SCHOOL FOOD SCRAP COMPOSTING

Operations & Design Manual

CAPE COD HILL SCHOOL PROGRAM

Vienna / New Sharon - Maine

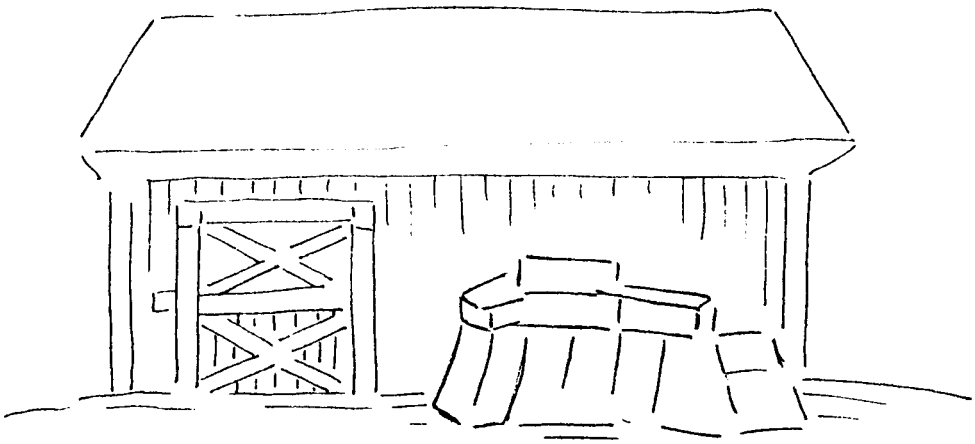
Woods End® Laboratories INCORPORATED

The Cape Cod Hill Design for School Food Composting

The Cape Cod Hill food scrap composting initiative is a joint project by the Cape Cod Hill School, serving Vienna and New Sharon, Maine and the Woods End Research Laboratory, Inc. of Mt. Vernon. The pilot project on which this successful initiative is based was funded by the former Maine Waste Management Agency.

Conceived in the summer of 1992, this composting effort seeks to return food scraps from cafeteria collection to a composting facility designed to be safe, sanitary, cost-effective and "user-friendly". The composting program is envisioned to join with elementary-level educational efforts underway presently in the school and to contribute to reduction of landfilled organic wastes.

The composting facility design developed by Woods End is representative of a *barn* with *compost stalls*, each arranged to be easily accessible, detachable and easily cleaned. The stalls and building rest on a poured, floating concrete slab. The interior portion of the slab slopes slightly to the center in which a drain is situated. Access to the building is through a sliding barn-door which permits wheelbarrows and bales of hay to be easily maneuvered.



The Food Scrap Compost Building

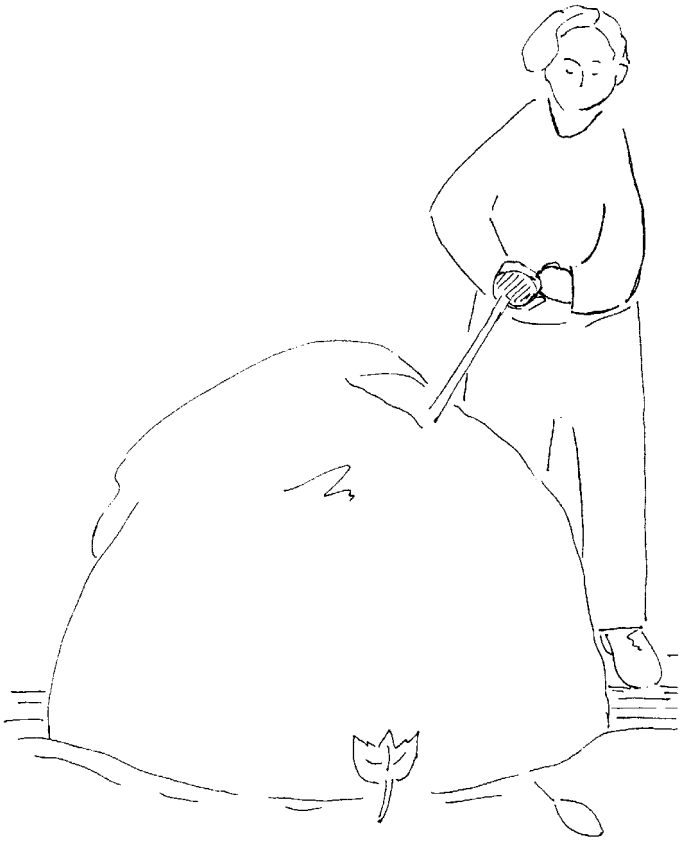
The building is passively aerated and illuminated through side-vents and fiberglass roof panels. There is no electricity or running water. Air movement is provided for by open, screened gable windows and at floor level. The lower vents permit flow from above down and out behind the compost stalls, allowing free release of heavier compost gases.

The building is sized to permit all annual food scraps to be composted. In addition, there is ample room to store necessary ingredients which include cured compost as a starter, limestone to stabilize pH, and hay as bulking agent. Finally, provision is made for hanging tools which include hay forks, spading fork, brooms, and compost thermometers.

The Cape Cod Hill Composting Barn is an innovative project conceived as a pilot program, but which has continued successfully for years. Design plans for the buildings are attached to this report.

1.0 Introduction to this Guideline

This manual has been developed in specific reference to the specially designed "Compost Barn" of the New Sharon/Vienna Elementary School located on Cape Cod Hill in New Sharon, Maine. The basic plan and operational design for both the compost building and the compost bins contained within it is of a modular nature and may be readily adapted to both larger and smaller situations. This manual documents the activity associated with the Cape Cod Hill school pilot program and may be representative generally of procedures involved in maintaining any similar composting operation. All procedures should be carefully considered and adapted as needed to specific situations. The end result of the program and the activities it describes is sustainable in nature: students learn an important recycling activity, science teachers have a link to hands-on work, and a useful compost product results!



The End-Result: from

Garbage to Soil-Renewing Compost

in a climate of practical science and learning

2.0 Summary of Pilot Activities

The New Sharon/Vienna composting shed is intended to serve as a environmental disposal alternative to dumping scraps in dumpsters for landfilling. The primary focus is food waste generated in the school cafeteria and scraps from meals children bring to school which are not fully consumed.

The compost shed has been sited at a convenient distance from the cafeteria with good access for the transportation of food scraps in all weather and with access to water by hose from a nearby all weather water outlet on the main school building. An area adjacent to the compost shed has been designated for the final curing and screening of the compost. No electricity was required.

As detailed in the design drawing, the shed consists of an uninsulated vector-proof building. This building contains four slatted compost bins on a concrete floor with drainage for any leachate or cleaning waters. The bins have raised floors for aeration of the compost. A layer of straw or hay and/or leaves is placed on the base of the bin, and then compost ingredients (food scraps, dolomitic limestone, inoculant compost) are spread evenly and mixed thoroughly on this layer of carbonaceous material. Another layer of straw or hay and/or leaves is placed upon the layer of food material to receive the next day's food scraps. The layer of straw, hay or leaves are used to establish a mat of material so that the food scraps do not fall through the base of the bin. These materials are typically called bulking agents. Other materials that are also bulking agents are bark mulches, sawdust, woodchips and other bulky woody materials. These materials are not suitable for this type of operation as they tend to spill through the slats, base and sides of the compost bins. When the compost bin is full another bin is started in a similar fashion. This methodology works very well except for the extremely cold months of January and February in Maine. Composting need not take place during the summer months as the school is not in session. This is, however, a time for needed cleaning and refurbishment of the compost bins and for compost shed maintenance.

All the children at the school have been trained to separate the wastes during the lunch-time meal. Plastics and papers go into one large waste bin and food scraps into another. The food scraps are then transported in a wheeled plastic trash bin outside to the compost shed. These scraps are then spread on the layer of straw or hay and/or leaves, and mixed evenly (using a spading fork), with a small amount of ground dolomitic limestone and a mature compost to act as a bacterial inoculant and starter. This layer is then covered with fresh straw/hay and/or leaves.

A group of fifth and sixth graders has been trained in these activities, in the keeping of daily temperature records, and a quick cleaning of the shed, in a short five to ten minute break after their lunch. Other activities that remained to be carried out on a regular basis with adult help are:

- Restocking of hay, leaves, mature compost and dolomitic limestone.
- Adding and mixing of active piles together into a third bin when needed.

- Routine cleaning and maintenance of the compost shed.
- Taking compost outside for final curing.
- Watering compost inside and outside the shed as necessary
- Annual maintenance and repair of the compost shed and the adjacent environment.

3.0 Summary of Recommendations from the Pilot

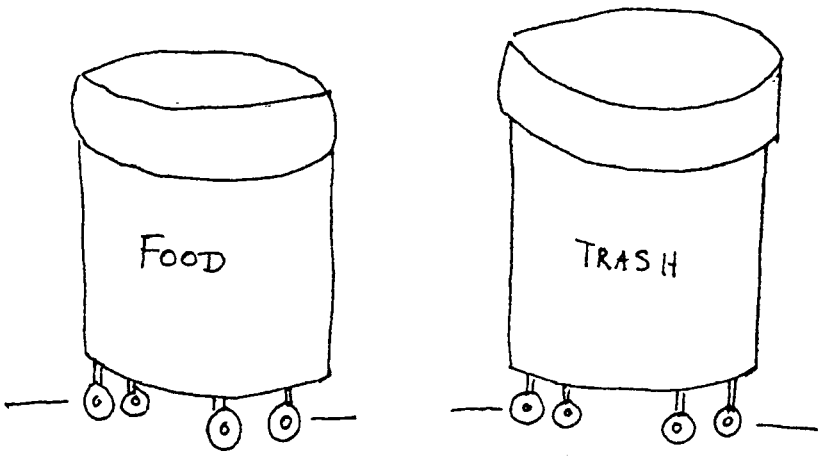
During the first year of operations at Cape Cod Hill several factors were observed that would help facilitate the composting in such a building:

- In any weather, active compost loses moisture quickly. Regular watering of the layers of compost helps alleviate dryness. In warm weather a routine misting of active bins to the point when water just begins to run off the pile greatly helps in quicker composting.
- Layers of hay /leaves placed between the daily food scraps should be enough to just cover the food material, but not be too thick, due to drying of the compost.
- Hay /leaves put at the sides and bottom of the bins should be fairly thick to allow good air movement and avoid food oozing out of the bins.
- Compost quickly reduces in volume to half the level of the bin. When two bins reach this stage they can be added together and remixed and watered.
- Cold weather comes on quickly in a New England fall and newly filled bins may readily freeze. To help avoid freezing it is recommended that the active compost piles be divided such that fresh food scraps can be placed on top of an already warm pile.
- When turning or moving compost from one bin to another it is vital that compact layers or clumps be broken up. This means that all the compost materials should be thoroughly “fluffed”, mixed and if needed remoistened.
- Water should be available to the building without having to be carried by children. The ideal situation is to have a frost free spigot in the building with a short length of hose.
- This project utilized hay and straw primarily for bulking. However, it has been found that fresh leaves may be used as a substitute or in mixture with the hay. Leaves are easy to handle, help retain moisture content, and the degradation of the compost is considerably improved.

Neglecting any of the above factors can lead to a delay in the maturing and completion of the composting in this type of operation. The major deterrent to compost maturation is most probably the lack of moisture, as the food materials mixed with just hay alone tend to dry out very quickly. As always, neatness of management and timeliness of practices help make for a successful operation!

4.0 The Food Scrap Composting Program

Food scrap composting begins with the concept of *Separation*: the removal of non-decomposable trash from organic, compostable scraps.



Source Separation of Food from Trash

To facilitate separation in the easiest and most hassle-free manner, two bin-systems are recommended. A variety of bins are available, and regular trash bins with or without wheels are sufficient. A simple beginning to a dynamic program!

4.1 Materials and Supplies

The following materials are required for the collection/composting program:

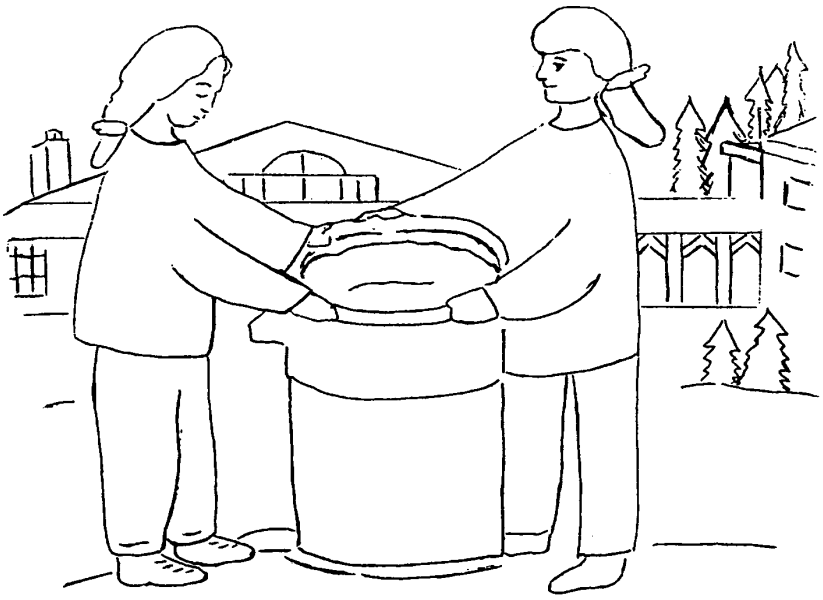
- Two large wheeled plastic trash cans. (Normally available in schools and used for recycling and trash collection).
- Optional: large plastic bags (used to line the bins for food collection). Newer biodegradable plastic bags are in the market. Check with your recycling coordinator. It is important to prevent leakage on the way to the compost shed!
- BIG Labels (placed on the trash bins to show which is for food waste and which is for paper, plastic and other non-compostible materials).
- Optional: bathroom scale, to be used to conduct an "Audit" by weighing the daily amount of food scraps. This is recommended for science teachers and in the stage prior to composting to gain an idea of the expected waste flow. In the case of New Sharon approximately 200

pounds of food scraps were recorded per week (250 students) and this translated into a four bin unit. Normally, the bins will be full after four to six weeks and will decompose to approximately half this amount in two to three months.

4.2 Collection of Food Scraps

For at least an entire week, prior to the actual design and construction of the compost building, the output of food waste for each meal should be weighed. At the same time as this waste audit is in progress the children should be taught to separate the food materials and the non-compostibles. The volume and weight estimates are needed so that the compost shed can be sized appropriately for the amount of food waste generated.

A group of parents and/or teachers can train the children in an elementary school to divide and deposit compostible and non-compostible materials into two separate waste bins. In New Sharon/ Vienna this was achieved very quickly and the incidence of materials ending up in the wrong container was very low. Children love to police! Throughout the process, both planning and support by parents in addition to school staff, as well as janitorial cooperation, is very important.



Cooperation in Food Scraps Removal

A successful school food composting program starts with an assumption of the amount in volume of food scraps. Beyond this, cooperative weighing is a way of "monitoring" and learning about the process. Once children see how much tonnage per year the school may be producing in garbage, they quickly grasp the dynamic of the process! Waste composition audits, whereby selected pupils pick out the types of trash, is a good training for environmental work, but must be carefully supervised.

In the Cape Cod Hill program, daily collection of food scraps happens in a particular manner. Children are called up in groups to dispose of trash, so that the line is never too long. Long lines are inefficient and promotes overly-hasty disposal that increases incidental contamination. Children are instructed (and trained) to pick out all paper and plastic items into the first bin marked "Non-Organic Trash". The paper component need not be as much a worry as plastic and laminated cartons. The moist paper and food scraps go into the second trash can.

It has been found that constant monitoring is needed to insure that this activity continues at a high level of non-contamination. As mentioned, persons best suited to do this job include janitors, members of the teaching staff and the older children who have been previously trained to perform this task. It has been found that an occasional presentation by staff on the importance of keeping plastic out of the compost greatly reduces the incidence of contamination.

It is advisable to freely designate "environmental pupils". In the Cape Cod program, "Green Awards" were issued at the end of the year to the students who helped monitor and manage the process.

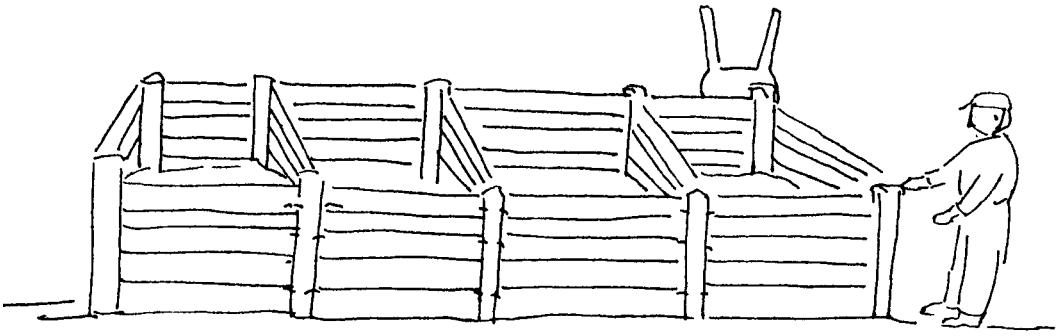
Contamination of composting by non-decomposable should not be under-emphasized. A relatively small incidence of contamination at the outset turns into a large effect in a finished compost pile, since the other materials have broken down and "concentrate" the non-decomposable matter. Quite aside from decomposition, food waste is 80-95% water and will therefore loose a large part of its mass. But plastic and metals do not reduce!

Once the training is finished and the measurements accomplished the children can continued to separate the food and this activity becomes an established routine. This enables a compost shed to go into full operation when construction is finished.

4.3 Filling Compost Bins

A variety of tools and materials are needed in the management of bin filling:

- Two Plastic Trash Cans (To hold limestone and compost)
- Spading Fork
- Ground Dolomitic Limestone
- Bales of Mulch Hay/Straw or Bags of Leaves (Or other suitable bulking agents)
- Finished Mature Compost
- 2 Empty Standard Coffee Cans
- Data Pad in Weather Proof Holder

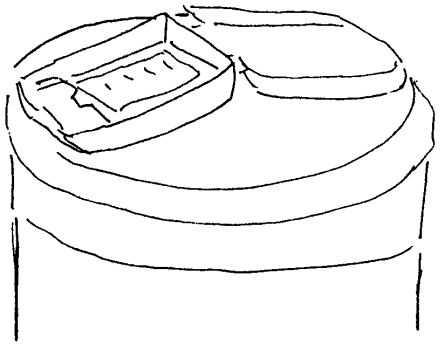


Compost Bin Layout

At New Sharon a group of older children (5th and 6th graders) wheel the container of food scraps that are collected in the trash bin, (lined with a double layer of strong plastic bags), out to the compost shed. The bags are lifted onto the new layer of straw/hay/leaves in the compost bin, dumped out and spread evenly on the hay in the bin, make sure that the food scraps do not come too close to any edges of the bin. Transportation methods to the compost shed may differ from site to site, but the closer the compost building is sited to the collection area the more convenient it is to move the food scraps.

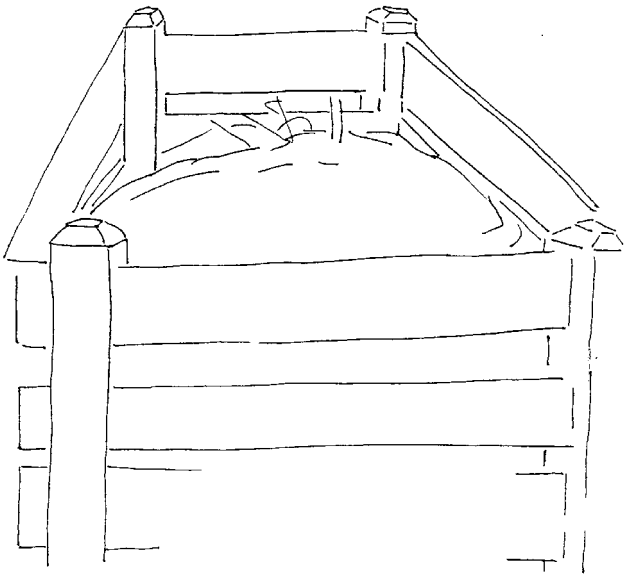
It should be noted that if the bags of food scraps weigh more than about forty pounds, that more than two or three children in the fifth and sixth grade are needed to manoeuver them, and they would need assistance from an adult. It is recommended that if larger sheds are used, the food being transported to the sheds should not be in lots of more than forty pounds. However, the lay-

ers of food could consist of more than forty pounds. This will in fact provide a better moisture to dry hay/straw layer balance.



The "Limestone Bin" with data pad

Children must be taught to spread the food in an even layer with a spading fork making sure that any material is kept away from the sides of the bin. This is so the food does not fall out, or have the potential to be pushed out of the bin by the weight of subsequent layers of food.



A filled compost bin covered with straw

After food layering, a half coffee can of ground dolomitic limestone is added and evenly mixed in with the spading fork. Also, two to three coffee cans of mature compost, which is used as an inoculant, are added and mixed in a similar manner. The dolomitic limestone is used to modify the pH of the food scraps which are already naturally acidic, and the compost acts as an inoculant for the correct type of soil bacteria.

After the food material has been amended a thin layer of straw is used to cover the layer of food and also fill in the sides of the bin, so as to avoid food spillage. The next layer of food is added in a similar fashion until the bin is full. A new bin is then started in the same way as the first one.

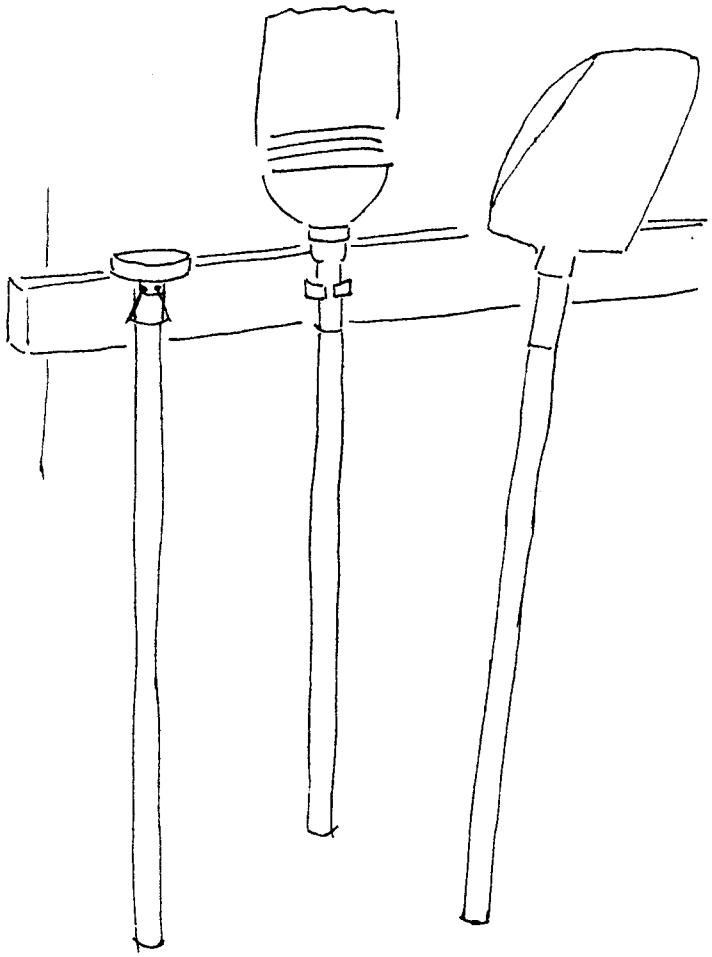
Adult supervision or overview of this situation is needed, but a trustworthy group of children can perform this task successfully with just a weekly check-up by an adult

The basic daily instructions should be visibly posted for all to see:

- Take the outside temperature and record it in the notebook provided.
- Take the temperature of the compost by using the thermometer with the long probe. Be careful not to bend the probe. Push the thermometer into the top of the piles in the full bins. Measure the temperature, read it and record the temperature. Then push the probe in to near the bottom of the pile read the dial and record the temperature. Do this for each pile in the shed.
- Put the Thermometer away.
- Place the food on top of the layer of Straw and spread evenly with a Spading Fork but do not push the food scraps too close to the edge of the Compost Bin so that they are in danger of falling out of the bin.
- Add half (1/2) a Coffee Can of ground Dolomitic Limestone and two (2) or three (3) Coffee Cans of Inoculant Compost. Mix these evenly into the layer of food scraps using the Spading Fork.
- When the amendments have been mixed in cover the food scraps with a thin layer of hay or straw. Make sure that the sides of the bin are also filled in so that the food cannot fall out.
- Make sure the Composting Shed is clean and no food scraps are on the floor. Sweep the floor each day with the Broom. Place any sweepings you have in the compost bin.
- Take the empty Plastic Bag and any other plastic waste to a Dumpster (or other disposal unit) and dispose of it.
- Return the Trash Can to the Cafeteria.
- Please always leave the Compost Building neat and tidy returning all tools and instruments to their correct holders or location.

5.0 Process Management

Depending on the size of the composting unit (number of bins), management practice will vary somewhat. In New Sharon, where a bin is filled approximately once a month, the following procedure has been adopted.



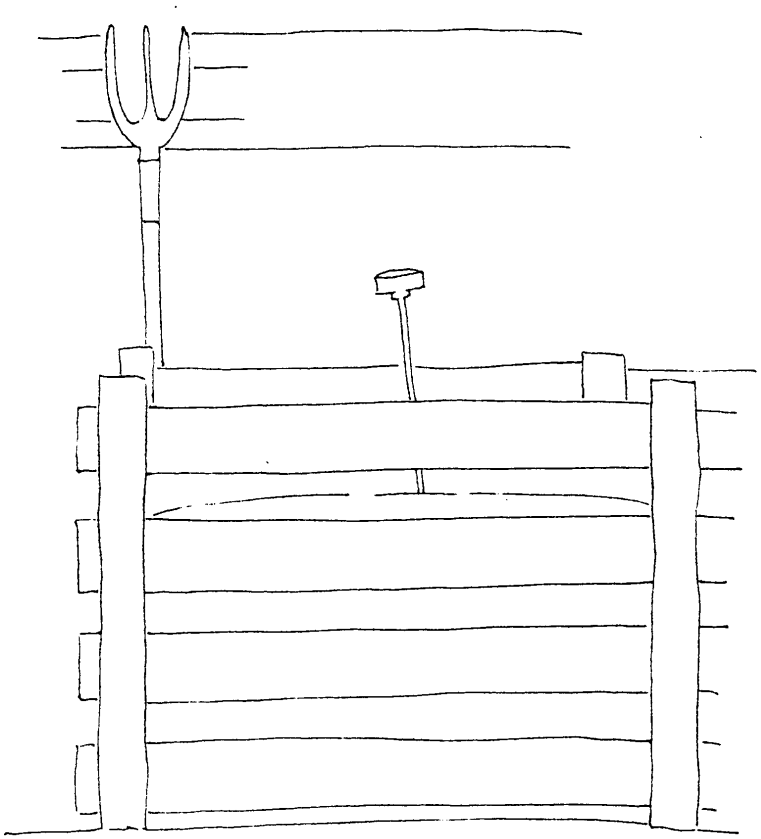
Basic Tools of the Trade Hang in the Shed

Personnel/Tools/Materials needed:

- Wheelbarrow
- Spading Fork
- Pitchfork
- Shovel
- 1 Five Gallon Plastic Bucket (to hold water)
- Broom
- Sufficient hose pipe.

- A fine mist nozzle to fit on the end of the hose pipe
- Racks to hang tools on
- Three children + weekly adult supervision

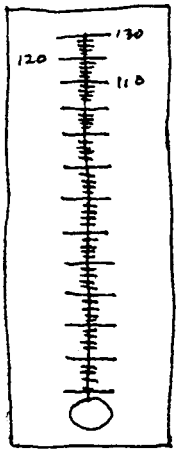
At the beginning of the school year after the first and second bins are filled completely, and are sufficiently reduced in mass they should be turned and added into a completely new bin. They should then be thoroughly mixed, and "fluffed" (this means that any layering that had formed in the initial bin, and any matting of material that occurred is broken up).



Compost Bins in Active Management

During the process of filling the new bin from these two original bins, water is added at the different levels as compost is put into the third bin. This is done so as to moisten the pile and encourage further degradation. Water should be added until it begins to run off the pile. The pile is not to be soaked but made damp enough to help degradation continue. The tools needed for this activity are a pitchfork, and hose with a misting nozzle. Wetting the piles in the bins during composting, and at other times with a fine spray, when the active compost appears too dry, is critical. Wetting of the piles should continue until water begins to trickle from the base of the compost bin or off the

side s of the piles in the bins. Watering in the late Spring weather when it is very warm may be required on active piles as much as every other day. Also, it is critical in really cold weather that the piles not be overwatered so that they cool off and freeze.



Temperatures During the Year Influence the Outcome of the Composting Process

Modifications to this procedure are vital during the coldest weather in Maine. From the end of November through the middle of March when really cold weather may be anticipated, full and active compost bins should be split into a new bin with the active bin being emptied to approximately half its level. Such a procedure would, for example, take a bin filled in October divide its contents in half, (if the contents are still warm, 110^{o}F +), and add the new daily food material to the top of this warm material to avoid the new food material freezing before it has a chance to start composting. The rest of the October bin, presuming that it was still warm enough, would be placed in another bin and have food added to it after the other bin was full., or alternatively be added to the September bin when it was sufficiently reduced in mass. Piles should be split in this way until the middle of March when it is sufficiently warm to start composting from a completely empty bin again. In this way piles should not freeze even in a severe winter as happened with the piles made in the late fall and early winter of 1993 in New Sharon. Piles made before the turn of the year did not freeze throughout the entire severe winter weather.

If the piles do freeze the composting is simply delayed until the weather becomes warmer and they thaw out. This can mean the formation of a certain amount of leachate as they warm up. The composting will also take considerably longer. Freezing of the piles should generally be avoided, but is not fatal to composting operations.

If the bins in the compost shed fill up before the end of the school year, the oldest materials should be moved outside the building to an area that is designated for final curing of the compost. These materials should be formed into a windrow or a conical pile. Care should be taken that the whole pile is moist enough to continue composting, that it is thoroughly mixed, and any clumping and matting formed in the bins is broken up. All of the piles should be placed outside at the end of the school year into a single windrow or pile, so that the whole composting shed can be cleaned. The

last pile should have decomposed sufficiently for it to be moved within a few weeks of the end of the school year. It should be noted that a conical pile has a greater volume to surface ratio. If is formed in hot weather it loses far less water than a windrow. Similarly, in cold weather a conical pile retains more heat

Turning of the piles, if the shed is operating well, is necessary only when piles are consolidated, or split in the winter, and when they are moved out of the shed to be finished and cured, thus turning is kept to a minimum.

The composting shed needs to be kept clean and tidy at all times. This means that after the daily operations the floor is swept and the sweepings placed in the compost bin being filled. The outside of the composting unit should always be clean and tidy. At times the interior of the shed will need a more thorough cleaning and washing down. This should take place at least once a month when the shed is in use. At the end of each composting year a total thorough cleaning should take place.

Volunteer time (by adults), or the allotment of a longer period of time, once a week, for the older children who have been trained to look after the compost building, will also be needed. This is to carry out the extra work of cleaning up the whole shed, moving the composts from bin to bin if necessary, transporting the compost outside when it requires curing and watering. A weekly assessment should be conducted, and the tasks carried out as needed.

Many of these further tasks are not weekly but need to be performed in a timely fashion when necessary. A well attended compost pile will need little work at the appropriate times but, could require considerable work if it does not have enough attention paid to it when required. The larger the composting unit the greater the activity and attention the compost has to receive. It is therefore important to have a group of people or an individual designated for keeping track of all activities concerning the compost building, and to time and coordinate these activities successfully.

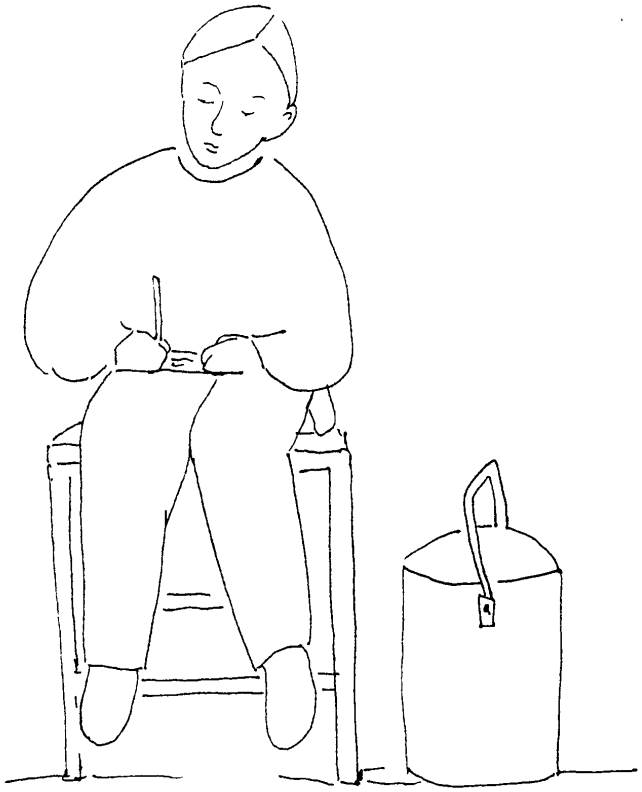
5.1 Compost Pile Monitoring

A proper monitoring program need not be complicated, but is a key both to success and to a proper understanding of the process.

A variety of tools and materials are needed:

Long Stem Thermometer (Range approx 0^{o}F - 200^{o}**F**) 36 inch stem

- Regular Atmospheric Thermometer
- Notepads
- Waterproof Notepad Container
- Pens
- Pencils
- Notepads

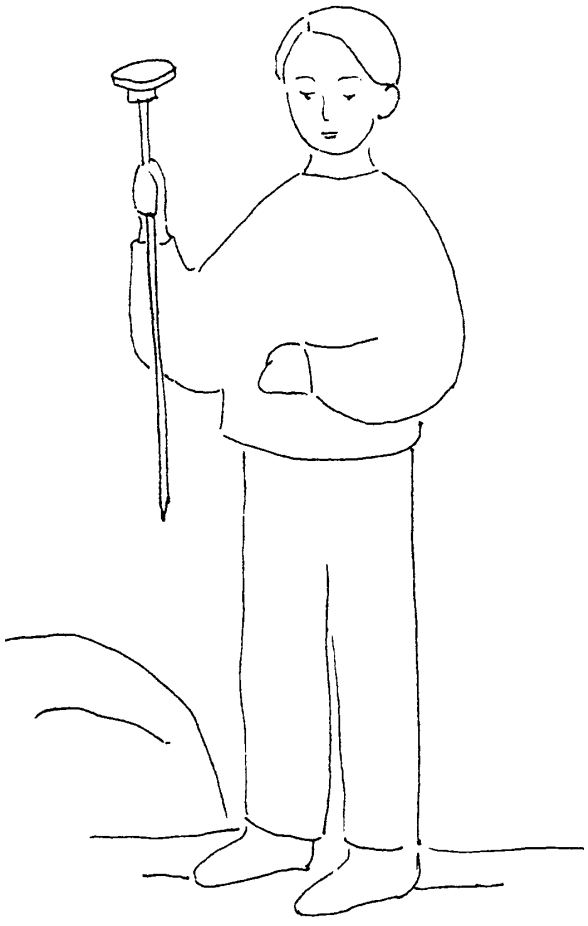


Records are Kept of Activities and Temperatures

The greater the time spent, and the greater amount of monitoring that is done, the more that can be discovered about the successful running of a compost pile or compost building. After the compost

is added to the active bin, temperatures should be taken near the base of the bin and in the center of the pile towards the top of the bin. These temperatures should then be recorded along with the daily (ambient) temperature, the conditions of the piles, and the times the piles are watered.

Temperatures are taken by using the long stem thermometer and pushing it into the center of the pile to take the top (1st) reading. The thermometer should be pushed in approximately 12 to 15 inches when the bin is full. Then when that reading is taken the thermometer should be pushed into the base of the pile to at least a depth of two feet for the next reading. These readings should take place in the middle of the pile and not toward the edged. Temperatures should occasionally be taken elsewhere to show the extent of the heating in the pile as this may give an indication of other factors such as the dryness of the pile (especially if the high temperatures are only in the center and then drop off quickly towards the edge of the bin). Great care should be taken to avoid bending the stem of the thermometer. It is fairly robust but tends to bend in one direction when used repeatedly.



The Thermometer Probe is an Important Instrument

If compost samples are taken, it should be noted in the record keeping books. Typical profiles for a good active pile should show a rise in temperature and maintenance of a fairly high temperature (110^{o} F+) for a number of weeks and then a gradual decline to ambient temperatures. Changes in such a profile should be carefully noted.

.

TABLE 1. Typical Page Entry From Monitoring Notebook

Date	Pile #	Ambient Temperature	Pile Temperature Top	Pile Temperature Bottom
1/11/93	3	32^{o}F	130^{o}F	118^{o}F
1/11/93	4	—	145^{o}F	125^{o}F
1/14/93	3	38^{o}F	135^{o}F	119^{o}F
1/14/93	4	—	149^{o}F	122^{o}F

Any comments on environmental conditions such as odors and vectors (pests such as flies, rats, mice, raccoons) can be made on the back of the recording page or immediately under daily monitoring. Make sure the date is recorded and the remediative action that took place is noted; if such an activity was necessary. Dates of pile movements and the different contents of each bin must be recorded with a brief description of the dates, age and condition of the contents of the bin.

An example of a management record recommended for the children is:

> November 1 1993: Piles 1 and 2 added together, clumps broken up, and watered. Both placed into bin 3, now pile 3. Pile 1 food materials from September Pile 2 food materials from October. Pile 3 now Sept/Oct food materials combined. New pile started in bin 4 on November 1st. so that bins 1 and 2 can be cleaned and dried out.

Or Alternatively if the weather is going to be really cold:

> November 1st 1993: Pile 1 and half of pile 2 moved into bin 3. Food from September and part of October. Fresh food from November added to pile 2 to keep the food composting.
>
> Nov 25th 1993: Pile 3 split half into bin 4, half remaining in bin 3. Fresh food started to be added to pile 3.
>
> January 3 1994: food added to pile 4 which was still warm, or added half of bin 2 to bin 3 and placing fresh food on bin 2 which is still warm.

In the spring, new piles can be started from scratch and older food piles are left to fully mature. In warmer climates, the juggling of piles should not have to take place as they will heat easily throughout the year.

Good judgement must be used on which piles to split and add to so as to keep the compost unfrozen.

If a pile fails to heat up or heats up briefly and then falls back to near ambient there are a number of factors which could be causing this. Typically lack of moisture and/or cold weather are critical factors but other factors such as lack of air, low pH or lack of a pile mass so that temperature can be maintained are also significant factors.

To correct slow and irregular heating it may be necessary to reconstruct the pile to allow more air and water in. Typically in Maine it will be most important to avoid piles drying out or becoming frozen as mentioned in this text. Monitoring and close observation will provide the tools to keep the piles composting well.

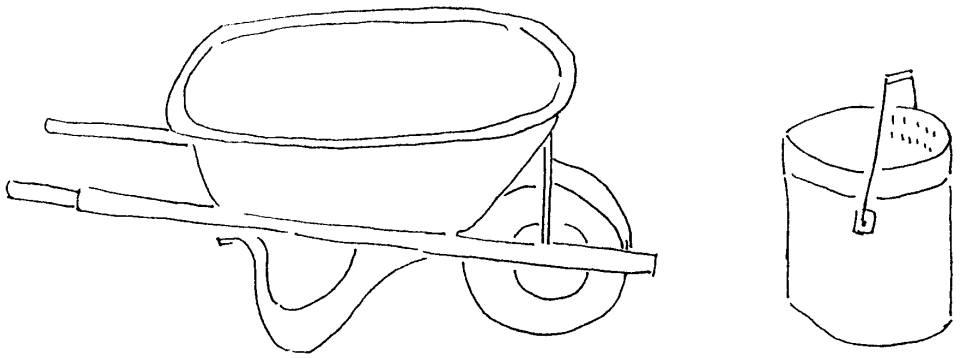
Other conditions that will indicate an unhealthy compost are odors which spread beyond the immediate environs of the composting shed. Also, vectors such as flies and mice entering the building. If the building is well built and kept closed except when monitoring and attending to the compost, none of these elements should occur. The compost will naturally smell inside the shed, first like warm food and a few days later there may be a mild ammonia-like odor followed by a slight manure odor similar to pig or cattle manures. These odors should be mild and basically only noticeable in the shed. If there are very strong odors outside the shed action should be taken. Piles should be remixed and aerated and watered according to conditions. (See the section on Trouble-shooting).

6.0 Finished Compost Management

Compost is moved from indoors to outdoors curing piles when it begins to appear well broken down, and the heat is subsiding. There is no precise moment when this should happen.

The tools and materials needed to manage the later curing process include:

- Wheelbarrow
- Shovel
- Pitchfork
- Tarpaulin/Grain Sacks
- 3/8—1/2 Inch Screen (typically a soil screen to be placed in a slanted frame or held over a wheelbarrow)



Finished Compost is Moved from Bins in Wheelbarrows or Bucket

The finished compost when it is finally cured outside will smell like a rich forest soil or leaf compost depending on its ingredients. Because of its source and the way that it is collected it will always need to be screened for plastic and larger items such as bones, plastic and cutlery, some of which will not have fully degraded or have been incorporated in the source material by mistake. Curing may take a long time depending on the moisture content of the compost and how well it is maintained.

Once the compost is screened the plastic materials should be placed in the trash. Other material that is not fully decomposed such as some hay, bones and larger pieces of compost can be placed in a small pile to continue decomposition. Or, alternatively they can be ground up or smashed so as to compost more quickly.

Screening should not take long and should be combined with planting and landscaping activities. The compost can be screened on an as needed basis. The compost should not be screened when it is too wet as it will clump and not pass through the screen. It is also important to make sure that the compost does not get too wet once it has been screened and if it is not going to be used immediately. It will probably be utilized fairly quickly, but if it has to be stored it should be under a tarpaulin, in a bag that can 'breathe,' or in a shed under cover. If it dries out it can always be remoistened when used.

Uses for the compost will range from adding it to potting soils or to the grounds around the school, or to be used in classroom science experiments to test how well it grows different plants. Other experiments could be conducted before the compost is screened but while it is curing to see the kind of insect life that may colonize a curing compost pile. Alternatively the beneficial or phytotoxic nature of differently aged composts could be investigated.

Some compost should be retained to add as inoculant for the following school years composting program. Depending on the size of the operation enough compost should be saved to complete a full years program.

Finished Compost Blends into the Landscape

7.0 Annual Cleaning/Refurbishing

Personnel/Tools/Materials needed:

- Hose with nozzle
- Wheelbarrow
- Wide Paint Scraper
- Scrubbing brush (hand-held)
- Push brooms (2)
- Shovel
- Several Volunteers

7.1 Cleaning

This work is best done on a warm dry summer day with wind to dry all the wet materials. The compost shed is designed to be thoroughly cleaned at any point where it is not in use or has been completely emptied for the purpose of cleaning. All components of the compost bins can be thoroughly washed and scrubbed. Easy access to the bins is facilitated by an even spacing of the bins near the center of the shed. The base of the bins and the front are completely removable leaving a framework that can be moved to different sections of the floor, so that the whole floor can be washed with a pressure hose and the water will go down the drain in the center of the concrete floor.

A shed of this size takes four hours to clean and reassemble. At this time any repairs can be done to damage and wear of the bins and the building, as well as any waterproofing and painting that is needed to keep the building in good repair should be performed.

7.2 Refurbishing

Personnel/Tools/Equipment needed:

- Mulch Hay/Straw/Hay
- Leaves
- Compost
- Dolomitic Limestone

The Compost Shed at New Sharon used approximately 150 pounds of dolomitic limestone, 15 regular bales of hay and 2 large trash cans of finished compost in one year. This took care of about 240 pupils with daily lunch programs.

The amount of hay required could be lessened considerably by bringing in leaves to replace part of the hay. Leaves are more difficult to collect and store, owing to the large volumes. If leaves are used they should be fairly dry and not matted or clumped.

The dolomitic limestone, hay and compost are stored in the shed along with all the tools needed for compost handling and monitoring. Only the leaves would need a location for storage of larger quantities. If the leaves are stored in bags it is easy to access them at any time of the year and they will still be good for composting. If they are stored in a large pile they will have to be hauled in by wheelbarrow from time to time.

The budget for the needed items should be approximately $50.00 per year. Many of these materials could be donated. The hay can be of mulch-grade (old or rained-on). Most rural regions will have farmers that throw out a lot more than that. Mulch hay should cost $1.00 a bale if there is a charge.

8.0 Compost Trouble-Shooting

8.1 Monitoring and Troubleshooting

For normal composting such as the type utilized in this project the only form of monitoring really needed is temperature measurement. If temperatures do not rise initially after about 3–5 days, it may mean that the compost is not properly layered or is too wet. In the absence of significant moisture, it is likely that an active compost will become too dry.

Additional monitoring that is helpful but not needed is oxygen determination and heat-stability measurement. The oxygen testing is performed using a small portable meter and may be helpful to determine if oxygen deprived pockets exist in the compost. For schools, such monitoring could be incorporated into a science program.

It is not unusual that oxygen may remain at a very low level throughout active composting; the O_2 monitoring is mostly useful to show when stability is reached, as the levels begin to rise later in the process. Unfortunately, this means the oxygen test is not cost effective. The self-heating test performed later in the composting helps determine if the product is truly finished.

The following check-list provides basic trouble-shooting useful for composting:

1. Moisture: test by feel;
    - Too dry? add water;
    - Too wet? if hot, it will dry itself –if it smells poorly and is not hot, add more dry bulking agent.
2. Temperature: check with long-stem thermometer at 12” and 24” depths:
    - 50–65^{o}C? pile is okay;
    - 65–75^{o}C? too hot! –if also too dry, add water;
    - 40–50^{o}C? –if too wet, add dry bulking agent, protect from rain; if too dry, add water; –if moisture is good, N content may be too low– add more scraps.
3. Odor: Observe odor before and during mixing:
    - strong ammonia smell? add carbon-source and/or gypsum if intolerable;
    - foul, sulfur or putrid smell? –if too wet, add dry bulking agent;

9.0 Curing and Storage

Once completed to a stage where significant heating (> 90^{o}F) is not occurring, compost may be stored by placing into medium-sized conical piles without special further preparation. At this stage, it is possible to but not always recommended to cover the piles loosely. Compost should only be covered in if heavy seasonal rainfall is likely to moisten the material to a point at which is becomes unmanageable. Covering with straw may be helpful.

Care should be taken in not piling too high a pile that is still heating to some degree. This may cause oxygen levels to go very low, resulting in anoxic conditions. Cure piles should be periodically forked and turned. If they re-heat after this, turning it suggests that further composting is required.

10.0 Equipment Sources

Nearly all the equipment mentioned above can be found in a hardware store including regular atmospheric thermometers. The only specialized piece of equipment that cannot be purchased there in the requisite size is the long-stem thermometer used to measure temperatures in the compost bin. This thermometer can be obtained from:

Reotemp Instrument Corp., 11568 Sorrento Valley Road, Suite10 San Diego, CA 92121

If you wish to obtain further monitoring or testing equipment such as oxygen meters and probes, maturity testing kits and testing information contact:

Woods End Laboratories , PO Box 297, Mt Vernon, Maine 04352

11.0 Suggested Further Reading

COMPOST THIS BOOK! The art of composting for your yard, your community and the planet. By Tom Christopher and Marty Asher. Sierra Club Books San Francisco, California.

ORGANIC GROWING MEDIA Use of Compost ion Potting Mixes. Woods End Agricultural Institute, Mt Vernon, Maine

LET IT ROT. Stu Campbell. Rodale Press, Emmaus, Pennsylvania

12.0 Compost Design and Construction

Amended to this report are plans and list of materials for full construction of a similar composting building.

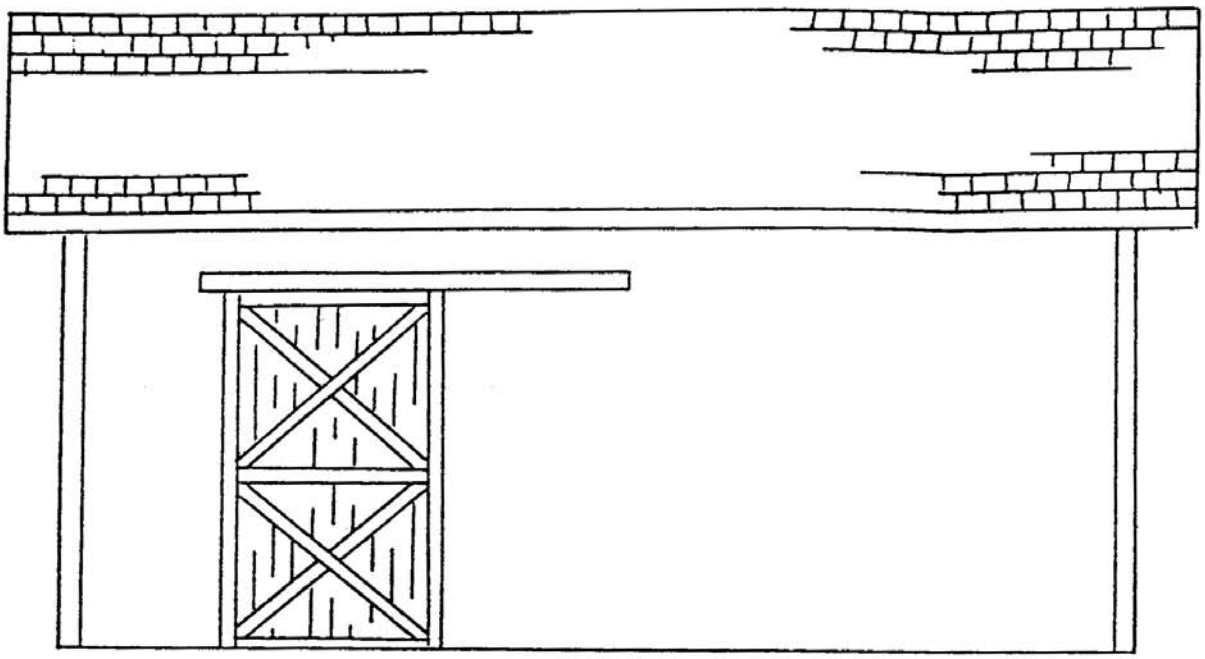
For further information please contact the authors at PO Box 297 Mt Vernon Maine 04352.

Web Site: www.woodsend.org

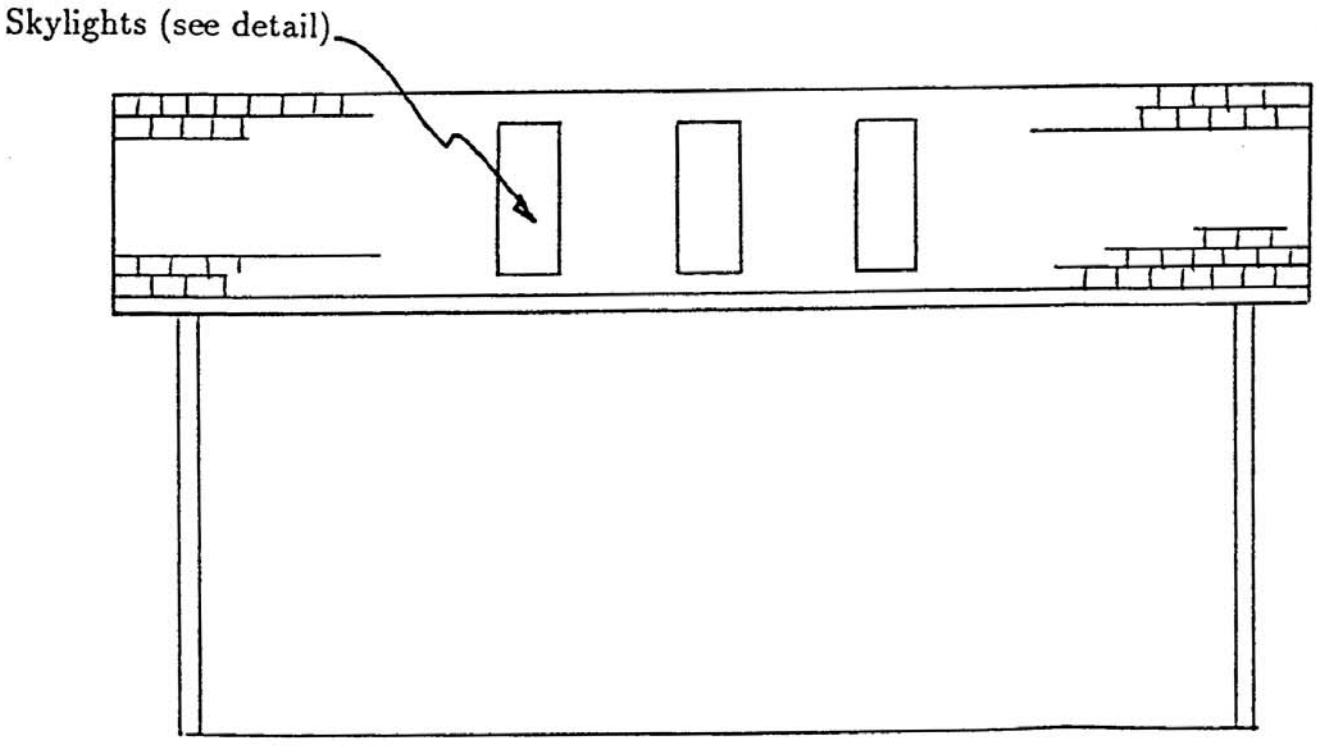
13.0 Video Featuring School Program

A University of Maine video regarding cafeteria school composting which features this project may be obtained by contacting the University of Maine, attn.: Kim Mitchell, Dept. of Public Affairs, Orono ME 04469.

Title: Composting Cafeteria and Commercial Food Waste

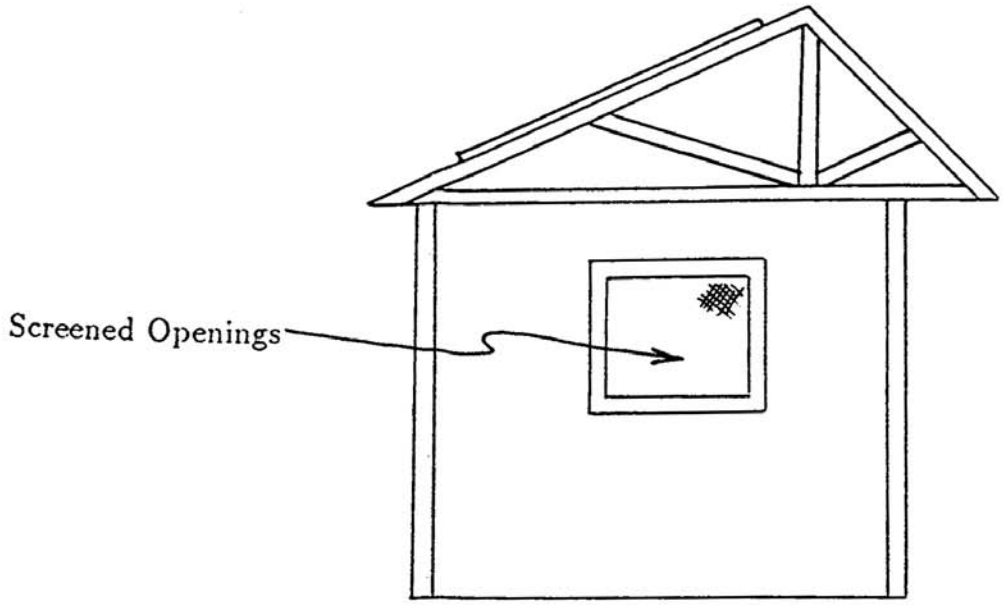


Front Elevation



Rear Elevation

DRAWING NUMBER 1



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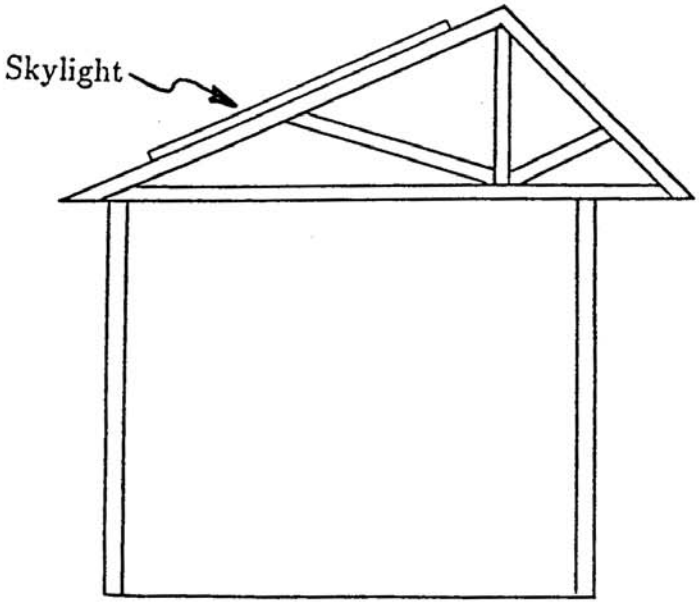


Scale 1/4"=1'

Side Elevation

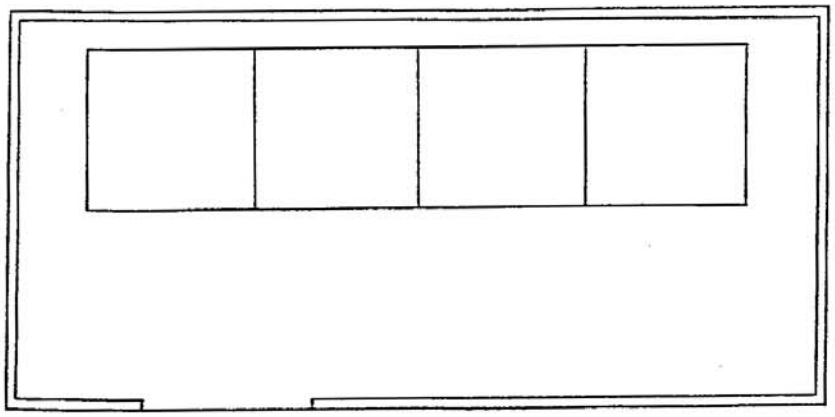
CAPE COD HILL SCHOOL
VIENNA / NEW SHARON

SCALE: (see note)	APPROVED BY: W. Brinton	DRAWN BY mlf
DATE: 2-28-94		REVISED

FOOD-SCRAP COMPOSTING FACILITY
FACILITY LAYOUT

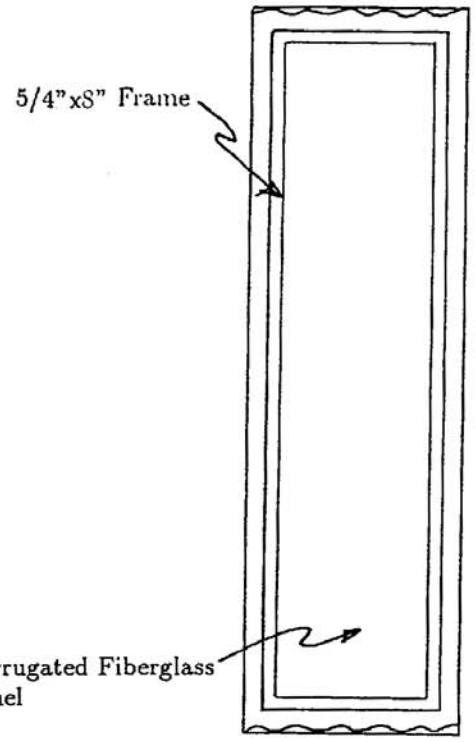
DRAWING NUMBER 1

WOODS END RESEARCH LABORATORY
Old Rome Road, Rt. #2, Box 1850, Mt. Vernon, Maine 04352



Floor Plan

Scale 1/4"=1'



Skylight Detail

Scale 3/4"=1'

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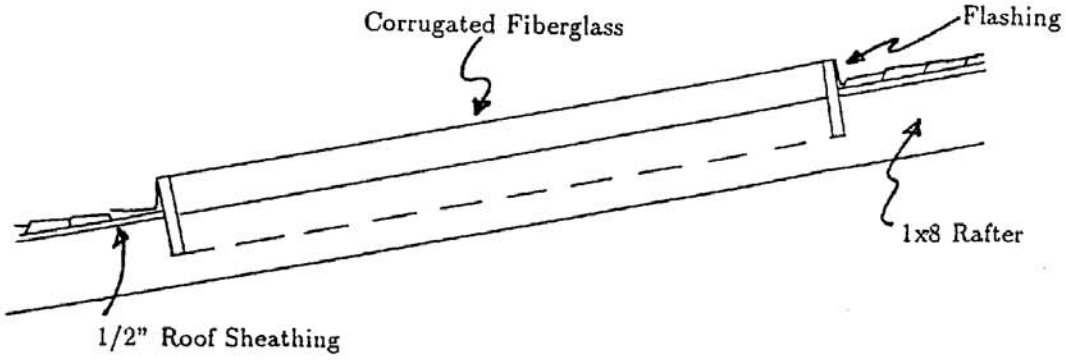

Scale 3/4"=1'

WOODS END RESEARCH LABORATORY

DRAWING NUMBER 2

Cafeteria Food-Scrap Composting Facility

Materials List

63 2x4x8'
18 2x4x10'
18 2x8x10'
9 2x8x12'
9 2x4x12'
2 1x6x14' #2 Pine
2 1x4x12' #2 Pine
2 1x4x8' #2 Pine
2 4x4x16' Hemlock
25 1x6x16' Super Board
3 5/4x8x14' Deck Stock
1 5/4x8x6' Deck Stock
10 1x8x8' T&G #2 Pine
15 4x8x5/8 T-111 Siding
13 4x8x1/2 CDX Roof Sheathing
4 Squares Asphalt Roof Shingles
1 Roll Tar Paper
3 2x8' Translucent Corrugated Fiberglass Panels
12' Corrugated Wood Strip (for fiberglass panels)
60"x8' Lead Flashing
12 4 1/2x1/2 Carriage Bolts, Nuts and Washers
16d Nails
8d Screwtight
8d Common
3/4 Galv. Roofing Nails
8' Sliding Door Track
2 Sliding Door Rollers
3 Track Hangers
1 Roll 4' Screening
3 Gal. Weathering Stain
1 Gal. Trim Stain

CAPE COD HILL SCHOOL VIENNA / NEW SHARON		
SCALE: (see note)	APPROVED BY: W. Brinton	DRAWN BY mlf
DATE: 2-28-94		REVISED
FOOD-SCRAP COMPOSTING FACILITY FLOORPLAN AND SKYLIGHT DETAILS		
		DRAWING NUMBER 2

DRAWING NUMBER 3

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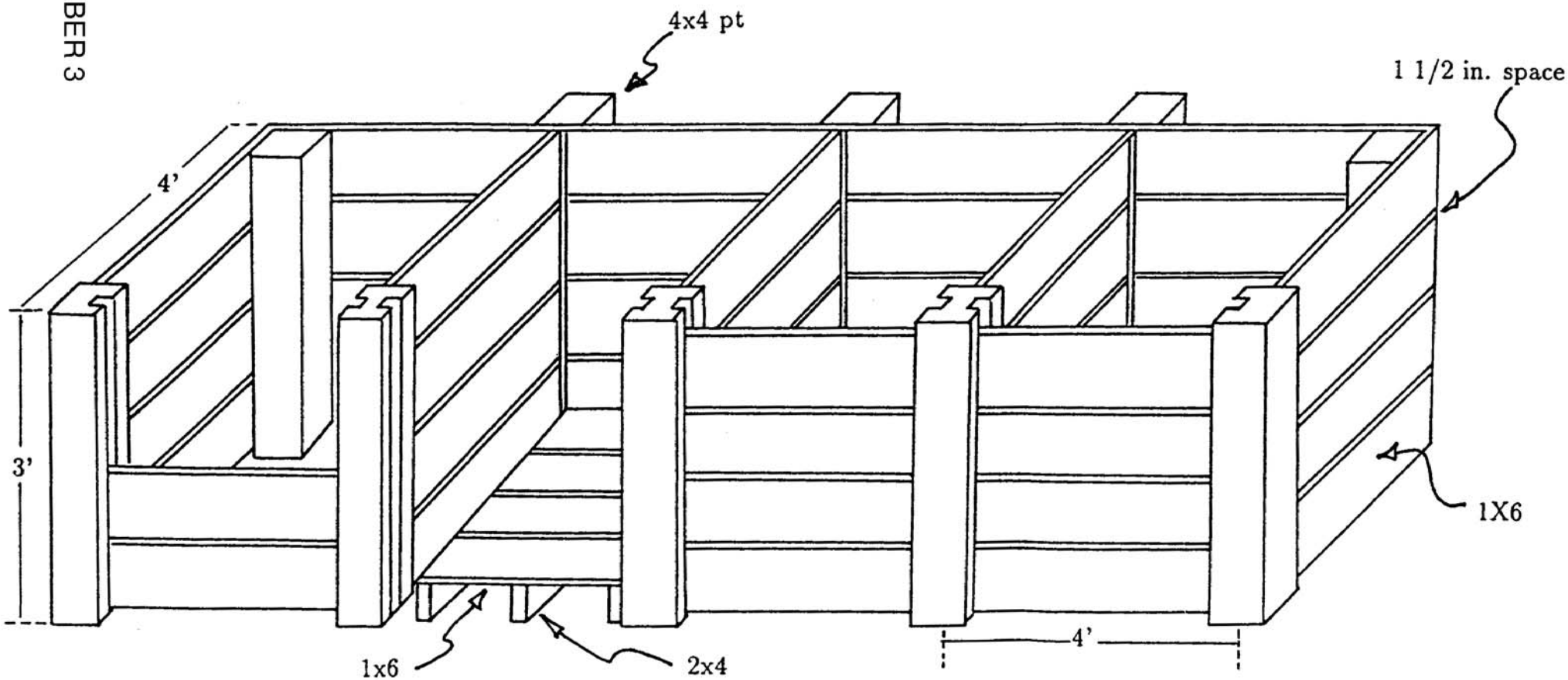


Not to Scale

Cafeteria Food-Scrap Composting Bin

Materials List

4x4x30 - for 10 upright posts cut to 3' each
1x6x208 - rough-cut, for side slat boards
1x6x128 - rough cut, for floor slats
2x4x32 - for splitting to 2x2 for making side cleats
2x4x80 - for floor base
Nails, suitable for materials in question
Optional - Hardware Cloth - only needed if rodents are a concern

WOODS END RESEARCH LABORATORY
Old Farms Road, Rt. #2, Box 1850, Mt. Vernon, Maine 04352

CAPE COD HILL SCHOOL VIENNA / NEW SHARON		
SCALE: (see note)	APPROVED BY: W. Brinton	DRAWN BY mlf
DATE: 2-28-94		REVISED
FOOD-SCRAP COMPOSTING FACILITY COMPOST STALLS		
		DRAWING NUMBER 3

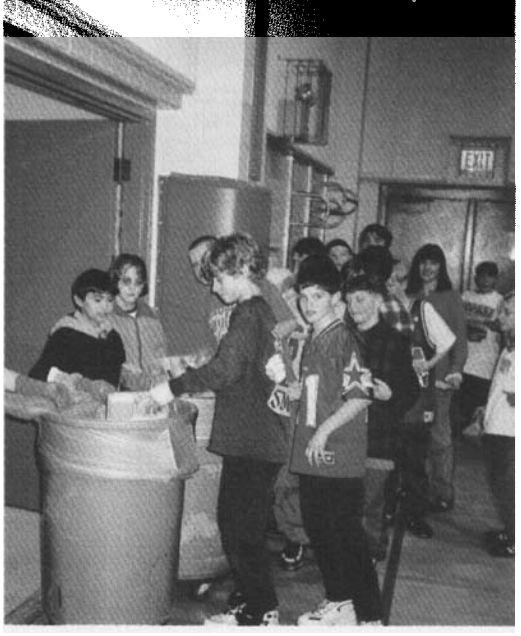
EDUCATION SHED

RECYCLING CAFETERIA FOOD RESIDUALS

Students at a school in Maine separate food scraps, wheel the materials to a specially built shed, and produce up to 16 cubic yards of compost per year.

A FIFTH grade class at the Cape Cod Hill School in New Sharon, Maine is composting food residuals from the school's cafeteria in a bin system. The school has 218 students in kindergarten through sixth grade and received a state grant in 1992 to build a composting shed and write a manual that could be used by other schools. Members of the Cape Cod Hill School's Parent Teacher Organization (PTO) applied for the grant and helped organize the project. Volunteers collected and weighed food from the school's cafeteria every day for two weeks to determine how large to build the shed and bins, according to Marianne Archard, PTO president.

The composting shed — designed by Will Brinton of Woods End Research Laboratory in Mount Vernon, Maine and built by local contractors — resembles a small, uninsulated barn with four compost "stalls," each containing a four-foot-square compost bin that can hold approximately three-and-one-third yards of material. The bins are elevated for aeration and have removable side gates to allow materials to be easily taken out. The shed has a cement floor with a drain to capture any leachate or cleaning water which then flows into gravel below the floor. The building is aerated by double screened gable windows and roof vents. Access to the building is through a sliding, wooden barn door wide enough to accommodate wheelbarrows and bales of hay. The door seals when closed to keep out flies.



FROM CAFETERIA TO SHED

Postconsumer food residuals are collected in the Cape Cod Hill School's cafeteria from the students' lunch trays. Each week, three of the 18 students in teacher Bud Pringle's fifth grade class are assigned composting duties. Two of the students stand in the cafeteria near 60-gallon plastic barrels to make sure that their fellow students are separating their food scraps, recyclables and trash into the proper containers. The barrels are color-coded and labeled, but Pringle says some of the younger students have not yet

Organics from student lunch trays (above) are taken to the composting stalls. Fifth graders add lime (below left) and monitor temperatures (below).

Photos courtesy of L. Pringle

learned to read and need assistance. The barrels are double-lined with plastic bags to prevent wet material from leaking or breaking through.

After lunch, the two students wheel the barrels from the cafeteria to the bins in the composting shed. The students tie off the plastic bags before dumping the containers into a bin. If the bin is empty, they first put down a layer of straw, hay or leaves to keep the food waste from falling through the bottom of the bin. A local farmer donates straw and hay and PTO volunteers collect and bring bags of leaves to the shed. The students untie the bags of food residuals, empty their contents and put the bags in a nearby trash container. They spread the food scraps out evenly in the bin with a spading fork (a tool that resembles a pitchfork but has a shorter handle and flat tines). The students then sprinkle two to three coffee cans of mature compost (used as an inoculant) and half a coffee can of dolomitic limestone to neutralize the acidity of the incoming materials. The new residuals are covered with a layer of hay or straw to provide bedding for the next day's scraps. The sides of the bin are filled in with hay or straw to keep materials from spilling out. Pringle says that leaves are used instead of hay or straw if the food residuals are relatively dry because leaves absorb less moisture. He notes that the ratio of food to leaves and hay is usually three to one.

The third student keeps daily records of the outside air temperature and uses a long probe to take temperatures at the top and bottom of the materials in each bin. Pringle estimates that it takes 15 to 20 minutes for the three students to complete their tasks each day. Pringle goes out to the shed three times a week to make sure that the tasks are being done properly.

The school has not had to add moisture to the bins because the food residuals generally are very wet. A hose can be run to the shed from an outdoor spigot on the school building if water is needed. The cafeteria generates approximately 200 pounds of food waste per week and a bin becomes filled after four to six weeks. After two to three months of composting, the first two filled bins of materials have decreased in mass by half. The two half-bins are combined in a third bin and mixed with water. Adult volunteers are needed to come to the shed on weekends and move materials from one bin to another because the students are not physically strong enough to do so.

Pringle says that it takes about a year to produce finished compost. The composting operation shuts down during the summer months when the school is closed and is less active during the cold months of January and February. Last year's finished compost, which was not screened, was used in the school's yard, flower gardens, around a school sign and in a special butterfly garden. He hopes that the project will produce 16 cubic yards of finished compost this year.— M.F. ■