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Waste Division & Diversion on the UCLA Campus

An Evaluation of the Waste Composition and Cost Effectiveness of Waste Disposal at UCLA, specifically Potential Impact of Implementation of On-Campus Composting

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Waste Division & Diversion

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Campus Waste Disposal Practices

Executive Summary

Our world faces a major problem in dealing with garbage. Garbage is for one, a predicament of management, intensified exponentially in Los Angeles, whose population is expected to increase by 360,000 people by 2030 (as estimated by the City of Los Angeles). The Sanitation Department of Public Works asserts that over 9.4 million tons of solid waste is generated by the City of Los Angeles every single year. Waste contributes to local and global pollution, to global warming, and to the perpetuation of inequity, as the consequences of our massive consumption and irresponsible disposal are going to continue to be felt by the poorest and marginalized. The issue of waste disposal is crucial and unavoidable.

With an estimated foot-traffic of 60,000 people per day, the University of California Los Angeles generates huge amounts of waste. While a greater percentage of this is now recycled, all too much of it goes into landfills, of which almost *none* of it belongs. Additionally, landfill space will continue to decrease, causing tipping fees and disposal costs to increase as we are forced to transport our waste farther away; this is in fact the situation that Los Angeles must currently address because Puente Hills, our local landfill site, will close in 2013. These variables manifest themselves in one major challenge: establishing new methods for handling the massive amounts of solid waste.

UCLA must act immediately. Our action research aims to identify what alternatives UCLA has and what it will take to effectively implement those alternatives. Ackerman Union serves as a focal point of research, allowing for evaluation of the waste stream and cost-analysis of what the establishment of composting services would be. Cost-analysis accounts for the service fees to employ Athens, including gate and tipping fees, and the differences in costs between waste taken to landfills, recycling facilities, and composting facilities. We hypothesize that a very high percentage of the trash generated in Ackerman Union is biodegradable. Additionally, a large amount of recyclable materials are put into trash bins, either by convenience or erroneously. Potentially, thousands of pounds of waste could be diverted from the Los Angeles landfill by installing food waste bins in either eatery kitchen areas and in public eating spaces.

I. What is the problem?

We create too much garbage and currently dispose of it in environmentally harmful and unstainable ways.

The problem that our entire world faces is simple at first look: we create too much garbage. This problem is intensified exponentially within the United States, where higher levels of income allow us to accumulate more resources, but more so, where we are embedded in a cultural addiction to consumption. New solutions are needed for the mass amounts of waste that California, as a state of nearly 38,800,000 people, produces. And as the state's population continues to increase, waste generated will too, making the issue of waste disposal all the more crucial and unavoidable. This research paper aims to identify what alternatives the people and state of California have and what it will take to effectively implement those alternatives; I have interspersed by recommendations throughout.

Without dispute, climate change is of serious concern. Landfills, in emitting methane which is a dangerous greenhouse gas, contribute to the warming of the atmosphere (Portney, 2000). The sun blasts out vast amounts of radiation that enters the atmosphere, hits the land, and is re-radiated back out into space. Greenhouse gases trap these many bands, particularly infrared radiation, and in the process trap heat in the atmosphere. Some natural greenhouse gases include water vapor, carbon dioxide, methane, and nitrous oxide. Other human made greenhouse gases, outlined by the Local Government Commission, include chloroflurocarbons (CFCs), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF6). Greenhouse gases today have increased to levels that are 27% higher than during any other point in the past 650,000 years. In 1751, carbon dioxide levels were under 300 parts per million (ppm). Today, those levels fluctuate around 380 ppm (National Council for Science and the Environment). Most of the carbon dioxide we allow into the atmosphere is combustion of fossil fuels in energy use. In the United States, 82.3% of anthropogenic greenhouse gas emissions come from energy related carbon dioxide. Second highest is methane, and third is nitrous oxide, accounting for 5.4% of greenhouse gas emissions, which is mostly generated by car engines.

Methane makes up 8.6% of greenhouse gas emissions, and while this is far less than carbon dioxide, methane has actually 21 times more power in greenhouse warming potential than the former. Methane comes from swamps, coal mines, oil and natural gas operations, agriculture (through the decomposition cows' stomachs), and lastly, from landfills. According to the United States Environmental Protection Agency, every American throws away an average of 1.3 pounds of food scraps daily. In addition to this, yard trimmings and food waste combined make up 24 percent of our

nation's municipal solid waste. The U.S. EPA also estimates that 75 percent of our waste is recyclable, leaving an astounding estimate of *actual* trash at 1%. Some more basic mathematics brings us to another remarkable number: while methane is responsible for 10.6% of global warming damage from human-sources in the U.S., landfill gas generates approximately 35.8% of all of that. This equates to 3.4%, the percentage of the entire nation's global warming damage that landfills are liable for (Energy Justice). In California, methane from landfills are guilty of emitting 1% of all of the state's greenhouse gas emissions (Proposed Scoping Plan).

A lot can be done to immediately address landfills' contributions to climate change. Greenhouse gas emissions can be reduced significantly through 1) waste generation is minimized, 2) increased diversion from landfills, and 3) more effectively capture air pollutants and gases from landfills. UCLA has the capacity to radically alter current behavior and directly take on the first two of these solutions.

Today, our trash is buried in landfills. But these landfills are affecting our environments adversely and they are filling up. While the amount of trash will continue to increase this year and every year subsequently, several other vital factors will make waste management even more difficult. Landfill space continues to decrease, causing tipping fees and disposal costs to increase as we are forced to transport our waste farther away. These variables manifest themselves in one major challenge: establishing new methods for handling the massive amounts of solid waste. In contrast to landfills, compost facilities allow biodegradable materials to use nature's cycle, break down without any external materials or treatment, and return to the Earth in the form of fertilizer.

II. Current Policies in Place

California will need to adapt drastically to climate change. Every household, public and industrial sector is feeling, and will continue to feel, the effects that the warming atmosphere has on the Earth. Taking into account that, "California is the fifteenth largest emitter of greenhouse gases on the planet, representing about two percent of the worldwide emissions," the University of California has now set goals for all ten of the campuses to reach 75% waste diversion by 2012 and 100% by 2020. Additionally, the California Air Resources Board and the Environmental Protection Agency have coupled to establish a Proposed Scoping Plan. This Plan contends that major changes must be made in California in order for the Assembly Bill 32 and California Global Warming Solutions Act of 2006 climate change goals to be met.

The Air Resources Board (ARB) has stated that "composting of organic waste material has become an important method of managing California's solid waste stream." The ARB quotes that 10 million tons of organic materials - more than 25 percent - are put into the state's landfills every year. In landfills, organic materials cannot access oxygen, creating an anaerobic environment which creates methane, the greenhouse gas with immense global warming potential. A 50 percent reduction goal for diverting organics from landfills has been established by the California Integrated Waste Management Board (CIWMB) for the year 2020, less than eleven years away. This goal has been established in mandate with AB 32's measures to reduce green house gas emissions statewide. As landfill methane emissions makeup one percent of California's current greenhouse gas emissions, diverting compostable material from landfills is imperative.

The ARB and CIWMB are primed to provide incentives for both commercial recyclers and local governments in order to motivate the separation of biodegradables. Furthermore, the ARB and CIWMB will collaborate with the Department of Food and Agriculture and others to supply direct incentives for the utilization of compost in agriculture and landscaping (Proposed Scoping Plan, p 63). I strongly advocate for such incentives; increasing the value of this market makes it probable that these measures will positively affect the clients of commercial recyclers, due to the benefits that companies, like Athens Services, will be receiving and from the increased market for compost.

III. Project Goals

To identify effective and low-cost methods to divide recycling, food waste, and garbage (landfill appropriate) into their respective streams, ultimately diverting more from the landfills, increasing revenue from recyclable materials, and sending the majority into compost facilities. The goals will support ASUCLA and UCLA in establishing sustainable practices to meet Zero Waste goals. With further research, the impediments to proper waste disposal will be evaluated to figure out how to best educate and influence behavior for the successful implementation of sustainable waste disposal on the UCLA campus.

The amassed data and analysis in this report indicate that the establishment of composting services on campus will cost less, both economically for the University and socially, by decreasing the externalities that current waste practices are afflicting on the environment.

IV. Initial Conditions

Ackerman Union, the primary on-campus food destination at UCLA, currently employs a system based around many and widespread trashcans with little diversification as far as trash contents and waste separation. There are _____ number of trashcans, with about (half) of them dwarfing smaller green recycling bins. These can only take up plastic bottles, glass, and aluminum cans, most of which are sparingly sold at Ackerman and are only there if individuals bring them in from outside sources, leaving the bins seldom used. This system is quite inefficient because it promotes

throwing away everything and sending it to landfills; there is currently no type of composting implemented, and recycling is inadequate. The most visited restaurant vendors during the 2007-2008 year were Taco Bell and cooperage, Panda Express, The Greenhouse, Rubio's, and Wetzel's Pretzels and candy, respectively. The top 5 frequented vendors had a combined 1.266 million consumers for the year. Other popular destinations include Jamba Juice and the newly opened Carl's Junior. On the top 5 list, Rubio's and Panda Express both use polystyrene containers for food, which is not ideal to use because it is not feasible to recycle, has potential health ramifications, and it takes up significant volume in the trash. Instead, converting to paper or other compostable containers can facilitate Ackerman's transition to a more sustainable eatery center where composting and recycling will be the primary trash dispersal mechanism and actual trash will be of a miniscule quantity and volume.

V. Methodology: Ackerman Student Union

Our group began with a goal which was to see if it was feasible to implement an effective system of composting in food production areas around campus. We began by examining every eatery on campus no matter how big or small to determine several different variables. First we collected information on the current state of campus eateries the number, type and location of waste bins at each eatery. In addition the types of utensils and style of food packaging given to customers was recorded. The signage for the various waste bins in the immediate area around each restaurant was documented along with a rough estimate of the amount of people that went through each restaurant during peak hours. Gathering this data allowed us to determine where best to focus our efforts, and after careful consideration we determined that Ackerman Union was the most ideal choice, mostly because it has its own loading dock that quantifies its own waste and costs.

Ackerman Student Union – chosen for its centrality and substantial student traffic - functions as the greater unit of analysis in quantifying average garbage content on campus. Random samples of trash bags will be divided up into recyclables, biodegradables, and landfill appropriate waste to get a statistically sound sample of the average waste makeup.

Between pre- and post-consumer composting systems, the more difficult to establish will be post-consumer waste management. In order to investigate the best way to institute a post-consumer waste compost program in Ackerman Union, we had to know the content of the waste being generated in Ackerman Union. To perform the necessary waste audits we contacted our stakeholders were able to have trash bags from all the various restaurants in Ackerman set aside for us to analyze. For our analysis each trash bag was first weighed on a non-digital scale to determine total pounds of waste, after which we set aside four containers that were used to separate the waste. The

trash was then divided into four categories: compostables, non-Styrofoam recyclables, Styrofoam recyclables, and non-reusable trash. Once each bag was sorted, each individual container was weighed to determine the relative amounts of each type of waste. We then took pictures of the containers before emptying them and moving on to the next bag. This process was done over a period of several weeks for over 50 bags of trash to ensure sufficiently accurate data.

In addition to waste audits, our group investigated several other topics relative to our research via the internet, contacting sustainability figure heads at other college campuses, and traveling to the nearest major landfill to UCLA in order to fully understand the nature of the waste management process at UCLA.

Landfillable (all Styrofoam)

Recyclable **Compostable** **Landfillable**

Waste Audits: Pictures Analysis

During our trash auditing methodology, our group took a variety of photos on various days that help validate certain trends that were commonly found in the trash. In the recycling section, the major items found were the lids to paper cups, random assortments of aluminum or plastic bottles, plastic utensils, sandwich or salad plastic containers, and salsa containers from Rubio's. There are currently some recycling bins located in positions adjacent to trash bins, but they can only accept aluminum cans, plastic bottles, or glass bottles; instead, these potentially recyclable products are

sent to the landfill. The most commonly found polystyrene (Styrofoam) products are food containers, particularly from Rubio's, Panda Express, and Jamba Juice. The category that had the most mass every time during our research was composting, and the commonly found items are compostable cups and utensils, plates from various vendors including Sbarro, food waste, napkins, paper cups, and newspapers.

The last of the four categories is actual trash that cannot effectively be composted or recycled. It was typically the smallest category by volume and mass, and there is a pattern to what commonly appears. The main culprit is not one particular vendor, but instead the methods of distributing condiments and sauces that several vendors employ. From Carl's Junior's ranch dressing and ketchup to Taco Bell's hot salsa to Panda Express's soy sauce, individual sauce and condiment packaging is a huge source of trash that cannot be diverted. Other trash sources are straws (which could potentially be recycled but are not), individually wrapped products like protein bars and bags of chips that are brought in from outside of Ackerman, and certain plastic wrappings. Taco Bell uses a combination of plastic and paper for certain food products they sell like Quesadillas and Empanadas, and these too have shown up as portions in the trash category. One of the most common items to appear is the plastic wrapping from Panda Express's fortune cookies.

During one day of trash auditing, we combined all of the actual "trash" that could not be diverted from the landfill and clearly established the main problem of individually wrapped condiments and sauces. One potential change could be the gradual switch to large dispensers of condiments. This system could prove to be much more efficient; consumers would take exactly how much they need – no more and no less. With individual sauce containers, there is a tendency to take more than you need, and this is proven by constantly finding completely unopened salsa, soy sauce, and ketchup wrappings in the trash. This new method could potentially eliminate a good portion of 3landfill trash from Ackerman, and it could also work towards better efficiency through waste diversion. Although Rubio's still generates recyclable waste through their salsa distribution policy, their system serves as a perfect example of what can be done to avoid individual wrappings, a huge culprit in the actual trash category of our research.

VI. Waste Audits: Results

[see attached Waste Audit Results document and Appendices for charts]

VII. Analytic Methods

Analytic Methods included a review of other college composting programs, investigation of polystyrene, identification of University, state, and national policies governing waste management, and exploration of Athens Services, Puente Hills Landfill, and the upcoming Waste-By-Rail system.

Athens Services

Currently, UCLA employs *Athens Services*, the primary waste collection and disposal service of Los Angeles, to handle all waste generated by the campus. Athens provides a wide variety of services for UCLA and its surrounding community including waste collection, recycling, disposal and even street sweeping. The residential hill uses the most services, which although complicated, is the most progressive in moving towards a zero waste campus. The residential hill and the campus both have landfill waste and recycling services but De Neve dining hall and more recently, Rendez Vous eatery also collect both pre-consumer and post-consumer food waste. The dining halls have a much less complicated system since it is a closed system and all china and silverware are reusable. The post-consumer food waste is scraped into a pulper that grinds up the food and disposes it into bins. Rendez Vous has a more complicated dining system that is more similar to what the campus and Ackerman see on a day to day basis. Although Rendez Vous does rely on post-consumer behavior to avoid contaminating their food waste bins, all of their food is served in compostable boxes leaving only the lids and straws for the separate been. Ackerman should look towards modlelling their eateries around Rendez Vous' style, which means new negotiations with vendors.

Los Angeles, along with UCLA have goals to reduce their waste, eventually to zero waste. To encourage this ideology the city of Los Angeles has offered a subsidy to help start composting programs. Currently they offer an 80 percent subsidy for the first year, 60 percent for the second year, and 20 percent for the third year until the full price is paid in the fourth year. This is a key piece of our cost analysis that will follow.

Landfills and the Site Determination

A landfill, or dump, is a plot of land designated for the disposal of waste materials and products through a daily burial process. Landfills have historically been the common solution to trash disposal in both rich and poor countries, differing in the supplemental activities that occur at such locations, such as recycling programs and waste processing. In order to determine the site of a landfill, many requirements and measurements must be fulfilled. Current state policies require that location analysis, stability analysis, capacity analysis, and recognition of the environmental and fiscal costs of

the landfill be accounted for. The selection of the land to be used is significant to both the trash producers and trash managers, especially as new landfills are being created with new transportation and operation costs. Los Angeles County, for example, is currently transitioning from using a local landfill at Puente Hills, which will close in 2013, to using a remote landfill in proximate deserts which will be accessed and managed through a waste-by-rail service. When evaluating the effectiveness of such alternative landfill programs, one should consider variables that might result in higher operational costs (road access, necessary transfer stations, land value, and the cost of maintaining government requirements and measures) as well as the inherent costs of the landfill (appearance, community support, pollution to ecosystem, and the opportunity cost of the land being used).

When building a landfill, city planners must also consider the stability and management of hazards within the landfill. Not only should the city managers be sure to provide stable and durable work within and around the landfill in order to mitigate the danger of gas, chemicals, and other by-products of the landfill, but they should also be very aware of unforeseen environmental threats. They should study the area and understand any geological issues that might threaten the structure, such as potential Earthquakes and fault lines, while also studying natural flows of the area such as underground aqueducts or rivers that might supply communities with water. Although open deserts do provide a current supply of land for the waste storage systems we utilize today, it is understood that landfills are not a sustainable means of trash management and that environmental stresses should motivate the innovation of new, sustainable waste management systems.

With every landfill created there exists associated environmental and fiscal costs. Current environmental regulatory agencies do ensure that modern landfills contain certain characteristics in order to restrict any negative externalities the landfill might present to the previously existing land. A series of liners and drains within the landfills prevent soil and water contamination, usually through a leachate system that stores run-off water and precipitation from the fill and prevents leakage of the toxic and fermented products within the landfill to surrounding areas.

Other concerns such as rainfall and water depths beneath the ground also are accounted for when determining landfill location. In order to dispose of waste that cannot be recycled or renewed through today's technologies, the Los Angeles Sanitation district designates 'landfills' or very large, often in the thousand acre range, plots of land that are emptied out and filled with trash. The sanitation district of Los Angeles proudly employs "many measures…to protect

the air, water, land, and the public," including a daily covering of the trash with dirt and cover materials, a developing recycling program, and an aesthetic maintenance of the landfills, as suggested by the photos of the Puente Hills Landfill.

Many newer landfills also employ gas systems that aim at capturing the gas products generated within the landfill during decomposition. Capturing these emissions can not only decrease greenhouse gas impact, but also can generate a feasible source of liquefied natural gas for vehicle fuel. There is potential for this, which the California Integrated Waste Management Board has acknowledged, but thus far only plans to create a Discrete Early Action measure for such methane control has been made (Proposed Scoping Plan, p.62; CIWMB website). Evaluations of existing waste-to-energy plants should be taken and extensive measures should be made to construct methane-capture systems within every landfill possible. State policy should mandate that every single new landfill built have the best system in place in order to mitigate the climate change impact made by landfills and to take advantage of the energy that can be harnessed.

Besides the environmental and physical cost of the landfill, there are also large financial costs associated with the construction and operation of the landfill. For example, the new Mesquite Regional Landfill will require construction funds of over $100 million dollars for the initial construction. This is on top of the $44 million dollar fee for obtaining the land. The waste by rail service that the Sanitation District of Los Angeles is developing and hopefully utilizing by 2010 will shift the landfill for the county to a desert location that is out of site and out of mind while closing the Puente Hills landfill that is on the inland of the city at the same time. The landfill will be served by a rail system that is based on current rail lines and with the construction of "materials recovery facilities (MRFs) located throughout Los Angeles County" that will filter the waste for hazardous materials and some supplemented recycling, as well as internodal rail yards used [to store] residual waste" that are stored in "internodal containers" and are carried by the rail service. (Waste by rail system poster). Additional fee's for road construction, supplemental recycling and processing facilities, and transportation fleets also are required over the years developing the landfill. Contrastingly, the job opportunities and revenues generated from the commerce and trash management do benefit the local community. For example, the Mesquite Regional Landfill will generate "host fees of $17 million…and 250 jobs" for the Imperial County (6). The costs and benefits of the landfills vary from system to system and should be considered when developing future plans for sustainable waste management.

The capacity of a landfill is also critical to development of such systems. When creating the landfill, whether in canyon or as a mound, the landfill must maintain a capacity that is economically viable as it should have a long life, a small

environmental impact, and realistic operational costs. It is the job of city planners to determine such values as the amounts of trash generated per household are growing alongside the increased urbanization of many cities and regions. Los Angeles County alone generates upwards of 18,000 tons of trash per day that is dispersed between the three functioning landfills, each of which has a foreseeable capacity issue (LA City of Los Angeles: Sanitation Department of Public Works).

Ultimately, the disposal of trash into landfills, local or remote, have associated fiscal and environmental costs that must be considered when developing a system of waste management for an exponentially growing population, living in an increasingly dense society where land is becoming less and less available.

University Program Comparisons

Composting practices are integral parts of waste management and many college campuses across the nation have already implemented composting programs. The same general system of composting has proven effective for most of the colleges researched although it is necessary that each institution modify its system to fit the specific campus. There are several different ways in which composting can be achieved and when examining colleges all over the country, obvious trends become apparent in terms of what works and what does not.

The most prevalent form of composting focuses on management of pre-consumer and post-consumer waste in cafeterias and other food production areas on campus. Managing pre-consumer waste is an easily executed goal and amounts to little more than a brief education of employees and proper placement of compost bins. At UC Davis, a campus of over 25,000, it was estimated that an eatery which serves 1,800 people per day generates between 150-200 pounds of compostable pre-consumer waste (1). Based on computer records, the eateries in Ackerman Union at UCLA serve over 5,000 people per day, which would translate to roughly 500 pounds of compostable pre-consumer waste generated every day. In addition Occidental College in Los Angeles estimated that it took one dining facility employee at a an extra 30 minutes to prepare the pre-consumer waste for composting (2), so there is no significant increase in the workload of employees when it comes to managing pre-consumer waste.

Post-consumer waste must be handled differently due to the involvement of the student body and general public. UC Davis also measured post-consumer waste and found that an eatery which serves 1,800 people per day generates around 400 pounds of compostable post-consumer waste (1). Again using computer records, it can be estimated that Ackerman Union at UCLA generates roughly 1,000 pounds of compostable post-consumer waste each

day. Understanding the waste flow is essential to management of post-consumer waste and most campuses use some form of waste auditing to determine the standard content of garbage. At UCLA it was found that the average 15 pound bag of trash from campus eateries contained less than half a pound of non-compostable, non-recyclable materials. Getting that remaining 14.5 pounds into bins specified for recyclables and compost may be challenging. Berea College in Kentucky attempted to collect post-consumer waste by placing separate bins in their campus eateries, however they had to halt their efforts because of excessive contamination of the compostable materials with non-compostable trash and recyclables (4). One reason for the ineffectiveness at Berea was due to a lack of adequate signage to make it obvious to students how to properly dispose of their waste. Washington College in Maryland took the opposite approach using brief, straight forward, easily interpretable signage and has had more success (5). This practice is vital if post-consumer waste is to be managed well and all campuses that have working post-consumer waste collection programs have signage of this kind. UC Davis has also made extra efforts in an attempt to educate its student body about the benefits and proper ways to compost by placing pamphlet boxes all over their campus and holding workshops to further educate people (1).

In addition to food production waste management there are other types of college composting programs that exist. One of these focuses on the redirecting of landscape waste such as leaves, branches, and shrubs to more effective uses in composting. Another, which mainly occurs on campuses in more rural areas, involves composting animal waste and straw but because these to types of composting are not the focus of our proposal they will not be covered in any more detail here.

College composting programs have existed in this country for decades, for example the system at Rice University has been around since the 1980's while that at UC Davis was started in 1999. Middlebury College began a food waste and landscape composting system in 1993 and since then has saved over $200,000 in landfill disposal costs (6). Haverford College in Pennsylvania has determined that if they add an on-campus composting system known as the Somat, they would divert 800 pounds of waste from the landfills per day and save $3,269 dollars per year (7). The bottom line here is that each system, no matter what school implemented it, has saved money and has been successful enough to last for years.

UCLA is a world renowned university and if the campus were to implement some of these very simple and effective practices the benefits would extend well outside the actual waste that would be reused. UCLA is a large, urban

campus that is not ostensibly the most ideal choice for composting, because there is no on campus composting site and the high population density generates an above average amount of waste (3). However, we seek to shift the prevailing societal perception that so-called "natural" initiatives do work in dense urban landscapes. If successful composting were implemented at such an influential university like UCLA where its location and size make composting more difficult, then a new precedent will have been set. Sustainability is the way of the future and the responsibility to lead by example lies with powerhouses like UCLA.

Eliminating Specific Material Waste: Styrofoam

Polystyrene, frequently called by its brand name Styrofoam, material is extremely lightweight, low-cost, and efficient in heat retention, but with those benefits come significant cons. For one, polystyrene has potential health risks. The main chemical component in these containers is styrene, which has been suspected to have the ability to migrate from the container into foods or drinks. Furthermore, this migration may be intensified when foods or drinks are hot, or when they contain alcohol or acids. The rate of migration has been recorded as high as 0.025%, which seems minuscule, but over time, the accumulation may be a significant health risk. Studies seem to suggest that styrene is a hormone mimic of estrogen; therefore, it can disrupt normal hormone function. Exposure to small quantities over a long time period is suspected of causing various physiological issues, ranging from chromosomal abnormalities to low platelet counts to negative neurological effects like fatigue, nervousness, and difficulty sleeping. The International Agency for Research on Cancer lists styrene as a possible human carcinogen, but these studies have been primarily based on workers in styrene-related chemical plants. Nevertheless, it is clear that more research is needed on the toxic effects of long-term exposure, especially because of the already established mal-effects of hormone mimicking components in humans and its subsequent accumulation in the brain, nervous system, and other areas of the body.

The universal recycling symbol can be found on the bottom of polystyrene containers, but is a material really recyclable if it is not an economically viable option?

Polystyrene is imprinted with the Recyleable symbol that also indicates its plastic type, #6, despite the fact that every large-scale attempt to recycle it has been unsuccessful (SOURCE). The California Department of Conservation has estimated that the recycling of polystyrene costs over $3000 per ton. This means that polystyrene in fact has a negative recyclable value. To contrast this with other materials, the recycling of glass, for example, costs about $89 per

ton. All attempts to recycling polystyrene on a large-scale basis in the past have failed; overall, less than 1% of polystyrene is recycled in California, according to a report commissioned by the State of California.

Because of the extensive volume that these types of food containers occupy in waste that is thrown into landfills, it initially seems like a good idea to recycle this material. To accurately analyze the plausibility of recycling polystyrene, it must be looked at through an economic eye. First off, there are seven distinct categories of recyclable plastics, each of which cannot be recombined with one another during the recycling process. Categorized 1 through 7, they are: polyethylene terepthalate (soft drink bottles), high-density polyethylene (milk jugs), PVC (cling films, blister packaging), low-density polyethylene (margarine tubs), polystyrene (insulation foam sheets, cheap toys), and everything else, usually polycarbonate. All polystyrene packaging products represent 1% by weight of the total municipal solid waste disposed in U.S. landfills, although their volume is significantly larger. When considering recycling polystyrene, there are two key inhibitors. One is transportation and its associated costs. Transporting polystyrene over long distances to a recycling center is costly, and it must be compacted and "densified" in order to make this process cost-effective. The other key inhibitor is contamination. Almost all food containers are highly contaminated from food products and must be cleaned prior to recycling. This requires additional resources and time distributed out to laborers, both of which increase costs. Overall, recycling depends on supply and demand. At this point in time, it is not economically viable to recycle food service polystyrene. In business, "economics rule over emotion[s]," and this applies to recycling polystyrene; recycling firms will not pursue this option because it is not cost-effective and thus, I argue that the notion of Styrofoam as recyclable should itself be thrown away.

Banning Polystyrene

Styrofoam products have been banned from the city of San Francisco. The ban took effect in June of 2007, dictating that all food vendors in the city use only recyclable or biodegradable food ware, such as to-go containers and bans Styrofoam™. Currently, vendors are excepted if their food ware is not replaceable by another material that is within 15% of the same cost. Violations of the ordinance result in fines, penalties, or "other civil enforcement action." (sfgov.org) San Francisco created this Ordinance in light of *Styrofoam™'s* adverse effects on wildlife, the oceans, humans (Styrene may be a carcinogen and neurotoxin), and the City's polluted landscape. Currently, a violation of this ordinance results in a warning for the first offense, a $100 fine the second time, $200 the third time, and $500 for a fourth or more offense. This is enforced by the City administrator and is partially enforced by customer complaints.

Environment California, a 30-year-old advocacy organization, has been working on a campaign to ban single use Polystyrene food ware. Their efforts have manifested in Assembly Bill 1358 which has most recently surpassed the first step in state-wide implementation as it passed out of the Natural Resources Committee in late April of this year, 2009. The organization will no doubt continue to push the passing of AB 1358 but we must not ignore power of political interest groups. Political opposition for such legislation is inevitable, and the groups that would take on the biggest costs of new regulations will be the most aggressive, especially those that can most cheaply organize to lobby against legislation. Not surprisingly, current opposition includes the California Restaurant Association, the California Retailers Association, and Society of the Plastics Industry. Another note: Los Angeles County Solid Waste Management Authority has given public support to the Bill, but the Los Angeles Area Chamber of Commerce opposes it. The University of California can make an immense statement and impact by instituting this ban, regardless of how long it takes AB 1358 to pass.

Although it is lightweight, energy efficient, and has strength comparable to its weight, industries and vendors should consider alternatives to polystyrene. There is no irrefutable evidence that implicates styrene as a carcinogen or toxin, but studies certainly suggest the possibility, and when dealing with a hormone mimic that can interact, accumulate, and change the human nervous system, every precaution should be taken. Also, the lack of cost-effectiveness for recycling polystyrene further raises the incentives for using different packaging products, such as paper, which can be composted. We believe that polystyrene should be banned from UCLA entirely, starting with the substantial percentage of it which is used daily for food. If entire municipalities can ban polystyrene, then UCLA can as well. We can put vendors on notice, give them a timeline to comply, aid them in finding cost-competitive and adequate alternatives, and require that all food sellers abide by standards for food containers, encouraging biodegradable containers first and foremost, and recyclable ones second.

X. Cost Analysis

[see attached Cost Analysis document]

V. Recommendations, including Future Research

We outline below recommendations for action, some for immediate implementation and others for the near future, which we assert should be initiated as soon as the Fall of 2009.

Immediately

Couple every single trash can in Ackerman Union with a recycling bin.

Increase number of recycling bins, decrease number of trash bins.

Add in recycling bins for items besides bottles & cans (ie for plastic plates, bowls, forks)

ASAP Action

* present to the ASUCLA Board of Directors (possibly in late summer of 2009, per personal conversation with Roy Champawat)

Full Composting Program in Ackerman Union:

- Pre-Consumer Bins in all Eatery Kitchens/Food-Prep area
- Post-Consumer Bins on all Dining Floors & Patios
- Training Staff
- Education Campaign / Signage for Student Body & UCLA Community

Review the Composting Program at Rendez vous restaurant:

- Examine the successes and obstacles of removing trash cans and replacing them with only recycling and food waste bins. Review educational and direct signage and measuring average waste weights. Problems and solutions identified will serve as models for action in Ackerman.

Sociological Analysis of Best-Bin Placement

- Research methods of measuring best bin placement in public area (i.e. Ackerman Union) for optimal placement of trash, recycling, and compost bins
    - Foot traffic
    - Sociological / Psychological behavioral influences
- Create Floor Maps of Bin Placement

Goal: eliminate all Styrofoam and, where possible, condiment packets

Full Cost Analysis of Packaging Alternatives

- Enable each Eatery to switch to alternative packaging (Suggestions/alternatives for "bad" items)
- Potentially establish Ban on Styrofoam

Long-Term Goals

Generalize to Lu Valle, Northern Lights, etc.

Establish complete Campus-Wide Composting that will continue to be cost-effective and managed sustainably

V. Conclusion

Implementation of Pre & Post-Consumer Composting: Social Support

Today, we are stuck in a system of trash. Humans are creatures of habit, and we all innately want to make systems easier. This is accomplished by simplifying things that are typically more complex. A trashcan, for example, is the simple means of converging various categories of trash into one collecting device. Over time, as a society, we become accustomed to these methods and resist change because it is difficult. In our minds, the idea of one simple trashcan has taken precedence. As our society evolves and becomes smarter, we are noticing that even though this system may be easier, it is certainly not sustainable for the future. We now have a much more refined recycling program in parts of the world, but nonetheless, the superiority of "trash" has not yet diminished. It is important to move over the hump of one collective trash to a society that implements specialization for each waste category. The need for bins that are separate for recycling, composting, and trash is essential. At first, it will prove to be challenging to accurately inform the masses about the changes, but this can be accounted for by excellent, concise, and informative signage, employee and management's help to confused citizens, and most importantly time. Time has drilled the trashcan into many of our minds as the single end destination for our food, drinks, or other possessions that we want to part ways with, but our society has realized the fallacy of this. Once smarter, more efficient waste-management systems are incorporated for some time over a larger spectrum, it will take over as the innate thoughts in people's minds throughout our society.

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