Policy Brief: Copper Corridor Gold Team

Susana Puga, Jacob Eberspacher, Kelsey Liss, Allie Mcgranaghan, Bridgette Pina

Arizona State University

Introduction:
The Copper Gold Team worked with city of Miami, Arizona to address their biosolids challenge. Miami is small, rural town in Gila County of about 1,781 residents. Miami would like to reuse biosolids, however due to high disposal and transportation fees, their only present option is to send it to a landfill approved to handle biowaste. The original task of the Copper Gold team was to investigate how/if green waste may be used to minimize the stigma of human waste as well as whether an arrangement could be made with mining operations to use the biowaste for land remediation purposes. During the initial project research, the City of Miami chose to apply for a grant to begin composting biowaste for the city. Thus, the attention of the Copper Gold Team was turned toward investigating composting practices best suited for Miami, cost of different composting strategies, and research how Miami may successfully market composted biosolids. The following policy brief will outline our findings and recommendations for the city of Miami based on our research.

Stakeholder Engagement:

Stakeholders are a vital component in this process. The thoughts and opinions of everybody involved must be carefully analyzed to determine any possible complications that could arise. For this problem in particular, the biosolid usage was concentrated to a small population so it was easier to compose an analysis of stakeholder opinion. Each stakeholder was carefully considered, all with varying degrees of engagement and interest.

The residents of Miami are primary stakeholders in this project, so their thoughts were held in high regards. A stigma developing against biosolid usage and skepticism of its safety was inevitable and has happened in situations similar to this in the past. Once “human fertilizer” is brought up, people approach very warily with concerns about several issues. Typically, once waste is disposed of at home it follows the ‘out of sight, out of mind” policy; the average human
doesn’t really consider or care about what happens to their waste afterwards. It isn’t until biosolid matter is going to be used that their interest piques. There are many studies that identify different strategies to cope with the stigmatization of biosolids that are applicable to this study. One case study was completed in a small town in Canada. The study tracked the thoughts of the local public when possible biosolid usage was suggested. In this study, the education and opinions of 23 randomly selected citizens were recorded. Of the 23 participants, 9 were opposed to using biosolids for fertilizer, 7 were in favor, and 7 were uncertain. The 7 participants that were in support of biosolid usage all had a background in agriculture. Only 1 person had a background in agriculture out of the 9 participants who were against biosolid usage. This proves that people who aren’t properly educated on subjects by experts can be misled or uninformed. The mental models of stakeholders can either hinder or help a project depending on how they are utilized. In the Canada case study, many of the participants were concerned with the safety of usage as well as the facility; all concerns that could be addressed at a workshop or even tour of the facility. (OMAFRA, 2010)

One main group that would be beneficial to also target are the children in the Town of Miami. Facility workers could give presentations to the town’s elementary school, middle school, high school, and community college. There are many outreach activities that would be perfect to implement in the classroom for elementary aged children including educational coloring pages, gardening activities, and take-home information for all of the parents. Middle school students could take field trips to the facility and experience the treatment process first hand. This could lead to many science experiments with their teachers and knowledge of nutrient cycling. High school students could complete special projects and possibly intern at the facility. Increasing outreach to children will help communicate the benefits of biosolid usage to parents.
Another way to target residents would be to offer educational workshops or meetings. Gift cards/ bags of biosolid fertilizer could be offered to all of the attendees to incentivize participation from the community. At these events, the residents could be given the opportunity to ask any questions as well as speak with the expert’s present. Another option that may be more accessible for people are educational handouts depicting the benefits of biosolid usage. These handouts could be sent out with the local newspaper or attached to residents water bills. This would be a great option for residents who live in the rural areas of Miami since it is more convenient and accessible. Unfortunately, organizing workshops and educational events are very costly. It takes time and money to plan events, find a location to host the event, and find incentives to give attendees; a budget would have to be implemented. With careful planning and analysis, it is possible that bi-monthly events could be scheduled for the first 2 years until biosolid usage is widely accepted. Although residents are an important group of stakeholders, mining companies, wastewater personnel, and the ecosystem are critical players as well. The Mining Community has been around since the late 1800’s and serves as an important attribute to the town of Miami. As of 2018 one of the main mining companies involved in the town is Freeport-McMoran, others are BHP Copper, Inc. (The Miami Mine, the Copper Cities Mine, the Old Dominion Mine and related properties and the Solitude Tailings). Since there are a large number of actors who would benefit to compost and remediation, we definitely suggest a partnership between the mining companies and those processing the compost.

Case Studies:

Looking at these case studies allows Miami, AZ and the Miami Copper Corridor project to be better prepared financially for budget and marketing strategies. Using case studies allows project developers to find and implement what’s best for the project and community. The Casper
Regional Landfill case study has allowed the Miami Copper Corridor Bio-Waste project to identify the potential cost of the composting project as well as the budget for the site. According to the management of the City of Casper’s Wastewater Treatment Plant (WWTP), “The city of Casper faces over $5.4 million in landfill projects in the coming year to line new deposit areas, known as cells, reduce pollution and expands its composting operations”("Wastewater Treatment Plant Biosolids Composting Equipment" 2011 Exhibit C - 2 of 3). The Casper Regional Landfill project, although much larger and expensive than the Miami Copper Corridor project, allows us to identify the labor for designing, contrasting and operating the composting system as well as where in the system the Miami Copper Corridor project could save money. It needs to be noted that in this case study the comparison of a population of 55,000 (Casper, WY) to a population of 1,780 (Miami, AZ). Along with the information on the system as a whole the Casper Regional Landfill case studies provides information on the additional labors to treat biosolids, cost of all necessary equipment, electric cost to run the system, and lastly the water costs. According to the management of the WWTP, “No solid waste operations costs for top soil. Biosolids composting will eliminate the need for solid waste staff to purchase top soil for reclamation of landfill cells and vegetation or side slopes for stabilization”( "Wastewater Treatment Plant Biosolids Composting Equipment" 2011 Exhibit C - 2 of 3). The management of the WWTP believes that the self-sufficient system of using biosolids as compost materials will produce less greenhouse gases and ultimately save the town money.

In addition to the Casper Regional Landfill, another case study was Tacoma Grow in Tacoma, Washington. This case study was focused around getting over the stigma of using biosolids as compost and marketing the product to the residents of Tacoma, WA. In Tacoma, WA they developed their own brand to help market the compost called TAGRO, they focused on
positive branding. TAGRO’s initial strategies included mailing promotions, and speaking
directly to potential customers. Tacoma’s website states that TAGRO’s program contributes its
success to focusing on responsible marketing rather than public acceptance of the use of
biosolids. Another strategy that TAGRO uses is public education, which can be implemented in
Miami, AZ. TAGRO offers Wastewater Treatment Plant tours for students and community
groups so that they can see the WWTP processes up close to better understand the products that
they are buying. TAGRO also gives presentations to school K-12 to explain how the product is
made as well as provide samples. This could be implemented in Miami School Districts to better
engage a wider demographic of students. TAGRO’s case study shows that implementing this
strategy of marketing is effective and inexpensive. Another case study used when marketing
biosolid compost is Loop from King County, Washington. Loop proved that having an online
presence was very successful marketing. Loop made sure that they provided information to
customers through social media accounts and user-friendly websites, Loop made their brand user
friendly by partnering with academic institutions. The last case study from North Battleford,
Canada where the city could only afford the Lystek solution. According to the Lystek website the
company installs thermal hydrolysis processing system, where the waste is decompressed to
sterilize and make more biodegradable biosolids. North Battleford is the first city in Canada to
adopt this system. Like North Battleford, Miami will be the first in its area to adopt a biosolid
compost solution to the copper corridor. These case studies help the Miami Copper Corridor
project know that creating a logo and theme for the green waste program will help drive interest
in the public and using a combination of marketing strategies will likely help reach the largest
demographic. By educating in schools and using social media the demographic of the younger
generation will be reached and using traditional print ads and mail flyers will reach the rest of the
generations. Based off of the results of the Caper Regional Landfill it will be suggested that the Miami Copper Corridor project use the Windrow technologies as it will be the most cost effective for the size and production of Miami, AZ.

Marketing:

Miami’s marketing approach will be key to the success of a composting operation; interest of stakeholders within the city is necessary to sustain the life of the composting operation. After reviewing the research, The Copper Gold Team chose to recommend direct mailing, social media outreach, email newsletters, business community partnerships, information panels, appropriate labelling, and brand creation as components of a successful marketing strategy for the city of Miami.

Social media, direct mailing, and email newsletters are the most intuitive forms of marketing on this list, but still have the potential to be successful in the small town of Miami. For example, Facebook - a staple of social media platforms for all demographics- charges a relatively small amount to create an add on their website. This add can be target audience based on location, interest, age, and online behaviors. This is ideal for the city of Miami because it allows their own niche audience to be targeted. Direct mailing and email newsletters similarly can give residents updates on the green waste/biosolids compost program. Offering both can target audiences that have preferences for either online or physical methods of communication. Both can deliver the same information, however direct mail is more personal (it is a tangible item that is addressed to the specific person) whereas email offers the convenience of speed. Strategically timed emails can make a difference in the success of the program. In 2012, Experian Marketing Services found that emails sent between 8:00 p.m. and midnight had the best open rate. Social
media, direct mailing, and emails are effective ways to both initially inform residents and to continually keep them updated through the life of the compost program.

Beyond spreading the words that this program exists, one of Miami’s key concerns in minimizing the stigma of human waste to ensure the success of the program. Through information panels, strategic product labeling, and site visits to composting facilities, the stigma can be broken down through increases in composting comprehension and trust in the program management. Information panels with stakeholders and the projected customer base are an opportunity to educate stakeholders about the safety and federal standards for the compost while addressing the concerns of the stakeholders in a transparent manner that establishes trust between program managers and stakeholders. The Handbook for Compost Marketing by the Selective Collection of Organic Waste (SCOW), notes the importance of product labelling to consumers have the best understanding of what is in their product as well as using compost site tours to educate the public about the processes behind their product (2015). Information panels also have the added benefit of alerting program managers of the most prevalent safety concerns of the public and can use this information to construct relevant and effective labels and site visits for consumers to eliminate the stigma of human waste.

Lastly, brand creation and community partnerships can elevate the success of Miami’s future composting program. Austin, Texas and Tacoma, Washington created Dillo Dirt and TAGRO respectively for their successful local compost programs. Each brand name reflects the identity of the community drawing from residents affinity for the community in order to create an affinity for the product as well. Developing a fun clever brand for the Miami’s compost can elevate the product and help it gain traction within the community. Though Miami is smaller than Tacoma or Austin, there is nothing in either case study to indicate that the success is not
transferable. Despite Miami’s size, there is still opportunity to partner with established, trusted businesses and community groups to both expand the consumer base and increase the perceived legitimacy of the compost program. The research may be lacking in studies of rural small-town composting programs, but Miami can be a crusader in small-town compost program formation by using the recommended marketing strategies and using their size as an advantage in spreading words and establishing trust for the program.

Suggested Solutions

When considering the right compost system for the town of Miami, we took every bit of research together and tailored it towards the unique problem at hand. There are various reasons why our group suggested the Aerated (turned) Windrow composting process. According to a representative from Duncan Family Farms, the Windrow turner is compatible with the Arizona climate. Another is the system’s ability to adapt to changing properties within the biosolids. When the process and technology itself are more durable it may save on potential unintended costs. Overall this option does have lower capital costs, however it can be more labor intensive. Based on last year’s volumes the majority of the material being composted will be biosolids at roughly 1,772 wet tons per year. The minority will contain green waste at about 91.5 tons per year. These volumes do not include certain items like wood products and construction materials. An EPA report titled *Biosolids Technology Fact Sheet Use of Composting for Biosolids Management*, projected operation and maintenance of a Windrow system at roughly $150 - $200 per dry ton per day. This equates to $265,800 - $354,400 per year.

The goal of this process is to create a safe Class A product that can be used for consumers and land remediation. Lystek describes this process stating, “In Class A biosolids, pathogens must be reduced to virtually undetectable levels and the material must also comply with strict
standards regarding metals, odors and vector attraction reduction (VAR) as specified in the US EPA, Part 503 Rule.” (Lystek 2018). This means a nutrient rich and higher quality product. In fact, the representative from Duncan Family Farms also confirmed we would not need much more green waste since the biosolids are already nutrient-rich and have enough carbon to maintain high temperatures. Based on that alone no inoculants are needed since they depend on carbon:nitrogen ratio in biosolids. This end-product compost can sell for $5 - $10 per cubic yard, or $10 - $20 per ton. This may potentially aid in operation and maintenance costs.

Now for some suggestions on the proper machinery needed for this composting process. As previously mentioned a compost turner is the ideal method because of the Arizona climate. These turners introduce oxygen into the compost pile speeding up the decomposition process. They’re extremely efficient, composting roughly three times faster than a bucket loader. We found one Windrow Turner in particular, the Wildcat FX700. As far as pricing it does vary, but roughly they are priced at $15,000. Another necessary piece of equipment, the Tub Grinders, which are needed for reducing the volume of green waste material. Their purpose is to also minimize the consumption of expensive landfill air space. The 1999 Morbark 1300 electric tub grinder with grapple is marketed at roughly $87,500. The next piece to our system is a simple but important one, the Temperature Probe. Since temperature largely determines whether the product will be Grade A - quality the probe must be used. A 36” Stainless Steel Temperature Probe comes with color coded temperature zones and is priced at about $99. Since it is made from stainless steel the device is durable ensuring a longer lifespan. This system also calls for a Screening Machine. This tool is largely used to help separate materials, depending on size. Essentially the shaker bed vibrates raw material, filtering fine particles from large materials.
Pricing of the ZYFY compost vibrator screening machine can range from $1k-$6k for the set. Another crucial piece of equipment is a tractor but more specifically the John Deere 6130M. This would be used to transport Green Waste, both pre and post compost. This particular tractor has an 130hp Engine and costs range from $40k-$100k+ (depending on model year, engine hours, etc.). Going forward into our recommendations for what storage method should be chosen, we suggest that a PVC/fabric covered structure covering to protect the windrows would be the optimal choice. This is for a variety of reasons, first, out of the protective structures available, a PVC/fabric covered structure is the cheapest option while being the best one for our application. At approximately $11 per square foot (adjusted from $7 February 1997 dollars to $10.95 March 2018 dollars to account for inflation due to age of data) (Steuteville, 1997), this is almost half the cost of constructing an open air metal structure which is around $19 per square foot (adjusted from $12 February 1997 to $18.76 March 2018 dollars to account for inflation due to age of data) (Steuteville, 1997). Second, having a structure above the windrows will allow for better protection from the sun and weather. This increase in protection from the elements comes with several benefits; reduced water use due to it not being dried as quickly by the sun, reduced risk for contamination due to adequate air-exchange allowed by the fabric as well as protection from precipitation, reduced odor due to adequate air-exchange as well as protection from precipitation, and reduction in wasted potential product due to extrinsic factors (ClearSpan, 2018).

During our research we found a company, ClearSpan Structures, who specialize in fabric covered structures for composting. According to their website, they offer an industry leading 20 year warranty on the structure’s fabric, and a 50 year warranty on the structure itself. We contacted them for an estimate and never received a response back, perhaps an email from someone more ‘official’ would have better luck.
In addition to this structure, surface stabilization may be needed for underneath the windrows as well as the working area depending on where the composting is going to take place. A 6” deep concrete pad would cost approximately $3.05 per square foot (adjusted from $1.80 March 1994 to $3.05 March 2018). Alternatively, lime stabilization could be used on the site at a cost of approximately $0.85 per square foot (adjusted from $0.50 March 1994 to $0.85 March 2018), but this type of stabilization is only effective in soils with medium to low plasticity, which appears to fit Miami’s geology (USDA, 2008), (Sikora, L. J., & Francis, H., n.d). According to a fact-sheet published by the Cornell Waste Management Institute (2005), concrete pads help to avoid contaminating windrows with soil, provide a good working surface, and allow the compost to be worked with in any weather conditions. It is also stated that reinforcing the working surface may not always be necessary in dry conditions, as many soils make good working surfaces but this can quickly change when weather becomes a factor. Regardless, the ground where the windrows go require some sort of preparation before composting begins. This could be one of the above options, or some other drainage managing material such as sand, recycled asphalt, or even fabric (Cornell, 2005). Our recommendation is to analyze the need for a reinforced working surface after zoning for this area has been decided and ecological risk, erosion risk, flash flood risk, as well as soil type can be more accurately assessed and accounted for.

In the process of determining a location to conduct composting, there are several important variables to consider. As noted above, erosion, flash flood risk, and ecological risk need to be kept in mind. Any erosion that occurs shouldn’t compromise the structure, compromise the environment or compromise the composting operation. If any water percolates through the windrows, leachate containing nitrogen, phosphorus, or other pollutants can be released and cause ecological damage if not accounted for. If production of these leachates is
unavoidable, they must be adequately contained by lagoons, birms, tanks, or natural filter strips (plants downhill that help absorb leachate) (Cornell, 2005). Planning the composting site with our yearly monsoons in mind would be wise to avoid any catastrophe. The nearby Pinal Creek is already a WQARF site and 3 mining companies present in the area formed a coalition called the “Pinal Creek Group” in order to reduce potential mining contaminant sources in the creek (United States Department of the Interior, 1997). This composting site should avoid causing any further damage to this recovering ecosystem, especially if it can be avoided through proper planning.

Lastly, in order to establish a market and use of this product, we suggest that a partnership with the local mining companies could be mutually beneficial. They utilize the new product, begin to normalize it, reduce their chances of mining-related contamination, and the local ecosystem gains an abundance of nutrients, increase in microbial biodiversity (Zhen, 2014), and reduction in heavy metal contaminants (EPA, 2016). A potential intervention point could be at Freeport McMoran’s Webster Lake Project near Miami. This project involves reclaiming a large portion of land previously used for some of the mining tailings from the area’s 100+ year mining operations (ADEQ, 2012). I believe this would be a good area to intervene because the project recreates some of the natural drainage of the area that was previously impeded by mining, and according to a study done by the EPA (2016), compost can actually help mitigate some of the damage done by heavy metal contaminants in the soil.

Conclusion
Based on the dynamics of the City of Miami and the successes of other city compost programs, the Copper Gold Team has recommended regular stakeholder engagement (bi-monthly meetings, school outreach, etc), the use of Windrow technologies, proposed marketing strategies, and partnership with the local mining companies as the most effective use of the proposed grant money. This program, despite the size of Miami, can mimic the marketing strategies of private business and other municipalities to bridge the knowledge gap from which the stigma of human waste arises and increases awareness of the program’s existence.

Bibliography


Organic Waste.


