ABSTRACT

AN INTERNSHIP WITH THE ZERO WASTE ALLIANCE

by Trevor Herron

This paper reports on an internship at the Zero Waste Alliance in Portland, Oregon. The Zero Waste Alliance is a non-profit organization that provides sustainability consultation for public and private organizations. The report focuses on three main projects and the professional development achieved as a result of this work. The main projects consist of a chemical assessment and ranking project for the Port of Portland, a waste management project for Widmer Brewing Company, and research of biodiesel fuels for a biodiesel coop.
AN INTERNSHIP WITH THE ZERO WASTE ALLIANCE
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Chapter 1:  
Introduction

The Zero Waste Alliance (ZWA) is a small 501 (c) 3 not-for-profit organization that is currently part of a larger organization called the International Sustainable Development Foundation (ISDF). ZWA provides support for organizations to help them reduce and eliminate their waste. The zero waste model is used as a guiding principle for the organization to follow. Their idea is that waste is a valuable resource, and that it does not have zero value or negative value in the case of large disposal charges. Internal resources and a network of universities, national laboratories, government resources, and private consultants are used to provide support for a variety of organizations that want to become more sustainable. ZWA provides education and training, management support, technical assistance, and assistance with documentation to organizations across many sectors.

One of the areas of expertise for which ZWA offers assistance is environmental management systems (EMS). Through the development and implementation of an EMS, a company can become recognized as an ISO 14001 certified organization. ISO is the International Organization for Standardization, and they provide internationally recognized certification to companies that successfully implement an EMS that is up to ISO’s standards. Larry Chalfan, the executive director of ZWA, was the CEO of the first company in Oregon to be ISO 14001 certified. His expertise is very valuable to companies that want to design an EMS that will be recognized internationally by ISO.

ZWA has also been designated by the U.S. EPA as one of eight national Local Resource Centers (LRC). The eight LRCs make up a Public Entity Environmental Management System Resource Center (PEER Center) that is set up specifically for local, county, and state governments that are interested in implementing an EMS. Thus far, only governmental organizations from Oregon and Southern Washington have utilized our LRC, but the organization has been set up to serve the entire Western region of the United States.
EMS, however, is only one of the areas of support that ZWA provides. We also provide training and education for organizations that are interested in learning more about the tools, methods, and concepts that are used to approach a zero waste process. We provide training for groups about Full Cost Accounting, Green Chemistry, Design for the Environment, and Life-Cycle Assessment. We work with the concepts of The Natural Step (TNS) to go beyond a Cradle to Grave framework to a Cradle-to-Cradle framework. We try to ensure that all resources that enter into the industrial or societal cycle are kept there, or are easily transferred back into nature’s cycle (McDonough & Braungart, 2002). This cyclical approach recognizes that our resources are finite, and that there are many ways to reuse these resources and keep them “in the loop”. Our efforts are reported to various interested parties through conferences, workshops and speaker services.

Technical services are also provided by ZWA and make up a large part of our activity. Lauren Heine is a former Fellow in the Green Chemistry Program at the U.S. Environmental Protection Agency in Washington D.C., and served as Director of Green Chemistry and Engineering for ZWA during my internship. Dr. Heine has created a database called the Chemical Assessment and Ranking System (CARS) that is used to identify all the chemicals used by a company, and assess which ones are most hazardous. The database has been very valuable to companies that want to reduce their environmental impact, eliminate their hazardous materials, and simplify their purchasing and disposal of chemicals. My first experience as a project manager was on a CARS project, which is outlined in the following report. Dr. Heine’s expertise and the CARS program are utilized on many technical projects, which include the identification of more benign replacements for toxic chemicals and hazardous materials, research on cutting edge solutions to technical problems, development of custom training programs, and identification of resources with the capability to provide solutions to the most difficult problems.

![Figure 2: Cycles of society and nature in a zero waste system.](image)
I was brought aboard at ZWA to provide support across all of these areas, with a focus on the development of new projects. My research and communication skills were used for business development, and by the end of my internship, I was prepared to conduct the projects that I helped bring in. I was given a great deal of latitude as far as what type of projects I was allowed to bring in, as long as the project ties into sustainable practices. My other tasks at ZWA were varied. ZWA is a small organization, so everyone is expected to contribute to any project that needs attention. The diversity of projects provided a very interesting working environment, and many opportunities to learn about new areas of sustainability.

ZWA was an exciting agency to work for at the beginning of my career in the environmental field, and an appropriate organization for my area of concentration in International Environmental Affairs. Although ZWA’s clients are for the most part local, the agency is dealing with issues of sustainability that are relevant internationally, and helping companies to comply with internationally recognized standards of environmental performance. I was exposed to the inner workings of organizations across many sectors, and I was able to learn about how governmental, academic, non-profit, and corporate organizations function in the pursuit of sustainable practices.
Chapter 2: CARS Project

One of the most applicable and marketable services that ZWA provides is a computer database program called the Chemical Assessment and Ranking System (CARS). CARS was developed at the Zero Waste Alliance to provide a framework for assessing chemicals and establishing priorities for substitution or elimination of potentially problematic materials or products based on ingredient chemistry. CARS is not a risk assessment tool, rather, it is a decision support tool that uses a database (made up of several databases) of chemical information in conjunction with information on how the organization uses chemical products. The database includes well-documented and publicly available information on chemical properties and some of their potential impacts on human health and safety, ecological health, and ecosystem-wide impacts in the context of sustainability. Screening of ingredients is performed against the database via each chemical’s unique Chemical Abstracts Service (CAS) number. The CAS number is the accepted identification number for chemicals, which allows CARS to cross-reference the chemical ingredients of a product across several different databases using one number.

The CARS database flags certain ingredients in order to identify potential problems with those ingredients. The database provides information about products used in an operation, and that information is then interpreted by a chemist who has supplementary information about the use of the product. The chemist takes into account the exposure pathway, concentration, and frequency of use to identify problematic products.

CARS provides information for companies so that they are able to make decisions about which products they want to eliminate, substitute, or continue to use. A company can set the parameters that most interest them about their products, so each CARS project can be tailor-made for individual companies. For instance, if you are mainly interested in the carcinogenic ingredients in your products, you can weigh the carcinogen criterion as the most important element of product evaluation. Another company may focus on the greenhouse gases emitted by their products. ZWA does not use CARS to make decisions for other companies; they simply provide the necessary data for companies to make an informed decision for themselves.
In 2003, ZWA received a challenge grant of $15,000 from the Bullitt Foundation for development and application of CARS. This grant was contingent on receiving matching funds and working with organizations interested in serving as beta test sites. Toward the end of my six-month internship, the Port of Portland Environmental Affairs Department (the Port) contracted with the Zero Waste Alliance to apply CARS to assess janitorial products used at Port facilities. I was familiar with the CARS program, but had not been heavily involved in a CARS project at that time. A project manager was leaving at the time that ZWA began the project with the Port, and I was asked to manage the project. The project was very interesting and a great challenge; and it provided me with an opportunity to earn money during my work at ZWA. After managing the project for two months, I was able to hand the managerial responsibilities of the project over to a consultant with much more experience, and who had just resigned from a position at the Port in their Environmental Affairs Department. The project benefited from the involvement of a well-established environmental professional, and I was able to gain valuable knowledge from a more experienced consultant. I was able to provide assistance to the project after stepping back from the manager’s position, but was not able to call the project my own from beginning to end. This chapter therefore, describes the CARS project to which I contributed in a managerial and technical capacity.

When I first took over the project, I began organizing meetings and creating an inventory of the Port’s cleaning supplies. A number of products in this initial inventory were identified that contained ingredients of concern. From there, a target was set to update the Port’s cleaning product inventory with products that would meet environmentally preferable product (EPP) criteria. In close collaboration with the Port, ZWA developed an EPP decision flowchart and an annual target of 65% for the number of janitorial products that would meet environmentally preferable criteria. Working closely with the project stakeholders, we reviewed and modified products in the inventory in order to meet the goal by June 2004.

By the time I began working on the project, a stakeholder group had been established and the Port made a commitment to increase the number of “environmentally preferable” janitorial products used at Port facilities to 65% of the product inventory by June 2004. The Port engaged ZWA to provide assistance in setting and achieving the
target using CARS and ZWA expertise. ZWA’s management of the project included developing and facilitating a stakeholder team, inventorying products, setting criteria for identifying environmentally preferable products, running CARS screens, conducting product assessments, and developing recommendations.

This project was unique in that stakeholders from several different organizations, involved in providing janitorial products and services to the Port of Portland, were included in the process from the beginning. The relationships among the stakeholders were complex, and I needed to set up a meeting between all stakeholders to introduce myself and learn about their roles in the project and how they would contribute. My first major task as the project manager was to set up this meeting, which was the first of several such meetings. Representatives from Portland Habilitation Center, Inc. (PHC), which provides janitorial services to the Port; Unisource Worldwide, Inc., PHC’s janitorial product supplier; Amrep, Inc., one of Unisource’s product manufacturers; the Port; and ZWA formed the cooperative stakeholder team. Although all of the members of the team had different interests, they were all very cooperative, and I felt very privileged to work with them. The stakeholder team corresponded frequently and met periodically throughout the project, working together to meet the Port’s janitorial products target by June 2004.

The initial product inventory included 28 products. I reviewed each product’s Material Safety Data Sheet (MSDS) and entered the CAS number for each product ingredient into the CARS system. Additional information regarding the percent ingredient composition, application, annual amount used, and frequency of use was also collected. A number of ingredients of potential concern were identified in the initial product inventory, and the product inventory was modified numerous times. Products were screened using CARS and either passed or failed the EPP criteria. Most of the products that didn’t pass were dropped from the inventory, or were reformulated by the manufacturer in an effort to meet the Port’s EPP criteria. Some products had essential ingredients that were flagged by the CARS database, and were not able to be reformulated to meet the EPP criteria. However, PHC (the users of the products who come into direct contact with the materials) came away with a greater awareness of the products used at the Port.
A strategy of simply eliminating known hazards (per MSDS information) as a means of identifying EPPs was rejected, and the CARS database was chosen by the Port as a more effective alternative for two primary reasons. First, MSDSs rarely list all product ingredients. They are designed to identify hazards as part of the employees ‘right-to-know’ and only those ingredients at concentrations above 1% (0.1% for carcinogens) which are classified as hazardous are required by law to be listed on MSDSs. Second, EPP criteria go beyond known hazards and regulatory requirements. Ingredients are evaluated using a more comprehensive set of criteria for environmentally preferable products. Therefore, in order to fully review products for consideration as environmentally preferable, ZWA needed full disclosure of ingredients from the manufacturers of the products. Amrep is the primary manufacturer of janitorial products used at Port facilities, so their cooperation was essential. They were a bit hesitant to give away their formulas to some unknown environmental consulting group, but they eventually agreed to provide full disclosure of their ingredients, provided that ZWA signed a confidentiality agreement. ZWA signed the confidentiality agreement and received the right to review formulations.

While Amrep provided full ingredient disclosure to ZWA, they were unable to obtain full ingredient disclosure from the manufacturers of several dyes and fragrances used in their products. Typically, the composition of dyes and fragrances is considered highly confidential. In lieu of full ingredient disclosure we agreed that dyes could be accepted if verified as food grade, and fragrances could be accepted if verified as compliant with the standards of the International Fragrance Association (IFRA) for health and safety. Of course, formulating without dyes and fragrances was also an option. For example, dye was eliminated from the formulation of one Amrep product, Tile Bright Cleaner as a result of the CARS review.

Amrep invested a significant amount of effort in confirming the use of IFRA compliance fragrances, removing dyes, and reformulating at least four of these products to meet or exceed the Port’s EPP criteria. Amrep showed a willingness to go beyond the requirements by continuing to reformulate using ingredients that would meet or go beyond the required criteria for environmentally preferable products. It seemed as
though they knew that this is the direction that the industry is heading, and they should be proactive if they want to remain competitive.

Since there are no universally accepted criteria for environmentally preferable janitorial products, and the availability of 3rd party certified products are limited, the Port and ZWA developed an EPP criteria decision flowchart for the project based on the Port’s environmental policy and priorities. The intent of the flowchart was to build on successful prior related activities including 3rd party certification programs and state or local government environmentally preferable product requests for products (EPP RFPs). Basically, if the product passed third party certification programs such as Green Seal, the Canadian EcoLogo, and Coastwide Laboratories Sustainable Earth Green Cleaning Standard or was formulated in partnership with the U.S. EPA’s Design for the Environment Program, the product could be considered EPP; and if the product met the criteria of State and local government environmentally preferable purchasing programs such as Massachusetts, Minnesota, Vermont, Seattle, WA, King County, WA, or Santa Monica, CA, then it could be considered EPP.

Finally if the product did not meet any of the above conditions, it was subject to full ingredient disclosure and required to meet the criteria chosen by the Port using the CARS screen. According to the Port’s criteria, an environmentally preferable product should not contain any ingredients identified as:

- **Carcinogens** - agents that causes cancer in animal tissue.
- **Teratogens** - chemical substances, organism (e.g., virus), or physical agents (e.g., ionizing radiation) capable of causing birth defects (genetic mutations or malformations) in a fetus, but not in the pregnant woman.
- **Persistent, Bioaccumulative, and Toxic Chemicals (PBTs)** - long-lasting substances that can build up in the food chain to levels that are harmful to human and ecosystem health.
- **Endocrine Disruptors** - synthetic chemicals that block, mimic or otherwise interfere with naturally produced hormones, the body's chemical messengers, that control how an organism develops and functions.
• **Climate Changing Chemicals** – gases in the atmosphere which have the ability to absorb the sun's energy that is usually radiated back into space from Earth, causing the greenhouse effect. (These would be the chemicals with elevated GHG impact.)

• **Ozone Depleting Chemicals** - man-made chemicals that are capable of destroying stratospheric ozone.

Screening for the above was performed by CAS number using the CARS database. Additional screening was based on chemical assessment and evaluation work by the Janitorial Product Pollution Prevention Project (JP4) (WRPPN, 2003) and Purdue University’s Indiana Relative Chemical Hazard Score (IRCHS) (CMTI, 2003). An ingredient was flagged for further review if it was classified by the JP4 Program as “X”, i.e., “Do Not Use” or “AP”, i.e., “Avoid if Possible” or if the Indiana Relative Chemical Hazard Score was above 15. The number 15 was somewhat arbitrarily chosen by Lauren Heine, the chemist at ZWA, along with the Port’s Environmental Affairs Department. These relative ranking systems were used to help flag concerns but were not used as strict cut-off limits if further review indicated appropriateness as an EPP. For example, the IRCHS for hydrogen peroxide is based on a concentration of 50%, and at that concentration it is clearly hazardous. However, products that have achieved Green Seal certification may contain hydrogen peroxide in much lower concentrations.

**Flagging criteria:**

• JP4 - rating of X or AP

• Indiana Relative Chemical Hazard Score – score must be 15 or lower.

The initial inventory was screened using the decision flowchart and the Port’s EPP criteria. Any product which achieved existing 3rd party certification or was approved by one of the State or local government RFPs listed in the flowchart, was designated as “passing” the Port’s EPP criteria. If the product had not been accepted by any of these 3rd party reviews, the product was assessed for full ingredient disclosure. If full ingredient disclosure was not possible, then the product could not be fully evaluated and was disqualified. Once all the ingredients were known, the product was then screened using the CARS database and its EPP status was determined by the output compared to the criteria on the decision flow chart.
The stakeholder team worked cooperatively to ensure that reformulated and replacement products were acceptable to PHC and the Port with regard to price, performance, effectiveness, availability, and usability. PHC, the Port, and Unisource worked cooperatively to reduce the final inventory to 22 products (reduced from the initial inventory of 28 products) by eliminating redundant and unnecessary products.
Eliminating products from the inventory presented a potential problem for meeting our goal of 65% EPP. Although reducing the amount of products used by the Port had environmental benefits (less chemical use) and administrative advantages (streamlined purchasing), it also gave more weight to the few products that could not be reformulated to meet the EPP criteria, which could make it more difficult to reach our goal of 65%. Fortunately, even with the reduction in total products, the Port was able to meet its goal of 65% EPP. The final inventory of products is listed below.

**Final Inventory**

**Products Passing the EPP Criteria (73%)**
1. 520 E Glass Cleaner
2. 510 E All Purpose
3. 310 E Neutral Cleaner
4. Outstanding Floor Coat
5. Gum Off
6. Blot that Spot
7. Spray Zyme
8. Allstar Acrathane Sealer
9. Tannin Spotter Plus
10. Rug Steam Concentrate
11. Allstar Stinger
12. Tile Bright Cleaner
13. Gentle Scrub
14. Taj Mahal Floor Finish and Sealer
15. 910 E Shower Cleaner
16. 330 Floor Restorer

**Products Which Do Not Pass the Port’s EPP Criteria**
17. Cinch NRS No Rinse Stripper
18. Gum Solv
19. Allstar Base Shooter

**Products Without Full Ingredient Disclosure Information**
20. Ecolab Prep Pak
21. A456 Disinfectant
22. Host Dry Extractor Carpet Cleaner

The Port’s target of 65% EPP janitorial products was exceeded with 16 products passing the EPP criteria (equivalent to 73%). Of the 16 passing products, two products (the 520E Glass Cleaner and the 510E All Purpose) were Green Seal certified, and four products have been approved by the State of Minnesota (310 E Neutral Cleaner, Taj Mahal Floor Finish and Sealer, 910 E Shower Cleaner, and 330 Floor Restorer).
The project was a success for everyone involved and it gave me real hope that business interests and environmental interests can exist and thrive in the same setting. The workers who use the products are more knowledgeable about what they are using, the inventory has been simplified, and the manufacturer is prepared for similar demand for environmentally preferable products in the future.

In my opinion, CARS is the most practical service with the most immediate applicability that ZWA offers. I see CARS as a good tool for reducing toxic ingredients in a wide variety of products. CARS can be utilized by many companies across a wide range of industry, and with the right marketing, it has real potential as an income generator for ZWA.
Chapter 3: Widmer Brewery Project

Perhaps the most significant contribution that I made to the Zero Waste Alliance was bringing in Widmer Brothers Brewing Company (Widmer) as a client. I met a Miami Alumnus, at an alumni gathering, who is a financial director for Widmer. Upon meeting a Miami Alumnus, I asked about their operation and inquired if they had any need for technological and/or managerial assistance that ZWA could be involved with. He informed me of an interesting waste management problem that the company was dealing with that ZWA might be able to help with.

Widmer Brewery has become the largest brewery in Portland in recent years, and the growth of their brewing operation has created new challenges for a company that started as a microbrewery. The brewing operation produces a large amount of waste beer and tank bottom solids (e.g., spent yeast) that is very costly to dispose of if allowed to go down the drain into the sewer. The brewery had been collecting this “high strength” waste in a tank and sending it to another brewery in Washington, where the material was used for ethanol recovery. Approximately 6,000 gallons of this material is generated per week at the Widmer facility, and the storage tank can store up to two weeks worth of the material. Previously the waste liquid was removed from the tank on a weekly basis and sent to the Olympia Brewery, which accepts the material for free and turns it into ethanol to be sold as fuel. However, the Olympia Brewery was bought by Miller and shut down, including the ethanol recovery plant. A new means of disposal was needed for the “high strength” unwanted liquids, and Widmer Brothers Brewing Company was interested in identifying the most environmentally sound and economical means for handling the material.

I set up a meeting with the facilities manager of the brewery and the Zero Waste Alliance. ZWA’s chemist, Lauren Heine, was present at the meeting to make sure that the right questions were asked, and that the responses to those questions could be properly interpreted. The facilities manager of the brewery provided information about the chemical makeup of the “high strength” material. The waste liquid is characterized as containing 5% alcohol by volume, 70,000 mg/liter total solids, and 8,930 mg/liter volatile solids. The pH of the liquid is approximately 5.5. Some variations are found in the
values of alcohol, pH, and solids. The BOD value for this waste is estimated to be approximately 100,000 mg/L. Disposal of this waste, without treatment, would raise BOD values of current discharges by Widmer to the City’s sanitary sewer system from 3,000 mg/L to approximately 5,000 mg/L. It is difficult to be precise about the increase in sewerage costs associated with this increase in BOD, because it depends on when the city checks the facility’s discharge. A sample is taken once a month, which is representative of the entire month. If the discharge is checked at the time when the brewery is releasing a large amount of “high strength” waste, the monthly sewerage bill will be much higher than if the sample is collected without this waste. However, based on the average increase of BOD, the added cost to Widmer associated with releasing this waste into the city sewer system is estimated to be approximately $10,000/month, and represents a significant increase to the cost of doing business. Releasing the waste into the sewer system was not a viable option for the brewery on an economic level, however, the ethanol recovery plant was preparing to close within the next month, and the waste would be dumped down the drain at that time if no other options materialized.

During the meeting, ZWA explained the funding option provided by the Portland Development Commission (PDC) that has been made available to ZWA in the past. The PDC is a division of the city government whose mission is to achieve a vital economy with healthy neighborhoods and quality jobs in Portland. This mission is complemented by the Zero Waste Alliance’s efforts to develop environmentally sustainable solutions and successful local businesses. The Portland Development Commission has committed funding to provide an incentive program for businesses in “Urban Renewal Areas” to implement zero waste and sustainability strategies and to promote job creation and retention. The Zero Waste Alliance has entered into a contractual agreement with the PDC to provide support and document projects funded through this program. The program is designed to provide an incentive for companies to take on innovative pilot projects that are developed from or incorporate zero waste strategies in business operations. Projects that create a model applicable to other businesses with similar operations are preferred. Other goals of the program include enhancing Portland's national reputation, capitalizing on new markets and new technology, and saving private businesses money while reducing the impact on the environment.
Funding is provided by the City of Portland to promote industrial innovation and encourage businesses to move toward environmentally sustainable practices. The PDC views this program as an opportunity to showcase the practical application and benefits of sustainability. Financial support for these projects is provided in the form of matching funds. The PDC will match 50% to 100% of the company’s contributions made to the project in the form of equipment, hourly wages, and or cash. The PDC’s contribution generally pays for ZWA’s compensation. The program is expected to provide the following benefits for companies that work with ZWA:

- Reduced Costs
- Waste stream reduction
- Energy efficiency
- Material utilization efficiency
- Hazardous materials management and reduction of use.

After informing Widmer of the funding option provided by the PDC, and providing some possible solutions to the problem, Widmer was interested in pursuing the project. The project was a perfect fit for the PDC matching funds. The brewery is in an “Urban Renewal Area”, the project is designed to make a local company more competitive, and zero waste principles are applicable to the situation. The next step was to secure the funding from PDC. This process took longer than I expected. The project seemed tailor made for the funding, but PDC was still dragging its feet. They were very interested in the project, but their funding from the City of Portland was being reduced. The Zero Waste Alliance was expecting to have $30,000 dollars available to cover three projects during the course of the year. The PDC reduced this sum to $10,000 dollars, but they were still interested in doing three projects. After many telephone calls and email correspondences, the PDC agreed to provide $4,000 in matching funds to the Widmer project.

I was responsible for the preliminary phases of the project, which included background research and providing an overview of various options for the waste stream. During this process, I learned quite a bit about the disposal options for this waste material. I spoke with many landfill operators, government officials involved with solid
waste disposal at the city and state levels, and representatives of the tri-county waste disposal/recycling group known as METRO. All of these parties had useful information about how such material can be disposed of, however, the default option was always land application. It soon became apparent that the easiest and most likely option for the disposal of this material was land application. However, it is not a high quality use for the material. ZWA is more interested in finding high value uses for waste streams, and finding a place to dump it on land is probably the least valuable application for the material. Unfortunately, the standard response to the questions I was asking was land application, so we needed to dig a little deeper and use some creativity to find higher value uses for the material.

I spoke with officials at the Oregon Department of Environmental Quality (DEQ), and found out what type of permitting process that Widmer would have to go through to land apply the material. Although it was not an ideal use of the material, I thought it may be a good temporary solution to avoid high sewer bills. Finding a home for the material during the dry summer season was not very difficult. Based on the chemical profile that Widmer provided me, the major difficulties associated with land application would present themselves during the wet season when the ground is saturated (October through May). The method of application may have to be regulated during the wet season in order to control pooling, erosion, and runoff. This would be an added expense, because a machine would have to be used to evenly spread the material around a large area. The material could be transported east of the Cascade Mountain range where there is significantly less rain, but transportation costs then become an issue.

Certain composting operations were interested in accepting the material for free in order to keep their compost piles wet, but they would not have any need for it during the long wet season. Land application on open fields or compost piles was appearing more and more to be a temporary solution, with few long-term benefits.

I also examined more long-term and higher value options for the disposal of the beer waste. One such option was to feed the material to livestock. Many food processing operations that try to achieve a measure of sustainability in their operations use their byproducts as livestock feed. I did some research about this option and found that a major obstacle exists, because the beer waste can cause gas in cows and create serious
health problems. Further investigation would have to be done to find out if there is a way to feed the material to cows without damaging their health.

A final option that I investigated involved innovative technology that has recently begun to be used in Oregon. Methane gas is being harnessed from cow manure at dairy farms in Central Oregon. The gas is used to generate electricity on a small scale, but as the practice becomes more tried, and as new technology is developed, it may be used on a larger scale. This technology would be very helpful in agricultural regions where large-scale feeding operations are present, and where the demand for electricity is relatively low.

Other options were not well received initially by the brewery. In speaking with the client, it became apparent that there was not an interest in investing serious capital into processing this beer waste. I had mentioned that they could consider creating an ethanol recovery system onsite at the brewery, or process the spent grains to make other food products. This would require the development of new machinery to create a product other than beer. Mr. Larry Chalfan, Executive Director of ZWA, has come across this type of business mentality many times in recent years when consulting with companies on how to become more sustainable. In order to become sustainable, some level of diversification of production is helpful, and most businesses are not prepared to take on this challenge. In other words, byproducts from any operation should be utilized in order to create another product, but breweries make beer, and they are not interested in making anything else. It is risky in the short term to take on a new production line, and it can also take away resources such as labor and production space. It is understandable that companies would be hesitant to aggressively pursue sustainable operations for this reason, which creates a real challenge for organizations like ZWA that are advising companies on how to become sustainable.

After initiating the project with Widmer Brothers Brewing Company, securing the funding from the PDC, and investigating some potential solutions to the waste disposal issue at the brewery, the project was handed over to Padmanabhan K. Melethil, a more experienced consultant. Mr. Melethil further pursued the options for which I provided an overview. Eventually he was able to locate a farmer who was able to use the material to feed cows. Used as a feed supplement in low quantities, the waste material did not cause
health problems in the livestock, it was a higher value use than land application, and it could also be sustained throughout the year. His final analysis showed that the material would have the highest value if reprocessed for food products such as beer batter, crackers, bagels, etc. His work showed that the Widmer yeast represents a high-value product with market potential. However, Widmer never became interested in this option for the same reasons stated above.

As often happens in the world of business, the Widmer project was spawned from a connection made outside of business hours. However, once put into the professional context, my pursuit of an interesting project materialized into something useful for all parties involved. I learned much during the course of this project, had fun doing it, and the experience provided me with good preparation for similar projects in the future.
Chapter 4:

Work with the GoBiodiesel Cooperative

The project that most interested me during my time at the Zero Waste Alliance was with the GoBiodiesel Cooperative. Biodiesel is diesel fuel made from vegetable oil, and is an important step in the right direction for our country’s energy needs. The GoBiodiesel Cooperative is working to produce, and spread the use of biodiesel around the Portland area. I worked with the GoBiodiesel Cooperative to obtain some grant money from the Portland Development Commission to assist them with one of their many needs as a start-up company. The cooperative is in its beginning stages, and they have many needs that a consulting firm like ZWA could help fulfill. In the end, I was not able to get grant money for the GoBiodiesel Coop. My work with the GoBiodiesel Cooperative helped provide the Coop with a better understanding of the funding mechanism at the city level, and I learned much about a new technology that interests me a great deal. It also provided me with a career interest for the future. My involvement with the coop helped shape my interests in the environmental field and was important for my development as an environmental professional. I came away from the work with the GoBiodiesel Coop with a sincere interest in promoting biodiesel as an important step toward much needed energy solutions.

I knew very little about biodiesel before starting at ZWA. I had heard about people using spent cooking oil to run cars, but I just passed it off as a fringe environmental group experimenting with a technology that would not be viable on a large scale. When I researched biodiesel in more depth, I became more and more interested in its possibilities.

Biodiesel is made from vegetable oil, animal fats, and/or recycled cooking oil, and is a nontoxic, biodegradable replacement for petroleum diesel. Running diesel engines on vegetable oil is not a new idea. In fact, the diesel engine was originally designed to run on peanut oil, but the petroleum industry eventually cornered the market on diesel fuel. Although diesel engines are designed to run on straight vegetable oil (SVO), a more refined product such as biodiesel has advantages over SVO. Biodiesel does not have to be heated if used in warm weather and it burns better in the engine than SVO, leaving less deposits (Green Car Congress, 2005). One of the things that makes
biodiesel the fastest growing fuel alternative in America is that it does not require that a car be modified (Thompson, 2003). The only modification required is in old cars with rubber gaskets in the fuel line, as the biodiesel is a mild solvent and will corrode the gaskets. This is not an issue for newer cars with synthetic rubber gaskets that are more resistant to the corrosive quality of the fuel. The fact that the fuel is a solvent is another one of its advantages, because biodiesel actually cleans the parts of the automotive system as it passes through them. In speaking with people that are familiar with the fuel, I have found that old fuel lines of cars run on biodiesel can appear as clean as if they just came off the assembly line. The solvent quality of the fuel can, however, create clogging of a fuel filter when the car is switched over to biodiesel after a long time of running on conventional diesel, because the built up deposits in the fuel line are flushed through the filter. The most important advantages of biodiesel as an alternative to petroleum diesel are the reduced emissions and the fact that it is a renewable resource.

As Figure 4 demonstrates, there is a significant difference in emissions between petroleum diesel and biodiesel (except for a slight increase in nitrogen oxide which can
be improved by using a catalytic converter). The reduction in emissions can have a direct impact on air quality and the greenhouse effect. The emissions of carbon, which contribute to global warming, are offset by growing more raw material to make biodiesel. Crops that produce oil take carbon out of the carbon cycle and store it until it is consumed. If done correctly, the production and consumption of biodiesel can equal a zero net gain in atmospheric carbon. This carbon cycle is much more sustainable than extracting and burning fossil fuels. Biodiesel is also biodegradable and far less toxic than petroleum diesel.

The processing of biodiesel is very simple, which is another environmental advantage over petroleum diesel. Biodiesel is made by adding methanol to vegetable oil in a process called esterification. Esterification is the chemical process of removing the glycerine stem from the molecule resulting in a much smaller molecule, which improves characteristics such as viscosity that are desirable for use as an engine fuel (Frisby et al, 1993). The only byproduct in this process is glycerin, which can be used as soap, helping the process fit into a zero waste model. Biodiesel belongs to a family of fatty acids called methyl esters, which are defined by the medium length fatty acid linked chains. These linked chains help differentiate biodiesel from regular petroleum diesel. Although biodiesel contains a similar number of BTUs as petroleum diesel (130,000 vs. 140,000 BTUs respectively), the chains have a higher flash point (Hofman, 2003). This makes biodiesel a much cleaner burning fuel while being safer to handle and store than petroleum diesel.

Of all the advantages of biodiesel, the most important is that it is a renewable resource. Biodiesel can be made from a variety of oil producing crops such as soybean, mustard seed, canola, and palm. Mustard seed, for example, is 40% oil and the residual organic material can be applied to crops as an effective pesticide (Tyson et al, 2005). This crop can be grown in dry climates of the west and is resistant against many diseases. Biodiesel can even be made from algae. “While traditional crops have yields of around 50-150 gallons of biodiesel per acre per year, algaes can yield 5,000-20,000 gallons per acre per year” (University of New Hampshire Biodiesel Group, 2005). Algaes grow best off of waste streams, and they can be used to treat wastewater. There is also a possibility of using the algae residue left after extracting the oil as a fertilizer.
Whatever the source, the prospect of growing crops to make fuel is much more sustainable than using fossil fuels. It is obvious that growing crops year after year is much more sustainable than drilling for dead dinosaurs. However, being less dependent on other countries for our fuel and providing more income for our farmers may bring us closer to sustainable living in ways that are difficult to comprehend. Reduced dependence on foreign oil would drastically change the geopolitical landscape, and renewed wealth for American farmers would have a cultural impact on the United States. More people would stay in our rural areas if there is money to be made, and we could go back toward our agrarian roots.

I first learned about the GoBiodiesel Cooperative (GBC) while doing research at the ZWA office. I wanted to find out who was involved with biodiesel in Portland, and I found GBC on the Internet. I was particularly interested in the organization because their fuel is made exclusively out of used vegetable oil. They pick up the used vegetable oil from restaurants for no charge, when they normally have to pay a company to get rid of the material. The used oil is then refined into biodiesel. Members of the Cooperative receive 110 gallon drums of the fuel at their homes where they can use it to fill up their diesel cars or even heat their homes. They pay less taxes because they are technically not buying the fuel. They are members of the coop that makes the fuel, so their membership dues cover the cost of picking up the oil, refining it, and delivering it. Their production model is to produce fuel from used vegetable oil at many small refineries throughout a region (however they currently have only one small refinery). The decentralization of their operation reduces the amount of fuel used to transport the fuel, and spreads out the negative impact of industrial activity throughout a region rather than centralizing this activity in a huge industrial complex. I sent an email to the administrator account found on the GBC website, and I got a response from the director of the coop.

I informed him of the possible availability of funding for the GBC from the Portland Development Commission, and asked him if he would like to meet with ZWA to discuss a potential project. I set up a meeting with the Executive Director of ZWA, the Chemist at ZWA, and the director of GBC. At the meeting, we discussed several options for potential projects. One such project would be to develop a filtration system for the used vegetable oil that can be cleaned and reused rather than throwing away filters.
Another idea for a project that was brought up at the meeting was to help redesign the refining system to harness any vapors that were released during the process. These vapors could be used to generate power to run the small refinery. The GBC had not decided whether or not it would be a non-profit organization, and it was interested in consulting with ZWA about the advantages of being a 501(c) non-profit organization.

The meeting went very well, and I thought that the GBC would be a perfect fit for the PDC funding. After several emails to the PDC, it became apparent the their main interest in funding a start-up company would be job creation. Although biodiesel has great potential, and I think it could be very beneficial for Portland to become the center for biodiesel production on the west coast, the prospect of job creation was not very high. There are only a few employees at the small refinery, and our projects would not add a significant number of jobs in the short term. The PDC therefore decided not to pursue a project with the GBC, and I had to relay the disappointing news to the director of the coop. He was very understanding, and was not surprised at the outcome of our discussions. Apparently he has had plenty of other doors slammed in his face, but he is determined to “bring about the environmental, economic, and public health benefits of biodiesel through education, production and use” (GoBiodiesel Coop, 2005).
Chapter 5:
Professional Development

One of the most important things that I have learned during my experience with ZWA is how to work in a professional office setting. I had never held a professional position or worked in a business setting until starting my internship. Of course every office setting has its own peculiarities, and it takes time to adjust to any work setting, but there is a certain code of conduct in a business setting with which I was not accustomed, and my first challenge was to adapt to the professional world. As I adapted to a professional workplace throughout the several months that I worked at ZWA, I acquired office skills that will be useful for me in future professional positions. My experience at ZWA has: given me a greater comfort level in professional settings, improved my clerical and organizational skills, improved my knowledge of useful computer technology, and given me experience in creating marketing material.

ZWA is in the World Trade Center in downtown Portland, and the work setting is very professional. I wore a tie to work everyday, and spent many hours in meetings with high-level professionals. I spent much of the time in these meetings not saying a word, because either I was not as familiar as the other people in the meeting with the subject matter being discussed, or I simply did not feel confident in that setting. As I spent more time in the professional setting, I began to feel more comfortable. Eventually I began to realize that the major distinctions between the professional and nonprofessional worlds are largely superficial. Once I had the right clothes and became more familiar with the workplace, I was able to be myself without having to change on a fundamental level. However, going through this process of adaptation, even if on a superficial level, has increased my confidence in the meeting room greatly.

Much of the work that I did at the Zero Waste Alliance consisted of basic clerical work around the office. My first task at ZWA was to organize the contracts of all the projects. It was a good way to get familiar with the different projects and learn about how they are funded. This process included organizing the contracts, making copies of each contract, and filing them into a user-friendly system. I also devised a filing procedure for new contracts toward the beginning of my internship. The organization wanted to have a standard procedure for filing contracts so that we maintain a level of
consistency in the office and to make sure that copies of all contractual agreements are
organized in the proper way. These were fairly simple tasks, but organization is clearly a
major element of a successful office, and I was able to contribute to the basic operation of
the organization, while improving my own organizational skills.

My experience at ZWA also taught me how to use different software, and gave
me greater fluency in the computer programs that I have already learned. My work
generally helped me to build on the computer skills that I had already acquired during my
studies, but I did learn a very useful program in Microsoft Word called Mail Merger. I
was solely responsible for creating a mass mailing for a conference dealing with the
disposal of electronic equipment. I not only learned how to use Mail Merger, but I also
performed all of the clerical duties associated with a mass mailing. Many of these
clerical duties were fairly time consuming and at times left me longing for more
interesting project work. However, I learned that administrative busy work is a big part
of making an organization like ZWA work, and even the Executive Director had much of
his valuable time chewed up by time consuming administrative duties.

I learned very much about how to create a web site when I brought in a friend of
mine to do some pro bono web design for ZWA. In fact, I learned more about computers
from this friend during the time he spent on the web site, than I have in the past several
years of using them. He was brought in to develop a web site for the Chemical
Assessment and Ranking System (CARS) that ZWA offers. I was able to work with my
friend on developing the web site, which provided me with a fundamental understanding
of the way web sites are developed. The site was completed in less than a week, and
ZWA was quite pleased with the way it turned out (there is a CARS link at
www.zerowaste.org). The web site has a distinctive style from the rest of the ZWA web
site, but certain qualities, like the colors and elements of the formatting, provide some
continuity that lets you know that you are still viewing Zero Waste Alliance material.
Although I appreciated learning about how something I use everyday is developed, I do
not have the interest or the patience to become proficient in the language of web site
development.

I obtained experience in creating marketing material during my internship. One
of the first significant tasks I was assigned was to create a one-page summary of a project
that had recently been completed. The summary follows the format of previous “one-pagers” that were made for marketing purposes. The idea is to be able to have a portfolio of all the projects that have been done, so potential clients can learn about our projects through an attractive and consolidated format. It can be quite a challenge to summarize these projects into a one-page document, but it was an interesting task, and I learned very much about the particular project that I was summarizing. The creation of the document entailed not only composing the document, but also asking for help with revisions, communicating with the company for whom we did the project to make sure that they agreed with the way the project was represented, and formatting the document so it was consistent with the other one pagers (see one-pagers in Appendix A). The creation of these one-pagers was a great way to get familiar with the kind of work that ZWA does, and a great opportunity to contribute to the organization.

Although the project work discussed in the previous chapters appears more significant and has a greater impact on a resume, the daily lessons that I learned in the office were very valuable to my development as an environmental professional. I am very appreciative that I was able to be involved in projects on a more profound level, but the experience I gained in the office has been a necessary part of my passage into the “real world”.

My coursework at Miami University gave me a very solid grounding in a broad range of subjects that are integral to environmental work. An ecology/business class called Sustainable Business Perspectives improved my understanding of the important business/economic aspects of sustainability, and helped me to keep sight of the harsh realities of the business world while pursuing a goal of improved efficiency and environmental health. The core curriculum at the Institute of Environmental Sciences gave me a systematic approach to problem solving that has proven to be very useful for project management and design. I made the most of my time at Miami University, however if I had been able to take more courses, I would have focused on improving my knowledge of the technical areas of environmental science such as chemistry, engineering, and hydrogeology. Although I do not see myself pursuing a technical career in a laboratory, a greater understanding of environmental systems on a molecular level would be very useful. As a result of my studies at IES, I have a solid understanding of
environmental sciences on a systems level, and I feel comfortable in pursuing the type of career that I want in the environmental field.
BIBLIOGRAPHY


**Scope of Project**

- Rejuvenation, Inc., in Portland, Oregon employs 100 people and is America's leading manufacturer of authentic period lighting. Rejuvenation is known for its commitment to the community and environmental quality. As part of the company's dedication to continual improvement through its environmental management system, Rejuvenation decided to tackle their brass antiquing process. Although legal to discharge at low concentrations, Rejuvenation understood that their primary brass antiquing effluent—selenium (Se)—is bioaccumulating and harmful to human health and the ecosystem. The company's specialized brass antiquing process is an important part of their business success because it provides a beautiful, antique patina to their products.

- Rejuvenation has been using flocculation, "forming particles into clumps," to treat rinse-water from their antiquing bath. This process discharged 600 gallons of wastewater per week and it was frequently hard to meet the 0.6 ppm (parts per million) selenium discharge limit set by the City of Portland.

- Rejuvenation wanted an alternative process that would be ecologically safe, provide the same robust beautiful patina to their products, and be affordable.

**Benefits**

- **Annual Cost Savings:** $14,165, 68%
- **Annual Water Savings:** 31,000 gal, 100%
- **Selenium to city sewer:** 0.00 ppm, 100% less
- **Product Quality:** Uncompromised

**Old System**

- Cost of flocculation equipment: $55,000
- Cost of chemicals and supplies to operate and maintain flocculator: $15,755/yr
- Labor costs of operating flocculator: $3,900/yr
- Cost of sewer discharge permit (for Se): $2,000/yr
- Total annual costs: $21,655/yr
- Water use: 31,200 gal/yr
- Selenium discharged to sewer: No

**New System**

- Cost of ion exchange system: $8,100
- Cost of permit (for Se): $0
- Cost to recharge cartridges (incl. transport): $7,500/yr
- Total annual costs: $7,500/yr
- Water (evaporation loss): ~60 gal/yr
- Selenium discharged to sewer: Yes

**Results**

- Led by Dr. Lauren Heine, Director of Green Chemistry and Engineering, ZWA researched and evaluated alternative chemical processes and vendors. ZWA recommended a system designed by Birchwood Casey to remove selenium from antiquing process rinse-water on-site. After proving the effectiveness of this system, a larger scale process was designed and implemented through US Filter that requires minimal maintenance and purifies multiple rinse tanks.

- The new system uses ion-exchange and eliminates the discharge of process water and sewer discharge fees. The rinse-water is continually purified and reused and metal ions are removed by the ion exchange units. The units will be recharged for reuse once or twice each year, resulting in cleaner rinse water and more consistent product quality than previously attained. While the process still uses selenium, it is contained within a closed system that completely eliminates discharge to the environment. Rejuvenation will reduce their annual processing cost by 65% and they are delighted with the results of this project.

Portland Development Commission's Business Outreach Program provided matching funds to support this project. If you would like to know more about this program, please contact the Zero Waste Alliance, One World Trade Center, 121 SW Salmon, Suite 210, Portland, Oregon USA 97204 Tel. 503-279-9383, Fax. 503-279-9381, email: info@zerowaste.org and www.zerowaste.org

The Zero Waste Alliance is an initiative of the International Sustainable Development Foundation – a 501 (c) 3 not-for-profit organization.
Zero Waste Project Report

Scope of Project

- Stormwater Management, Inc. (SMI) of Portland, Oregon, develops filtration systems for treating stormwater runoff. SMI uses a leaf compost-based medium in some products as an effective filtration medium. The all-natural, 100% recycled Compost Storm Filters (CSF®) leaf media is an excellent example of how resources traditionally regarded as waste can be used to achieve environmental benefits.

- CSF® media is a highly organic material. Using current commercial analytical testing methods, it is difficult to distinguish between biogenic hydrocarbons found in leaf compost and petrogenic hydrocarbons found in refined petroleum products. Because the use of compost for storm water filtration is a relatively new application for compost and the testing methods were designed for fuels, there are problems with applying commercial analytical methods to measuring TPH in compost. As such, it appeared that if this all-natural water filtration medium had elevated levels of TPH that would increase disposal costs, and thus impact the ability to sell the media.

- SMI is committed to providing affordable and effective systems for stormwater management, but was in jeopardy of losing a significant market for their product. The Zero Waste Alliance (ZWA) was called to research and to serve as an informed arbiter in the process of overcoming this unforeseen issue.

- ZWA approached the problem with a variety of strategies including:
  - Comparing results of TPH measured in CSF® by different commercial analytical labs and methods;
  - Evaluating results from measuring TPH before and after exhaustive silica gel treatment to better distinguish between biogenic and petrogenic TPH;
  - Coordinating expert forensic analysis to identify the relative source compositions for measured hydrocarbons;
  - Benchmarking against other composts;
  - Reviewing other U.S. and international regulatory limits for TPH in compost; and
  - Reviewing relevant literature.

**Benefits**

"On an immediate basis ZWA’s help saved us about $25,000 of the accounts receivable that were being withheld. If you look at the potential benefit relative to future sales it could be measured in hundreds of thousands of dollars in revenues." 

James H. Leahy, V.P. Research and Development, Stormwater Management, Inc.

Results

- Led by Dr. Lizzan Haines, Director of Green Chemistry and Engineering, ZWA assembled enough evidence to alleviate concerns about apparent TPH levels in CSF® leaf media. As a result, it will continue to be used for stormwater filtration.

- ZWA helped advance understanding of the chemical composition of CSF® media and the methods used for testing TPH in compost-based materials.

- ZWA helped secure a place in a growing market for a company that is using zero waste principles to help keep our rivers, lakes, estuaries, and oceans clean.