DAVIS HONORS CHALLENGE

# Academic Template

## Campus Composting Initiative

2009-2010

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Composting is a novel method of waste disposal that diverts organic materials, such as food scraps and paper, from the landfill to a facility where the waste can be treated and broken down back into soil. Addressing how composting might be a more efficient waste disposal option is a timely and relevant question for academic operations invested in staying current with a green agenda. If your academic operation is interested in integrating compost into your established waste stream, consider taking some basic steps towards assessing the development of a program.

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# Academic Template

[Template for food processing facilities]

This template is designed for implementing composting practices in academic and food research settings. Here are some basic but important questions you'll need to answer to discern what procedures will work in your facilities. Ascertaining as many specifics as possible is important for practical composting solutions.

1. ] What type of material is produced?

Example:

| | |
|---|---|
| Brewery | Spent Grains |
| Winery | Skins, pulp, seeds, stems, pumice |
| Dairy | Cheese |
| Food Processing | Tomato, peach, prune, olive |

- Knowing what type of materials are produced is important when accessing what kind of containers will be needed to transport the materials.
    - Materials with high moisture will need bins more protected against leakage than materials that are dry.

- Accessing what type of materials a facility is producing can be best answered through a visual assessment or an interview with the manager of operations.
    - A visual assessment is a visual estimation of quantity and type of material in respected bins.

2. ] What time of year does production take place?

Example:

| | |
|---|---|
| Grapes | Late June/Early July—Oct. |
| Peaches | Friday after July 4$^{th}$—Friday after Labor Day |
| Prunes | June-Sept./Early Oct. |
| Olives | 2-3 weeks during Nov./Dec. |

- Monthly figures are important because depending on the season, different facilities will have varying degrees of activity on site.
    - Some months will be very active, while others will have no activity at all.
    - Knowing these figures can help you create a streamlined plan for your specific facility.

3. ] What amount of material is produced? Annually, monthly, weekly, daily?

Example: Winery Operations Material Stream—Pumice

| | |
|---|---|
| Daily | 2 tons |
| Weekly | 10 tons [5 days a week] |
| Monthly | 40 tons [3 months a year] |
| Annually | 120 tons |

- Knowing the amount of material produced is important when trying to coordinate material pickups.
    - In this instance, daily pickups are a must with the quantity of material being produced.

- Knowing annual figures is also important in deciding whether a composting initiative is even viable in your facility.
    - In some operations, total diversion is so small as to not validate a composting plan.

4. ] What are the material expelling methods of each facility? / What bins does each specific operation require?

Example:

| | |
|---|---|
| Winery | Mechanically collected in 4x4 ft MacroBins, then dumped in dumpster |
| Brewery | Shoveled into 35 gallon bin |

- Knowing how the materials moves from facility equipment to material holding containers is important when trying to find a compost bin that will work in each specific facility.
    - In the case of the winery, where pumice moves directly from a specialized machine into a short but large 4x4 bin, the more traditionally sized and shaped waste bins, such as the upright 35 gallon one used in the brewery, would not be suitable as compostable bin replacements.
    - The brewery bin on the other hand, could be easily replaced with a similarly sized and shaped bin for compost since material is shoveled directly into the bin.

5. ] How many bins are used?

- Knowing the number of bins used by each operation is important when ascertaining how many compost bins you will need to replace what is currently being used.

6. ] Where is bin storage located?

- Knowing the location of bins is important when coordinating material pickups with the custodial staff.

7. ] What is the frequency of collection?

Example:

| | |
|---|---|
| Brewery | Regular pick up at 4 pm 2-3x/wk |
| Winery | Requires afternoon (3 pm) and evening (8 pm) pickups daily |
| Tomato | Regular pick up a 4 pm 2x/wk |

- Knowing how often material pickup is required is vital in implementing an effective composting program in your facility.
    - Daily pickups are not always necessary, but in some cases, production levels may be so high two pickups a day may be necessary.

8. ] Are there any special considerations needed for a particular facility?

- As mentioned above in the case of the winery operations, special consideration is needed when considering compost bin replacements that will be viable in current facility operations.
- In the case of food processing facilities, in addition to new compost bins, bins may also need to be food grade.
    - Food grade bins are bins that must stay within this facility, they can't be moving around to other facilities. Bins must be specifically labeled to ensure this doesn't happen.

9. ] Challenges

- Some challenges you may face:
    - Funding
        - Adding another stream may require additional transportation and staff for pickups.
    - Coordinating additional transportation required for new organics stream.
    - Coordinating additional staff required for pickup of new organics stream.
    - Lack of awareness
        - Educating those working in the facility and custodial staff picking up materials does have a learning curve.
        - Persistence and enthusiasm during the transition are a must.

*For a more in-depth look at the detailed information needed to draw up an effective composting plan in your facility, reference the attached Robert Mondavi Institute Case Study.

# Robert Mondavi Institute

Case Study

# Robert Mondavi Institute (RMI) Case Study

**Coordinators**: R4 Recycling and Davis Honors Challenge

**Purpose:** To ascertain the best strategies for implementing composting procedures into the Robert Mondavi Institute's new winery, brewery, and food processing facilities.

**Procedure:**
1.) Preformed one physical waste audit to determine how much waste from the RMI offices and food labs could be diverted from the landfill and composted.
2.) Preformed in-depth interviews and on-site tours with heads of winery, brewery, and food processing operations to secure detailed information on quantity, consistency, frequency, and management of RMI facility waste streams.

## Definitions of Terminology

**Biodegrade** - The process where materials break down or decompose by the action of living organisms.

**Compost** - A mixture of decaying organic matter, as from leaves, food scraps, and paper products, used to improve soil structure and provide nutrients.

**Compostable** - A material that breaks down to become what is effectively soil. It contains no toxins and can support plant life.

**Contamination** (as related to compost) - Incorrectly placed materials in the compost that should belong in the landfill or recycle bin.

**Diversion** - Diverting material from the landfill, either by composting or recycling.

**Physical waste audit** - A formal, structured process used to quantify the amount and types of materials being generated by a specific source. Information from audits will help identify current practices and how they can be improved.

**Recyclable** - Materials that can be collected, separated, processed, and made into new products.

**Visual assessment** - Visual estimation of quantity and type of waste in respected bins. Potential for viewer bias.

**Zero Waste** - A "whole system" approach that seeks to reduce the amount of consumption, minimize waste, maximize recycling, and ensure that products are made to be reused, repaired, or recycled back into nature or the marketplace.

## UC 2020 Zero Waste Goal

**UC Recycling and Waste Management**
*Each campus will submit for certification one pilot building at a LEED-EB "Certified" level or higher by July 1, 2008*

*To facilitate the implementation steps for the policy, campuses will develop an inventory of buildings that meet the scope eligibility requirements above, and then group these eligible buildings into categories of buildings with similar operational and maintenance needs. Campuses will submit proposed core credits for one of the building type groupings identified above and any campus wide core credits to the U.S. Green Building Council by July 1, 2009. A core credit is a credit that will be sought for either all scope eligible buildings on a campus, or for all buildings within a building type group.*

*By July 1, 2009, the University will evaluate efforts to date and develop an implementation plan and funding strategy toward a goal of achieving campus wide LEED-EB certification.*

**Recycling and Waste Management**

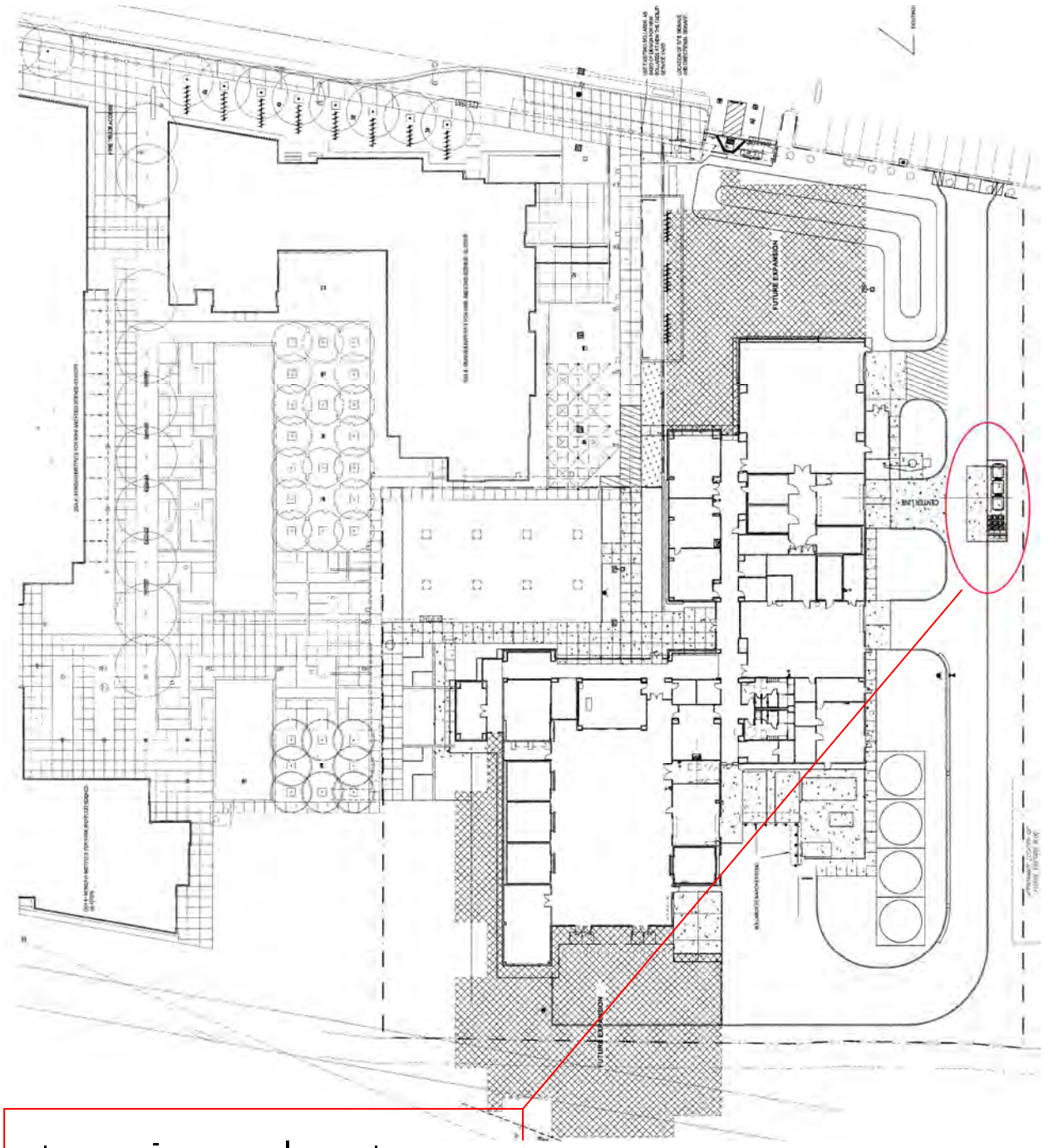
a. In response to Public Resources Code Section 40196.3 which states that the Regents of the University of California are encouraged to comply with code Chapter 18.5, the "State Agency Integrated Waste Management Plan" and in support of the California Integrated Waste Management Board's goal for a "zero waste California," the University voluntarily adopts the following waste diversion goals:
   - 50% by June 30, 2008
   - 75% by June 30, 2012
   - Ultimate goal of zero waste by 2020

b. All campuses will develop an Integrated Waste Management Plan (IWMP) and funding mechanism by June 30, 2007.
c. Waste reduction and recycling elements shall be integrated in Green Building Design and Sustainable Operation implementation goals and into campus operations as they are developed.
d. The University will seek to develop funding sources for financing waste reduction projects.

*Implementation Procedures for Recycling and Waste Management:*
- *The IWMP will include current and future programs, dates of implementation, funding, and exact diversion numbers intended to meet goals*

*• For purposes of reporting, the medical centers (and other traditionally exempted entities) (Satellite locations) at various campuses will be required to report solid waste and recycling tonnage to the campus entity collecting data for the report. Medical Centers and other exempted facilities are also required to meet diversion requirements. Exceptions will be considered for those entities which represent less than 1% of the overall campus solid waste tonnage.*

## RMI LAYOUT:



Close up of bin pick-up location.

## A. Physical Waste Audit (FROM FOOD LABS)

February 8-10, 2010 collected
February 11-12, 2010 audited
Location: Food Science and Technology and Viticulture and Enology
Coordinators: R4 Recycling: Lin King, Cristal Muñoz, DHC

The Numbers
Total staff: 4—1 from R4 Recycling, 3 from the Davis Honors Challenge

Recycling: 8.9 lbs – Mixed bottles and cans, aluminum foil
Compost: 142.7 lbs – Majority paper towels, food scraps, and paper plates and cups
Mixed Paper: 9.0 lbs – Mostly paper, some cardboard
Landfill: 128.8 lbs – Mostly lab materials (pipette tips, gloves, plastic ware) and plastics

**Amount of diversion: 55%**

**Analysis/Comments:**
In preparation for our 2 day audit, waste from the current Food Science and Technology and Viticulture and Enology buildings in the RMI was collected for a week. The waste filled eight 65 gallon carts and included approximately twenty four black trash bags. More than half of the waste collected was compostable with the majority of landfill waste consisting of laboratory materials. Even lab waste contained a significant amount of compostable food scraps and paper towels.

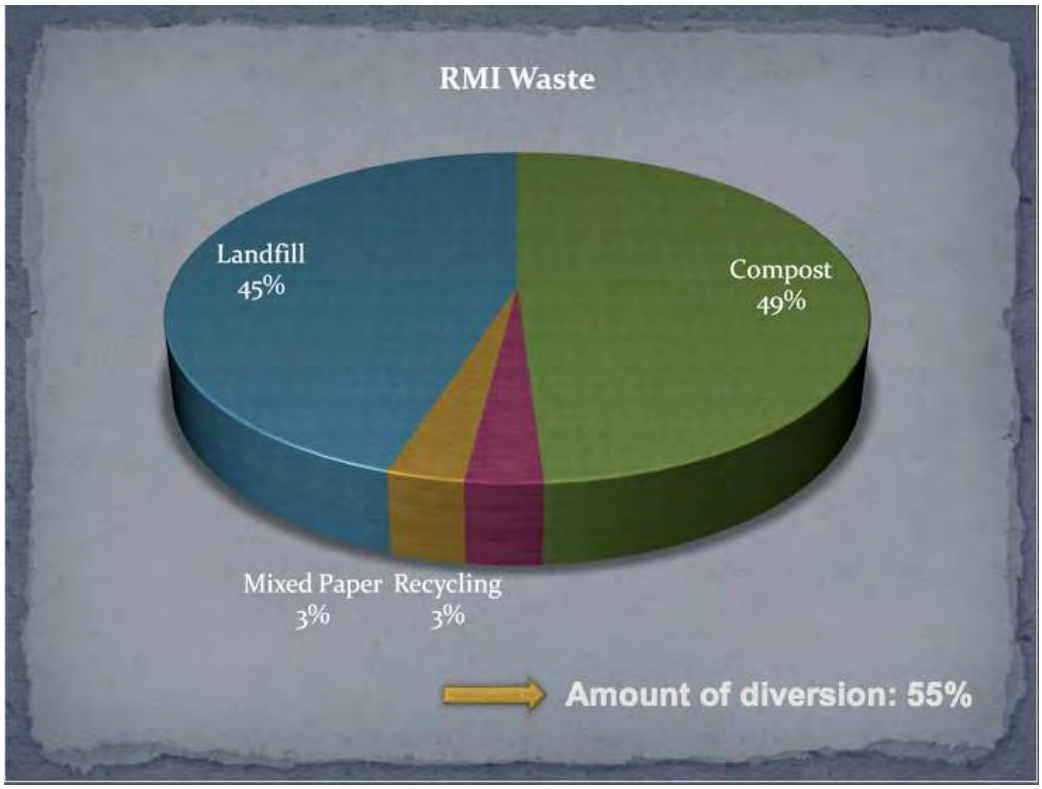



**Figure 1**—Total Diversion Rate of all waste collected during audit.

**Picture 1**—Yellow compost bins sorted during the physical waste audit of the RMI.

**Picture 2**—Sorting between compost, recycling, mixed paper, and landfill waste from the RMI.

## B. Interviews

**Interviewees:**

- Julianne M. Nola [Design and Construction Management]
- Charles Bamforth [Food Science and Technology, Professor]
- Charles Brenneman [Department of Viticulture and Enology, Supervisor]
- Molly Anne Lear [Food Science and Technology, Staff Rsch Assoc III]
- John Krochta [Food Science and Technology, Professor]

**Questions:**

- What is being produced?
    - How much?
    - How often?
- What type of material is produced?
    - Consistency (i.e. food scraps, solid, liquid)?
- Separation of materials:
    - Before or after collection?
- Containers:
    - Special containers for liquid waste?
    - Labeling?
- Transportation of materials:
    - Where is it going?
    - Material removal funding?
- Wastewater?

## 1. Charles Bamforth—Brewery Operations

| Operation | Beer |
|---|---|
| Type of Material | Spent Grains |
| Amount | 100 kg/10 wks |
| Total Amount Per Year | 100 kg |
| Material Expelling Methods | Shoveled into bin |
| Bins Required | 35 gallon bin |
| Number of Bins Used | 1 |
| Bin Storage Location | Outside |
| Frequency of Production (per wk) | 2-3 x/wk, max of 2 brew/day |
| Hours of Operation | 8 a.m. – 5 p.m., pick up at 4 pm |
| Time of the Year | 10 wks during Spring Quarter |
| Frequency of Collections | Requires regular pickup at 4 p.m. 2-3 x/wk |
| Additional Comments | *Candace Wallin said yellow compost bin would be a good substitute for the current bin |

**Table 1**—Details of brewery operations.

## Brewery Bins:

**Picture 3**—Consistency of brewery operations waste stream: damp spent grains.

**Picture 4**—Reusable bottles of UC Davis home brewed beer.


**Picture 5**—35 gallon brewery bin.

## Analysis/Comments:

Overview of Operations

- Pilot scale brewery.
- Main organic material: malted barley (in hot water)
- The material left behind from this is called spent grains which are currently composted.
- This material is not produced very often in a small scale brewery such at the RMI.
- Majority of brewing is done 2-3 times per week for 10 weeks during spring quarter.
- 1 ½ barrels produced per year = 1.71 L (about 100 kg of spent grain total)

New Facilities

- No foreseen operational changes.

Current and Future Bins

- Currently using 35 gallon bin.
- Would like to switch to the yellow 65 gallon compost bins.

Readiness for Implementation

- Ready now for implementation.

## 2. Charles Brenneman—Winery Operations

| Operation | Wine |
|---|---|
| Type of Material | Grape skins, pulp, seeds, stems, pumice |
| Amount | 2-3 tons red pumice for every 50 tons of red grape processed (daily) |
| Total Amount Per Year | 240-360 tons red pumice |
| Material Expelling Methods | Mechanically collected in bins, dumped in dumpster |
| Bins Required | 4 x 4 ft MacroBins [16-A-S] bins dumped in dumpster |
| Number of Bins Used | 3-4 |
| Frequency of Production (per wk) | 5x/wk (Mon.-Fri.) |
| Hours of Operation | Dawn-Dusk (12-14hrs) |
| Time of the Year | August-November 1st |
| Washing Location | NA |
| Frequency of Collections | Requires afternoon (~3 p.m.) and evening (~8 p.m.) daily pickups |
| Additional Comments | *Must figure out logistics of R4 Recycling pick-up and transport with MacroBins and dumpster |

**Table 2**—Details of winery operations.

**Winery Bins:**

**Picture 6**—24-A-S MacroBin.

## Specifications for the MacroBin 24-A-S

*Similar to 16-A-S except:*

| | |
|---|---|
| Volume Capacity: | 40,700 cubic inches / 176 gallons |
| Tare Weight: | 92.5 pounds |
| External Dimensions: | 47 1/8" (L) x 47 1/8" (W) x 28 1/8" (H) |
| Internal Dimensions: | 44" (L) x 44" (W) x 22 1/4" (H) |

**Picture 7**—16-A-S MacroBin.

## Specifications for the MacroBin 16-A-S

| | |
|---|---|
| Load Capacity: | 1,200 pounds |
| Volume Capacity: | 27,700 cubic inches / 120 gallons |
| Tare Weight: | 81 pounds |
| Maximum Stack Weight[1]: | 8,500 pounds (long term, ambient temperature)<br>10,000 pounds (short term (<1 month), ambient temperature)<br>11,500 pounds (long term, cold storage (35° F. and below)) |
| Molding Process: | High-pressure injection molding |
| Material: | Copolymer Polypropylene, U.V. stabilized |
| Approval: | FDA-regulated material |
| Container Design: | Double wall corner and center posts |
| Foot Design: | Two full-length feet with positive interlocking feature |
| Fork Lift Entry: | Two-way: 4 1/4" opening with patented integral slide-entry |
| External Dimensions: | 47 1/8" (L) x 47 1/8" (W) x 21 1/2" (H) |
| Internal Dimensions: | 43 3/4" (L) x 43 3/4" (W) x 15 5/8" (H) |
| OPTIONS: | ■ MacroLid<br>■ Rotator bar<br>■ Multiple color choices: Ivory, blue, green or gray (24-A-S only)<br>■ Center foot for added floor support<br>■ Customer identification with RFID tags or foil embossing |


**Picture 8**— The 4 x 4 ft bins are placed underneath this piece of equipment and the drum drops directly into the bins.


**Picture 9**—Compost receptacle must work in current waste disposal system with above dimensions and placement.

**Picture 10**—Close-up of 4 x 4 ft MacroBin.


**Picture 11**—An example of how winery waste stream is dumped into the 3 yard dumpsters. Note: this is not the winery's actual waste stream.

## Analysis:

Overview of operations

- Wine making: August - November 1st
- During harvest season operations are 12-14 hours long.
- Material: grape skins, grape pulp, seeds, stems, fermented pumice, other solids (insects, snakes, mice, etc).

New facilities

- Winery being sized to handle 100 tons of grapes. Transportation of material depends on how grapes are processed, examples:
    - 50 tons of red grapes equates to 2-3 tons of red pumice (which makes a great compost).
    - Whites: Depends on how efficiently pressed. Cramming scientific/artistic process into a 3 hr lab.

Current and Future Bins

- Currently using MacroBins (120 gallons/176 gallons).
    - Material from MacroBins dumped into 3 yard dumpster.
- Given the volume of material generated at any given time, it is impractical to transfer from a 120/176 gallon container to several 65 gallon containers.

Readiness for Implementation

- Ready for implementation.
- Campus has the ability to pick up and transport the 3 yard dumpster, which the final material is dumped into.

## 3. Molly Anne Lear—Food Processing Operations

| Operation | Tomato |
|---|---|
| Type of Material | Tomato skins, pulp, seeds, stems |
| Amount | 200-300 lbs/per day, 2x/wk |
| Total Amount Per Year | 6400-9600 lbs |
| Material Expelling Methods | Hand thrown away |
| Bins Required | 96 gallon bins, must be food grade |
| Number of Bins Used | 3-5 bins |
| Frequency of Production (per wk) | 2x/wk |
| Hours of Operation | Currently: 7 a.m. – 4 p.m., Summer: 7 a.m. – 6 p.m. |
| Time of the Year | Late June/Early July-October |
| Frequency of Collections | Requires regular pickup at 4 p.m. 2x/wk |
| Additional Comments | *Food Grade—bins must stay within this facility, they can't be moving around to other facilities. Bins must be specifically labeled to ensure this doesn't happen.<br>*Yellow 65 gallon bin would be a good substitute for the current bin. |

**Table 3**—Details of tomato processing operations.

| Operation | Peach |
|---|---|
| Type of Material | Peach skins, pulp, pits, stems |
| Amount | 200-300 lbs 1x/wk |
| Total Amount Per Year | 3200-4800 lbs |
| Material Expelling Methods | Hand thrown away |
| Bins Required | 96 gallon bins, must be food grade |
| Number of Bins Used | 3-5 bins |
| Frequency of Production (per wk) | 1x/wk |
| Hours of Operation | Currently: 7 a.m. – 4 p.m.,<br>Summer: 7 a.m. – 6 p.m. |
| Time of the Year | Friday after July 4th –<br>Friday after Labor Day |
| Frequency of Collections | Requires regular pickup at 4 p.m. |
| Additional Comments | *Food Grade—bins must stay within this facility, they can't be moving around to other facilities. Bins must be specifically labeled to ensure this doesn't happen.<br>*Yellow 65 gallon bin would be a good substitute for the current bin. |

**Table 4**—Details of peach processing operations.

**Picture 12**—Tomato processing equipment. Where final product is dispensed.

**Picture 13**—Peach processing equipment. Where final product is dispensed.

| Operation | Plum |
|---|---|
| Type of Material | Grape skins, pulp, seeds, stems |
| Amount | 5-10 lbs 1-2x/wk |
| Total Amount Per Year | 80-320 lbs |
| Material Expelling Methods | Hand thrown away |
| Bins Required | 96 gallon bins, must be food grade |
| Number of Bins Used | 3-5 bins |
| Frequency of Production (per wk) | 1-2x/wk |
| Hours of Operation | Currently: 7 a.m. – 4 p.m.,<br>Summer: 7 a.m. – 6 p.m. |
| Time of the Year | June-September/Early October |
| Frequency of Collections | Requires regular pickup at 4 p.m. |
| Additional Comments | *Food Grade—bins must stay within this facility, they can't be moving around to other facilities. Bins must be specifically labeled to ensure this doesn't happen.<br>*Yellow 65 gallon bin would be a good substitute for the current bin. |

**Table 5**—Details of prune processing operations.


**Picture 14**—Plum dehydrating equipment.

| Operation | Olive |
|---|---|
| Type of Material | Olive skins, pulp, pits, stems |
| Amount | 1000 lbs 2x/wk |
| Total Amount Per Year | 4000-6000 lbs |
| Material Expelling Methods | N/A |
| Bins Required | N/A |
| Number of Bins Used | N/A |
| Frequency of Production (per wk) | 2x/wk |
| Hours of Operation | N/A |
| Time of the Year | 2-3 wks during November/December |
| Frequency of Collections | Operation not yet functional. Planned to open in 2-5 years, small-scale operations. |
| Additional Comments | *Food Grade—bins must stay within this facility, they can't be moving around to other facilities. Bins must be specifically labeled to ensure this doesn't happen.<br>*Yellow 65 gallon bin would be a good substitute for the current bin. |

**Table 6**—Details of olive processing operations.

## Analysis:

Overview of operations

- Food Processing Facility
- Main organic material:
    - Tomato
    - Peach
    - Plum
    - Olive

| Operation | Quantity/day | Frequency/wk | Total Material/yr |
|---|---|---|---|
| Tomato | 200-300 lbs | 2x | 6400-9600 lbs |
| Peach | 200-300 lbs | 1x | 3200-3800 lbs |
| Plum | 5-10 lbs | 1-2x | 80-320 lbs |
| Olive | 1000 lbs | 2x | 4000-600 lbs |

New facilities

- No foreseen operational changes.

Current and Future Bins

- Currently using 4-6  55 gallon and 2  20 gallon bins.
- Would like to switch to using 6-7 yellow 65 gallon compost bins.

Readiness for Implementation

- Ready for implementation next season.

## 4. John Krochta—Dairy Room Operations

Material:

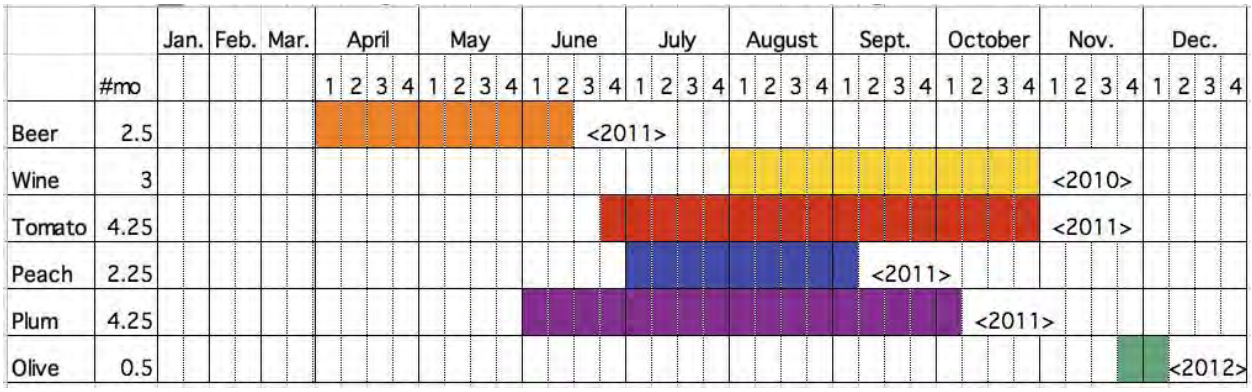
- Mostly liquid—milk, acid whey, wastewater
- Liquid waste down drain
- Some solids—cheese

Material frequency and quantity:

- No continuous production—very flexible facility
- Small lab producing on smaller scale (only 800 square feet)

## Calendar of RMI Material Production

**Figure 2**—Calendar of RMI operation productions.




**Significance:** Creating such a calendar helps visually assess when waste is being produced by which operation. This allows the creation of a successful waste pick-up, since a timely pick-up of compost is vital.

| | |
|---|---|
| Brewery | 100 kg |
| Winery | 120-180 tons |
| Plum | 80-320 lbs |
| Tomato | 6,400-9,600 lbs |
| Peach | 3,200-4,800 lbs |
| Olive | 4,000-6,000 lbs<br>*estimated |
| Dairy | Negligible |
| Total | ≈ 127-191 tons |

**Table 7**—Calendar of RMI operation productions.

## Funding:

Funding is vital for the implementation of a successful composting program. In regards to implementing a composting program in the RMI specifically, funding has presented itself as an obstacle for the following reasons:

- The RMI is a state funded building for which UCD received zero new funds for waste removal fees.
- The UC is facing a time of budget cuts.
- UC Davis must pay for the new waste stream with the limited funds they currently have.
- The cost of landfilling the waste in the UC Davis landfill costs $40/ton.
- To compost that same ton it costs an estimated $60/ton extra.
    - The main factor for this increase in price is the cost of transportation.

To overcome these obstacles some solutions were presented:

- Decrease the amount of landfill waste coming out of other operations on the UC Davis campus.
- Get the greater UC Davis campus community involved in taking an interest and initiative in composting.

In gauging where we should compost the waste produced by the new Brewery Winery and Food Processing building in the RMI, keep the following points in mind:

- The UC Davis landfill will be closing in approximately 2 years. When this occurs, the landfill waste produced by the UC Davis community will be taken to the Yolo County landfill, increasing the cost of the disposal of landfill waste.
- For every ton of waste placed into the landfill, UC Davis must deposit X amount of money into a landfill care fund. This fund is created to deal with landfill waste in the long run. With composting there is only the initial investment, lowering the cost of composting in the long run.

Though the initial cost of composting might not seem economically sound, the long-term investment overrides the difference in price. The long-term investment includes environmental benefits such as returning nutrients to the soil and decreasing the amount of landfill waste.

## Conclusions:

- RMI food labs are a great candidate for composting.
- More than half of the material coming out of the food science labs is compostable.
- The dairy operation will not be included in the compost project due to little and infrequent production of waste.
- All operations, except viticulture, are able to switch to 65 gallon yellow bins to collect their materials.
- Campus has the ability to pick-up the 65 gallon yellow bins, as well as the 3 yard dumpster used by viticulture.
- A composting program is ready for implementation within the brewery, winery, and food processing operations (tomato, peach, plum, and olive).

**Suggestions:**

- Use production calendar to effectively set up a compost pick-up schedule.
    - Greatest concern faced by departments was timely material pick-up to prevent insects, bugs, and diseases that can harm production.