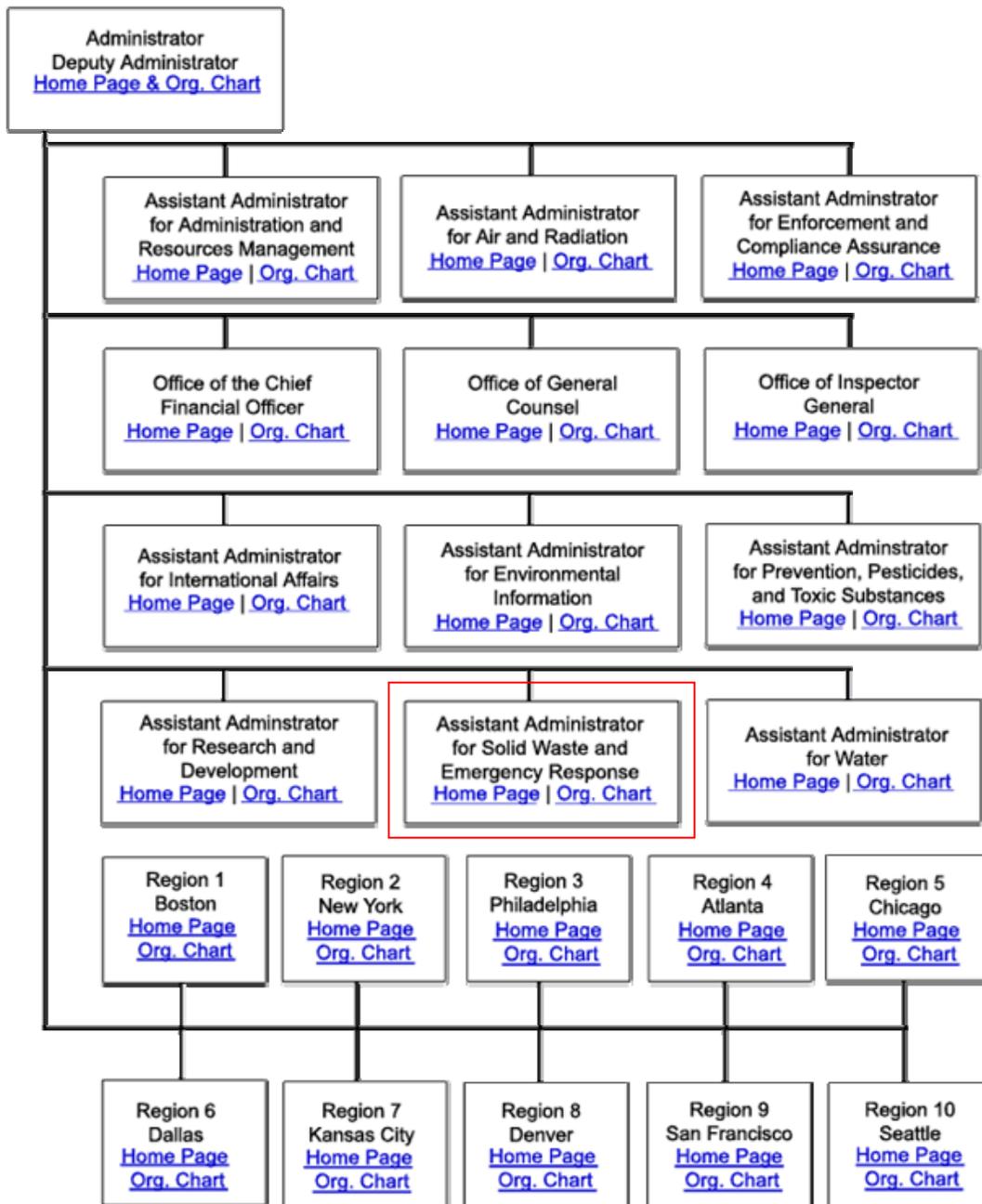
Figure 5) Organizational Structure of the EPA
(source : http://www.epa.gov/epahome/organization.htm)

The Office of Solid Waste and Emergency Response (OSWER) provides policy guidance and direction for the Agency's solid waste and emergency response programs. It has developed guidelines for the disposal of hazardous waste and underground storage tanks. The Office of Solid Waste (OSW) within OSWER encourages sustainability and safe materials management, and fosters waste reduction and responsible management practices. Furthermore, it regulates this waste under the Resource Conservation and Recovery Act (RCRA), which aims at protecting people from the hazards of waste disposal.

Due to its background and mission, the Office of Solid Waste will be responsible for administering the Act. Figure 6 shows the organization chart of OSWER and the Office of Solid Waste.
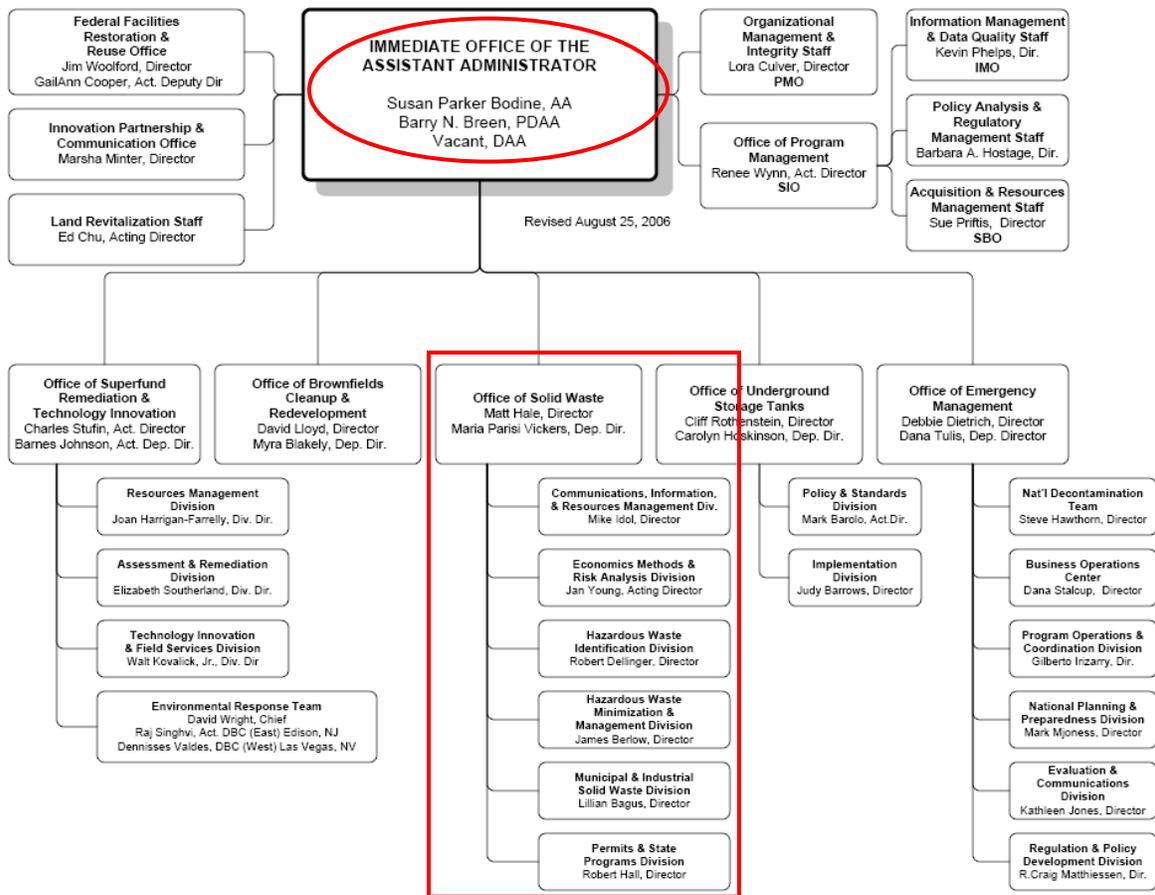
Figure 6) Organizational Structure of The Office of Solid Waste and Emergency Response (OSWER) (source: http://www.epa.gov/swerrims/docs/orgchart_0825_2006.pdf)

In order to implement the tasks required in the Act, the EPA will create an E-Recycling Taskforce to serve a provisional 12 month term within the OSW, with the option for an extension. Additionally, the EPA will contract with a consulting firm to conduct the required feasibility study.

	Time	Task
Taskforce	Within 6 months	▪ Issue certifications to facilitate tax credits ▪ Issue guidelines for recycling
	Through the first year	▪ Manage federal recycling programs ▪ Liaise with IRS relating to tax credit dispersal
Consulting Firm	Through the first year	▪ Conduct feasibility study (under EPA direction) of national e-waste recycling program.
	At the end of a year	▪ Report to EPA which then reviews and modifies it to present to Congress

Table 2) Timeline and tasks for first year of implementation for e-recycling taskforce and outside consulting firm.

E-RECYCLING TASKFORCE REPONSIBILITIES

For the first six months, the Taskforce will focus on issuing regulations to facilitate tax credits and guidelines for recycling. Throughout the first year, the Taskforce will guide federal agencies to perform recycling and liaise with the IRS regarding tax credits. This taskforce will also be responsible for evaluating the deliverables produced by the consulting firm.

Within 6 months

Issue certifications to facilitate tax credits

To facilitate distribution of tax credits, a certification process for handling and processing electronic waste will be designed by the taskforce. They will work with manufacturers and recyclers to ensure awareness of the opportunity created by these credits. The team will work with regional EPA offices that will help process recycler certification applications. Once established, regional divisions of the EPA will manage the certification process.

Issue guidelines for recycling

The Taskforce also has an obligation to issue guidelines for recycling. Upon commencement of the Act, existing state e-waste recycler certification guidelines will be utilized while new guidelines are investigated. These guidelines will be directed to waste handlers and waste transfer stations and will outline preferred recycling procedures for display screens and central processing units.

Report to Congress

When the consulting firm has finished the feasibility study, they will submit the report to the E-recycling Taskforce. At the end of a year the Taskforce will submit a report on progress of the program and the results of the feasibility study to Congress.

Through the first year

Manage federal recycling programs

To divert a large supply of e-waste from the municipal waste stream and provide an example for the nation, all federal agencies are required by the Act to begin recycling their electronic waste. The taskforce will manage the process of the federal recycling program by certifying eligible e-waste recyclers for each federal agency and ensuring communication between agencies on this issue.

Liaise with IRS relating to tax credit dispersal

The Internal Revenue Service (IRS) will administrate the dispersal of the tax credits outlined in the Act. The taskforce will liaise with the IRS to maintain an updated list of recyclers who are eligible to receive tax credits.

CONSULTING FIRM RESPONSIBILITIES

A consulting firm will be brought in to conduct the feasibility study of a nationwide electronic waste recycling program required by the Act. The OSW will write a task order against an existing mission contract in order to hire this firm. This means they will hire a firm already contracted to work for the EPA. EPA officials will manage the study, set direction for it and ultimately approve and revise it for presentation to Congress. Consultants will be responsible for Economic Methods & Risk Analysis, Environmental Risk Analysis, and Policy Analysis. Throughout the first year, they will conduct the feasibility study by gathering and synthesizing data from existing EPA offices as well as gathering new information. At the end of the first year of the program, they will submit a report of their findings to the taskforce who will then present these results to Congress.

Through the first year

Conduct feasibility study of national e-waste recycling program

The consulting firm will conduct the feasibility study throughout the first year. This federal program should be designed to eventually preempt any existing State recycling programs. The study will analyze multiple program approaches, such as collection of an advanced recycling fee, collection of an end-of-life fee, and assigning the responsibility and the cost of recycling electronic waste to electronics producers.

At the End of the first year

Issue report to the EPA

One year after the enactment of the Electronic Waste Recycling Promotion and Consumer Protection Act, the consulting firm should submit a report detailing the results of the feasibility study to the EPA, and it will be submitted to Congress by the e-recycling Taskforce. This report should describe one or more prospective nationwide recycling programs, estimate the quantity of display screens and system units projected to be recycled under each program, and include a cost-benefit analysis of each program.

STAFFING PLANS FOR E-RECYCLING TASKFORCE

As mentioned before, the newly created E-Recycling Taskforce will be coordinated through the Office of Solid Waste. A Program Manager will report directly to the Director of the Office of Solid Waste, and will be responsible for the implementation of the E-Waste Recycling Program. The Taskforce will consist of current employees of the divisions of the Office of Solid Waste who have the expertise to perform the specific tasks. Selected employees will be given provisional appointments to the Taskforce, adding the E-Waste Recycling Program tasks to their job responsibilities. Taskforce projects will entail 30% of specialists' workload and 20% of assistants' workload.
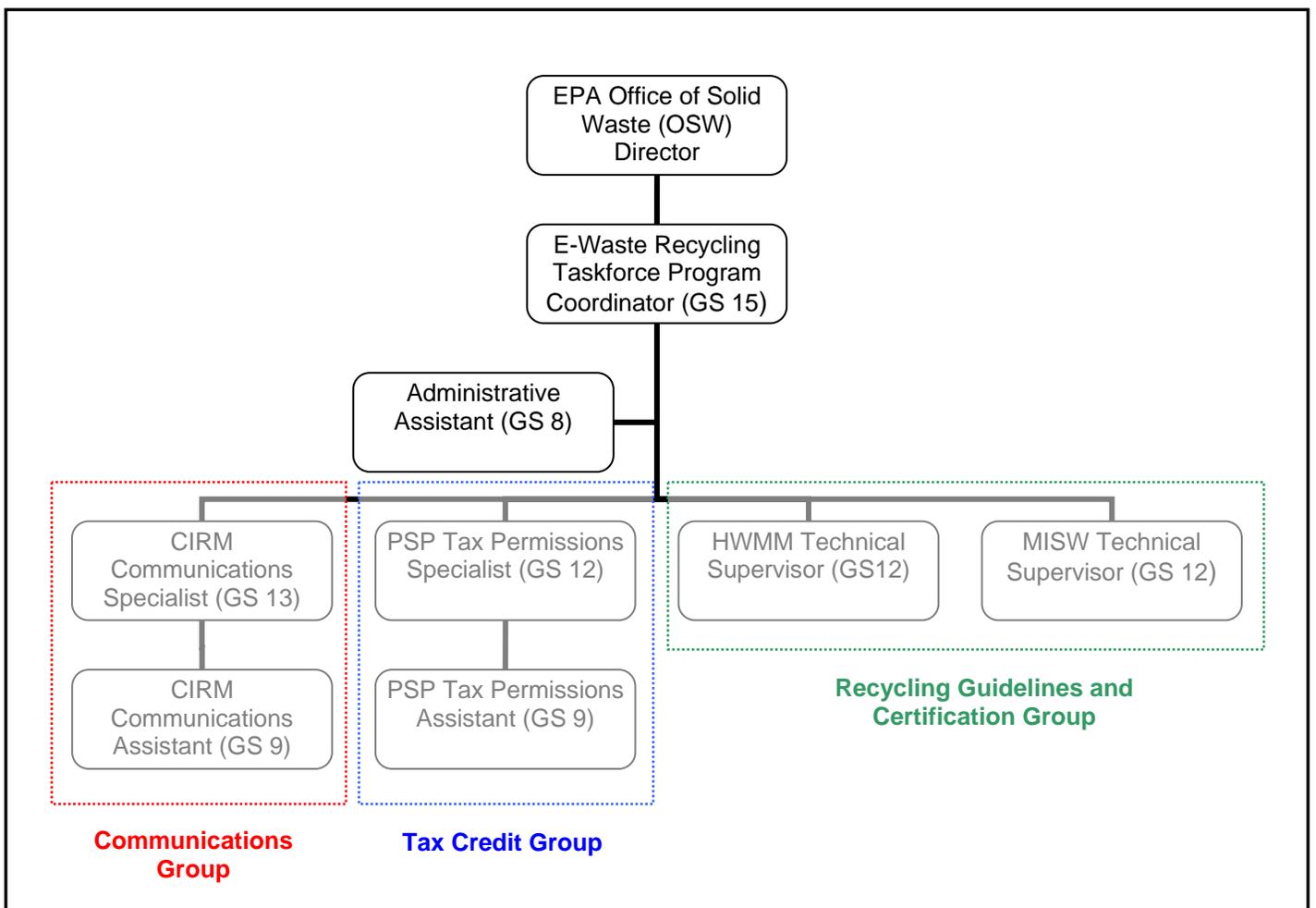

Figure 7) Organizational Chart for E-Recycling Taskforce

Program Manager of E-Recycling Taskforce
- GS 15 ($107,136.00 TO $139,275.00) - 100% Full Time Equivalent (FTE)
The Program Manager, promoted from within the OSW to head the Taskforce full-time, will oversee and manage the taskforce and maintain communication with the director of

the Office of Solid Waste. Moreover, the manager is responsible for coordinating with the consulting firm conducting the feasibility study.

Communication Specialist
- GS 13 (Salary Range: $77,353.00 TO $100,554.00) - 30% FTE
The Communication Specialist will facilitate communication between various federal agencies regarding the E-Waste Recycling Program to ensure smooth communication and keep all stakeholders updated. This individual will coordinate with the existing *Plug-In to eCycling* to promote creation of recycling facilities using the consumer tax credit and will serve as the information manager for the federal recycling program. Throughout the year, the taskforce will manage the federal recycling program and liaise with federal agencies. One person from the Communications, Information & Resource Management Division (CIRM) of the OSW is given this position as a joint assignment and is responsible for ensuring proper communication between the EPA and regional federal agencies.

Communication Assistant
- GS 9 (Salary Range: $41,497.00 TO $61,137.00) – 20% FTE
A communication assistant is needed to assist the Communication Specialist. This officer from the Communications, Information & Resource Management Division (CIRM) is responsible for working with the Plug-In to eCycling campaign to foster partnerships between electronics manufacturers, retailers, and governments, and to promote the consumer tax credit through the Plug-In to eCycling campaign.

Tax Permissions Supervisor
- GS 12 (Salary Range: $64,815.00 TO $84,257.00) – 30% FTE
In order to facilitate tax credits, the certification and permitting process must be designed by the taskforce. The Tax Permissions Supervisor will create guidelines for permitting tax credits based on previous data as well as provide information on tax credit certification processes to encourage e-waste recycling. The primary focus of this individual should be on promotion of the recycler tax credit with a secondary focus on the consumer tax credit. The individual taking on this position will come from the Permits & State Programs Division (PSP).

Tax Permissions Assistant
- GS 9 (Salary Range: $41,497.00 TO $61,137.00) – 20% FTE
The Tax Permissions Assistant will assist the Tax Permissions Supervisor. The assistant will come from the Permits & State Programs Division (PSP) and will be responsible for collecting previous recycling data and submitting the results to the Tax Permissions Supervisor.

Technical Supervisor (2)
- GS 12 (Salary Range: $64,815.00 TO $84,257.00) –30% FTE each
To manage federal recycling programs, one person from the Municipal & Industrial Solid Waste Division (MISW) will guide and supervise the federal government's recycling practices. This position is responsible for managing the technical aspects of waste handling, which must be included in recycling certification guidelines and the recyclers'

certification process. Ideally this individual will be highly experienced with the existing *Federal Electronic Challenge* (FEC) and *Recycling Electronic and Asset Disposition* (READ) programs and will efficiently partner with these programs. Previous experience with state level e-waste regulation is also a desirable qualification. Another technical supervisor will be drawn from the Hazardous Waste Minimization and Management Division (HWMM) to oversee the environmental aspects of e-waste recycling guidelines.

Administrative Assistant
- GS 8 (Salary Range: $35,252.00 TO $45,743.00) - 100% FTE
An office assistant will be newly-hired for administrative work and to assist task members with day-to-day activities. This assistant's duties will include typing letters and reports, taking calls, and preparing schedules and meetings.

PARTNERSHIPS WITH MAJOR STAKEHOLDERS

The EPA created the *Plug-In To eCycling* campaign to foster partnerships between electronics manufacturers, retailers, and governments [33]. This program is in the beginning stage, and the E-Recycling Taskforce Team can utilize the program to market e-waste recycling tax incentives to major stakeholders.

Manufacturers and Retailers
Manufacturers have the greatest ability and also the greatest responsibility to reduce the environmental impacts of their products. Many manufacturers would prefer a uniform national e-waste recycling system, which would increase recycling and allow inter-state trade. Moreover, manufacturers explicitly support the tax credit approach as it places the least cost on industry. Therefore, in addition to providing tax credit to recyclers, the Taskforce Team can interact with manufacturers to encourage product stewardship to achieve the goal of this legislation [33].

State and Local governments
Local governments have expressed a desire for an outside financing mechanism for recycling e-waste because they are bearing the disposal costs. As a result, local governments are interested in national legislation providing incentives for recycling. Furthermore, certification has to be processed by regional divisions of the EPA, but the EPA currently has only 10 regional divisions - Boston, New York, Philadelphia, Atlanta, Chicago, Dallas, Kansas City, Denver, San Francisco, and Seattle. This means the regional divisions will need to rely on local government's knowledge of the infrastructure in their areas. To make the a nationwide e-waste recycling program effective on a local level, it is essential to get the support of local governments [34].

	Commitments	Benefits
Manufacturers and Retailers	- Commit to the program for one year - Provide EPA with the results	- Access to the Plug-In partner site with resources such as Plug-In logo - Subsidization for e-recycling campaign
State and Local governments	- Hold a minimum of two electronics collection events per year - Engage and educate the community - Agree to provide EPA with the results of your outreach efforts and/or collection events	- Permission to use of the Plug-In To eCycling logo and brochure - Providing Case studies reflecting innovative approaches to eCycling by governments, manufacturers, and retailers.

Table 3) Commitments and benefits of participating in Plug-In partnership program for both public and private sectors. Based on current the Plug-In To eCycling campaign-
http://www.epa.gov/epaoswer/osw/conserve/plugin/index.htm

FIRST YEAR BUDGET AND REVENUE PLAN BACKGROUND

The E-Recycling Taskforce program budget includes all inputs deemed necessary for the first 12 months of implementation based on organizational, staffing, and key responsibilities mandated by the Act. General schedules for all US government salary tables were used to determine the personnel costs. The estimated 25% benefit cost is fairly standard for government employees. Other costs include the tax credits for recycling, consulting fees, and standard overhead including supplies, travel, and office space. This budget data was determined using the most up-to-date information available.

PROGRAM BUDGET

This budget is for the first year of the three year program. The total estimated cost for the first year is $1,749,338, including personnel, consulting fees and other supplies. The revenue lost to tax credits during the first year is $150,000,000.

Line-item Budget

Personnel Services

Salaries		$315,470.00
Fringe Benefits		$78,868.00
	Total Personnel Services	$394,339.00

Other Than Personnel Services

Human Resources		$15,000.00
Supplies		$10,000.00
Travel		$80,000.00
Office Expenses		$50,000.00
Consulting Project		$1,200,000.00
	Total OTPS	$1,355,000.00
	Total Operational Costs	$549,338.00
	Total Budget	$1,749,338.00
Recycler Tax Credit		$120,000,000.00
Individual Tax Credit		$30,000,000.00
	Total Tax Revenue Lost	$150,000,000.00

Table 4) Line Item Budget for first-year e-waste program.

Taskforce Personnel

The Taskforce consists of eight employees. The amount of time necessary to complete all program tasks was estimated based on the details of the tasks. Salaries were based on the GS rankings used by the EPA and scaled to the percent of FTE required to complete the necessary tasks.

Consultants

Because the duration of this feasibility study is only one year, it was determined that contracting consultants would be the most effective method of accomplishing the task. The consulting firm will be responsible for bringing together manufactures, recyclers, and state and federal representatives to compile their thoughts on the various recycling initiatives. A line item of $1,200,000 has been allotted to this task. Included in this figure is the cost for the request for price (RFP) preparation and selection process.

Supplies, Travel, Human Resources and Office Expenditures

A total of $155,000 has been budgeted for the program. Included is an estimate of the supplies and office expenditures, defined as any overhead not included in the personnel numbers (computers, pencils, paper, phone, office space, etc.). A small travel line item was also included. Additionally, $15,000 was allotted to human resources for an executive search for the Program Coordinator.

Tax Credits

The estimated tax revenue lost due to tax credits is $150,000,000 for the first year. The rational behind this number is based on the International Association of Electronics Recyclers' estimates that approximately 3 billion units of e-waste will be disposed of before 2010, with an average of about 400 million units per year [21]. Included in that figure is every type of electronic waste; however, the Electronic Waste Recycling Promotion and Consumer Protection Act only applies to central processing units (CPUs) and monitors larger than 4 inches. An estimated 30,400,000 units of e-waste will be recycled by certified recyclers and 4,100,000 units will be recycled by individuals. The number of tax credits distributed will likely increase in the following years as the number of certified recyclers grows.

FIRST YEAR MASTER CALENDAR

	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Creation of Taskforce															
Designate Taskforce Hiring Committee (Director OSW)	▬														
Hire Program Coordinator (Hiring Committee)		▬	▬	▬											
Hire Administrative Assistant (Hiring Committee)		▬	▬	▬											
Select additional taskforce members (Program Coordinator and Hiring Committee)				▬	▬										
Select consulting firm for feasibility study (Program Coordinator)				▬	▬	▬									

	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Issuance of Recycling Guidelines and Certification															
Create provisional recycling guidelines (Recycling Guidelines and Certification Group)					▬										
Advertisement to recyclers (Communications Group)						▬	▬	▬	▬	▬	▬	▬	▬	▬	▬
Create and Maintain database of certified recyclers (Communication assistant)							▬	▬	▬	▬	▬	▬	▬	▬	▬
Provide Provisional recycling certificates (Regional offices of EPA)							▬	▬	▬	▬	▬	▬	▬	▬	▬
Create stricter guidelines (Recycling Guidelines and Certification Group)												▬	▬	▬	▬

	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Federal agencies e-waste recycling program															
Partner with Federal Electronic Challenge (Recycling Guidelines and Certification Group)					▬	▬									

| Task	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Inform all Federal Agencies of Requirements (Communications Group)					■	■	■								
Compliance inspections (Regional offices of EPA)										■	■	■	■	■	■
Informational website for federal agencies (Communications Group)						■	■	■	■	■	■	■	■	■	■
Agency recycling database (Recycling Guidelines and Certification Group)										■	■	■	■	■	■
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Facilitation of Tax Credits															
Create IRS Guidelines (Tax Credit Group)					■	■	■								
Create and Distribute Informational packets (Communications / Tax Credit Groups)							■	■	■	■	■	■	■	■	■
Create consumer information website (Communication Group)											■	■	■	■	
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Feasibility Study (consulting firm with Program Manager's guidance)															
Information consolidation					■	■	■	■	■	■	■	■	■	■	
National electronics meeting								■							
First Draft									■	■	■	■			
Final Draft														■	■

Figure 8) Master Calendar for first-year implementation of the Act.

Creation of Taskforce

The first step in implementing the Act is the creation of the E-Recycling Taskforce. Initially the director of the OSW will designate a hiring committee in October before the first year with the goal of hiring a Program Coordinator to lead the E-Recycling Taskforce as well as an administrative assistant. Since these two individuals are the only Taskforce members being hired from outside the agency, they will be the only two the hiring committee is responsible for. However, once the Program Coordinator has been hired, the hiring committee will be responsible in an advisory capacity for selecting additional taskforce members. The Program Coordinator will be responsible for the selection of the consulting firm to perform the feasibility study. With the majority of the

positions being filled with joint appointments from within the OSW, the hiring process should be completed by February. This is the necessary first step to initiate the program. Once this is complete, different teams within the Taskforce will begin each of the four main tasks in parallel.

Issuance of Recycling Guidelines and Certification
In February, the Recycling Guidelines and Certification Group will be responsible for creating provisional recycling guidelines. This will be their initial task since it is necessary before the e-waste recycling tax incentive program can begin. Once that is completed at the end of February, the Communications Group will begin the public relations campaign to advertise the certification and tax incentive process to e-waste recyclers. As recyclers apply for certification, the Regional Offices of the EPA will be responsible for issuing provisional certification, and the communication assistant will be responsible for maintaining a database of certified recyclers for ease of communication. Beginning in September, the Recycling Guidelines and Certification Group will be responsible for updating the guidelines and creating stricter guidelines if necessary. With this timeline, recyclers can initiate the certification process and the Taskforce can begin administering certifications before deciding on a final set of guidelines, providing time to learn the issues while providing tax credits.

Federal Agencies E-waste Recycling Program
During February and March, the Taskforce will partner with the FEC to understand and promote READ compliance. The Communication Group will be responsible for informing all federal agencies of the requirements for the READ program, and any modifications that may be deemed necessary by the Taskforce. In July, the Regional Offices of the EPA will perform a compliance inspection to ensure that all federal agencies are complying with the e-waste recycling requirements. An informational website and database of recycling agencies will be created to maintain current information and facilitate communication with the agencies.

Facilitation of Tax Credits
Both the Communications Group and the Tax Credit Group will work in conjunction with the IRS to create tax credit guidelines beginning in February with the expectation that, once recyclers began applying for certification, the guidelines would be in place to begin providing tax credits. The main goals within this task after the completion of guidelines will be educating recyclers and consumers on the existence and requirements of the tax credits. For this purpose, informational packets and a website will be created and updated to maintain a continuing dialogue with the public and the e-waste recycling industry. This process will continue throughout the program.

Feasibility Study
The feasibility study will be conducted by the consulting firm with guidance from the program manager. As soon as the consulting firm is hired, it will consolidate information from other studies and recycling programs and analyzing the results. In May, the firm will conduct the national electronics meeting to bring together various stakeholders and take stock of their opinions. During the summer months, it will create a draft of the study

as an update on its progress, and it will complete the final draft for the end of the first year. At that point the program's direction will be evaluated in light of the feasibility study and overall success to that point.

FIRST YEAR PROGRAM PERFORMANCE MANAGEMENT

To ensure the program is meeting its goals, a program management system must be created. Performance management is a method by which a group or organization can ensure that enactment of a particular policy or law is being carried out. The first way to do this is to define:

- The boundaries of the issue
- The most important factors to measure
- What constitutes improvement in a particular condition [35].

The boundaries and most important factors to measure have been delineated as the four required elements of the Act mentioned previously.

Three additional measurements not mandated in the Act that will contribute to its effectiveness and likely re-appropriation are:

- Recycler performance standards
- Operating the program within budgetary & staffing constraints
- Tonnage recycled

Each of these seven performance indicators is discussed in greater detail below.

DEFINING PROGRAM SUCCESS - Collection

1. Recycling & Certification Guideline Issuance to Stakeholders
To establish a nationwide infrastructure for e-waste recycling and to facilitate its use, the E-Recycling Taskforce within the EPA's Office of Solid Waste will work with the IRS to administer tax credits to individuals who recycle e-waste and recycling companies who collect and recycle more than 5,000 units of e-waste. However, recycling companies who wish to receive this tax credit must be certified according to Taskforce guidelines. These guidelines are intended to ensure that recycling takes place in an environmentally sound manner. Initial progress will be determined by percent completion of the guidelines for certification, evaluated every thirty days. After guidelines have been issued, the amount of money granted through tax credits and a head count of participants, divided into consumers and recyclers, will be used as measures of success.

Year-one guidelines will not be stringent as the objective will be to ensure compliance with basic recycling standards and to encourage full geographic availability of services. However, the standards will subsequently be increased to ensure higher levels of environmental protection in years two and three.

Under the Recycling Electronics and Asset Disposition (READ) program, the EPA has awarded eight "Government Wide Acquisition Contracts" (GWACs) to small businesses

(three nation-wide, three in the eastern U.S., and two in western U.S.). The contractors are:

- Molam International, Marietta, Ga.;
- Supply Chain Services, Lombard, ILL.;
- UNICOR (Federal Prison Industries), Washington, D.C.;
- Asset Recovery Corporation, St. Paul, Minn.;
- Hesstech LLC, Edison, N.J.;
- Liquidity Services Inc., Washington, D.C.;
- Global Investment Recovery, Tampa, Fla.;
- Hobi International, Batavia, ILL.

The basic contracts run for one year with up to four possible one-year extensions and a combined potential value of up to $9 million [36].

Existing recycling companies may apply for and obtain certification from the E-Recycling Taskforce within six months of enactment of the Act. Attempts to expand certification to a further four large recycling companies by the end of year two, and an additional four by the end of year three, will broaden and deepen the e-waste recycling market. Smaller recycling companies will also be encouraged to apply for certification, with the aim of certifying 10 - 15 small companies per year. The Taskforce will require certified recyclers to maintain an audit trail documenting reclamation and recycling efforts. Documentation will be submitted with recyclers' quarterly business tax returns. The success of the certification requirements will be evaluated on a number of criteria, including energy reclaimed and environmental impact.

2.   Implementation of e-Waste Recycling Across All Federal Agencies
The Act requires management of the U.S. Government's disposal of approximately 10,000 computers every week [37] and its purchases of more than $60 million worth of electronic equipment and services annually [38]. At present, a significant number of these computers are stored, sent to landfills, or are shipped overseas where environmental standards are generally less stringent.

To address this issue, the Act requires that display screens and system units procured by the Federal Government be recycled by a certified recycler. The head of each executive agency is responsible for ensuring that this is achieved. In addition to the environmental and health benefits which will result from this, it will also provide a substantial stream of e-waste to recyclers which will support the expansion of the recycling industry. This approach will allow the Federal Agencies to lead by example and set standards for private industry and other organizations. Success will be measured by the number of agencies enrolled in the program, and the percent of all federal agencies that have enrolled. These numbers will be updated every thirty days.

3. Feasibility Study & Report to Congress

The Act requires a study of the feasibility of a nation-wide recycling program for electronic waste. This study will be carried out within one year of the Act's implementation and will include an analysis of several factors including:

- Depth, breadth and capabilities of current e-waste recycling market
- Other e-waste streams not currently included in the legislation
- Economic viability of the e-waste recycling market without tax credit incentives
- Other potential programs
- Cost-Benefit Analysis of all aspects of these programs

A consulting firm will perform the study and provide updates on its progress to the E-Recycling Taskforce. The progress of the study will be updated quarterly in terms of the total completed and also within three categories: tax credit, recycler credit, and consultant sub-metrics. Each of these categories will be evaluated individually to determine progress in fields including data gathered and analysis performed. The firm will submit the results of the feasibility study to Congress at the end of year-one as is required by the Act.

4. Recycler Performance Standards – Not Mandated

The Taskforce will include adoption of value-based performance measures for recyclers as part of the certification process. Quarterly reporting by recyclers of their performance in areas such as value added, energy used, and environmental impact will enable development of an e-waste recycling market that maximizes capacity and can sustain itself after tax credit incentive expiration [35]. (See Figure 9)

Index Name	What It Measures
Value Retention Index	Ranks recovery effectiveness of recycling operation or industry
Value Added Index	Assesses performance of individual recyclers by value they add to recovered materials
Energy Index	Compares energy to reuse materials with that required to produce new materials
Environmental Impact Index	Compares environmental impact of recovering used materials with that of procuring new

Figure 9) Atlee & Kirchain Value-Based Recyclability Measurements

5. Operating Within Budgetary & Staffing Constraints – Not Mandated

Monthly accounting reports monitoring performance versus the appropriated budget and headcount plans of the E-Recycling Taskforce will be monitored by the Program Manager. Opportunities for efficiencies or additional requirements may become apparent during the three-year span of the program. Effective management of these factors may support future re-appropriation of portions of the program.

6. Tonnage Recycled – Not Mandated

The most widely used performance measurement in e-waste recycling is tonnage or "mass" of e-waste inflow. This is one of few measurements for which the recycling industry already keeps data. Despite some shortcomings, "mass" provides a simple point of common understanding for all stakeholders and can be modified to increase its usefulness as a performance measure. Tonnage data will be collected on a monthly basis for inclusion on the E-Recycling Taskforce Scorecard (See Figure 10).

DEFINING PROGRAM SUCCESS - Reporting

Each of the seven performance measurements will be monitored regularly at a frequency appropriate to the requirements of the legislation and reported on a monthly basis using the E-Recycling Scorecard. The Program Manager will hold monthly meetings with Supervisors and Consultants leading each area of the program during which Scorecard performance will be reviewed for progress (See Figure 8).

DEFINING PROGRAM SUCCESS - Feedback

The process for gathering feedback from stakeholders and various constituencies of the E-Recycling Taskforce will involve a twice yearly rotation of phone interviews with the estimated 250 recyclers expected to gain certification. Monthly reporting requirements will likely precipitate rapport between recyclers, the Recycling Supervisor and Assistant that will allow for candid and more frequent feedback as need be. In addition, a telephone 800# and web-based comment board will be established to allow any stakeholder, but particularly certified recyclers, to provide feedback and make suggestions for improvements. The program will be responsive to making changes based on the input it receives through the feedback process to best promote e-waste recycling.

E-Recycling Scorecard

Recycling Guidline Issuance	WITHIN 6 MONTHS OF ENACTMENT					
	< 30 Days	< 60 Days	< 90 Days	< 120 Days	< 150 Days	< 180 Days
TOTAL % Complete						
1. Tax Credit GL						
% Complete						
2. Recycler Credit GL						
% Complete						

Federal e-waste Recycling Progress (READ / FEC)	WITHIN 6 MONTHS OF ENACTMENT					
	< 30 Days	< 60 Days	< 90 Days	< 120 Days	< 150 Days	< 180 Days
Count Total Agencies Enrolled						
% Total Agencies Enrolled						

Tax Credit Participation	YEAR 1		YEAR 2		YEAR 3	
	Individual	Recycler	Individual	Recycler	Individual	Recycler
$$ Issued						
% V (+/-)						
Headcount						
% V (+/-)						

Report to Congress on Feasibility Study	End of Year 1	
	YES	NO

Feasibility Study Progess	1 YEAR OF ENACTMENT			
	Q1	Q2	Q3	Q4
TOTAL % Complete				
1. Tax Credit GL				
% Complete				
Data Gathering				
Analysis				
Issuance				
Proliferation				
2. Recycler Credit GL				
% Complete				
Data Gathering				
Analysis				
Issuance				
Proliferation				
3. Consultant Sub-Metrics				
% Complete				
Data Gathering				
Analysis				
Issuance				

Recycler Performance (at prescribed levels)	YEAR 1					YEAR 2					YEAR 3				
	Q1	Q2	Q3	Q4	YTD	Q1	Q2	Q3	Q4	YTD	Q1	Q2	Q3	Q4	YTD
Value Rentention Index															
% V (+/-)															
Value Added Index															
% V (+/-)															
Energy Index															
% V (+/-)															
Environmental Impact Index															
% V (+/-)															

Tonnage Recycled	Year 1	Year 2	Year 3
YTD Program Total			

Figure 10) E-Recycling Taskforce Scorecard – monthly performance management reporting

CONCLUSION

E-waste is a growing problem in the United States. Computers, televisions, and monitors contain toxins that are harmful to humans and the environment, and people are disposing of these items at rapidly increasing rates. As a result, many states and nations have enacted legislation promoting the recycling of e-waste, but the United States has yet to enact comprehensive national legislation. To address this issue, three bills have been put forward, including **S. 510, The Electronic Waste Recycling Promotion and Consumer Protection Act**. This Act aims to reduce e-waste recycling by creating an incentive program involving tax credits for consumers and recyclers. To accomplish this, it requires the creation of a certification system for e-waste recyclers and guidelines to issue tax credits to consumers and recyclers. The Act also requires the federal government to recycle e-waste and calls for a feasibility study of various approaches to recycling e-waste.

We will implement these requirements of the Act through the creation of the first-year program described above. We will create an E-recycling Taskforce within the EPA's Office of Solid Waste to run the program, and they will work in conjunction with the IRS and a consulting firm to fulfill the required tasks described within the Act. The IRS will assist with the issuance of tax credits and the consulting firm will conduct the feasibility study. The budget and master calendar provided in this report define the limitations and expectations under which the Taskforce will work. Specific measures of success described on the Scorecard provided above will be used to ensure the program is on track at every step of the process.

The main focuses of the program include the rapid creation of a provisional certification system to begin certifying recyclers and providing tax credits as soon as possible. After the initial certification system is in place, the E-Recycling Taskforce will update the certification requirements on a longer timescale as necessary to make them more environmentally sensitive, and the consulting firm will conduct an analysis of the overall effectiveness of this approach versus other potential approaches to promoting e-waste recycling. The goals of the program are short-term awareness of e-waste and rapid implementation of a basic recycling program, followed by the study and potential implementation of a more rigorous program to improve its effectiveness at removing e-waste from the waste stream.

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