

I. A case for foam recycling (Proceed to section II if you are ready to implement a program)

Commonly referred to as Styrofoam, a trademark of Dow Chemical, foam #6 is also known as polystyrene foam, expanded polystyrene, EPS, and foam. Since its light weight helps reduce shipping costs and its excellent cushioning properties result in less breakage, foam #6 is widely used to protect electronics during shipping. Similarly, it is the material of choice for egg cartons, fast food take-out containers, foam plates, and foam cups because it is lightweight, insulates well (maintains temperature), and is inexpensive. Another benefit of this material is that it is recyclable.

In fact, foam #6 is a thermoplastic, so it is technically recyclable over and over again. So why isn't it being accepted in many community recycling programs? There are several reasons. First, it is not a significant portion of the waste stream. All foam #6 represents less than one percent of all products generated, by weight, in municipal solid waste.¹ Second, waste diversion goals are typically measured by weight, so the light weight of foam makes it unattractive (a truckload of loose foam only weighs ~1,000 lbs). Third, it takes more effort to collect a pound of foam than a pound of glass or cardboard.

So why should we recycle foam? First, foam has real value once it has been compacted. There are now many markets for foam and the price they pay often exceeds the price of cardboard and other popular recycling commodities.

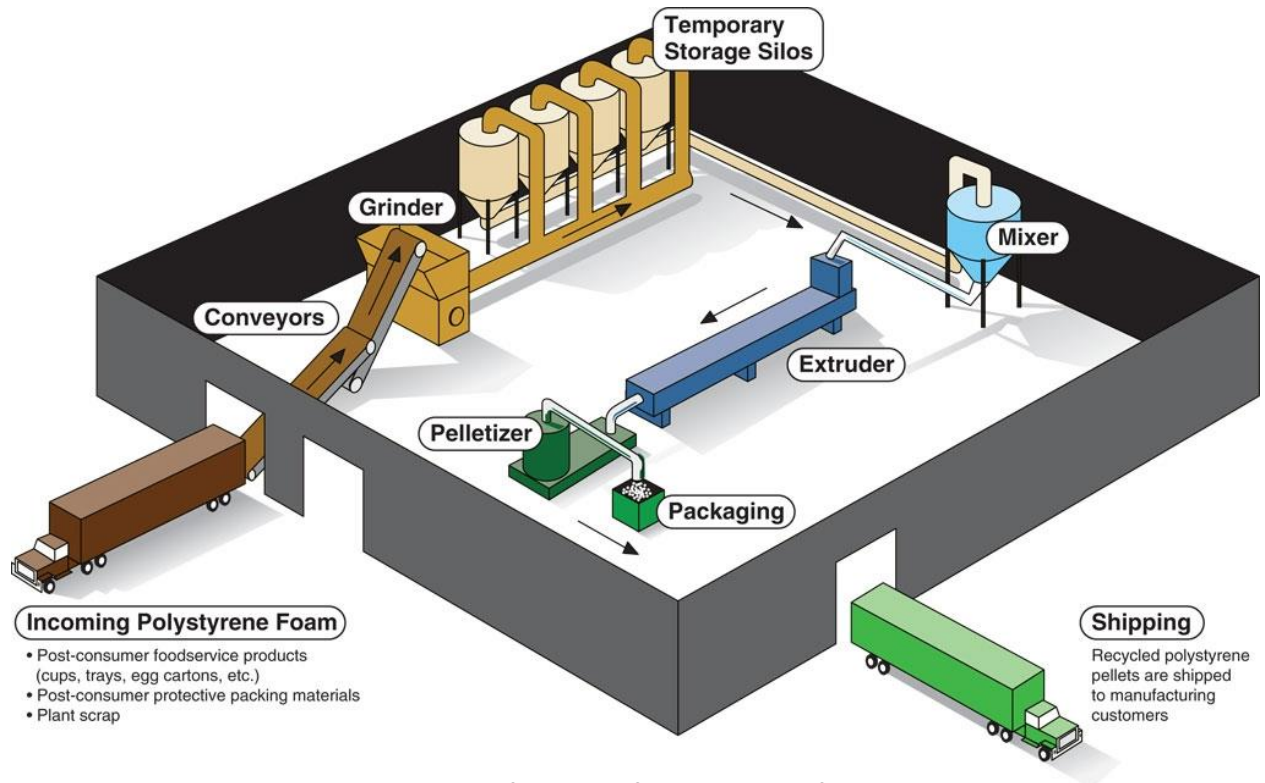
Second, new technology has made recycling foam much more efficient than in the past. For example, there are now many options for special compactors, called densifiers, that will compact foam to as much as an 85:1 ratio. This enables 40,000 lbs of material to fit on a 48' trailer. The equipment also requires less space than in the past and it is able to efficiently process mixed densities of foam at the same time. Plus, it does all of this while minimizing the amount of labor foam recycling may have taken in the past.



**A pallet of densified foam -
Approximate weight 1,000 lbs.**

And third, the conversion of foam into new products is a simple process that reduces the need to harvest crude oil from the earth and all of the energy associated with the process required to make virgin resin. The end result is that we realize a reduction in greenhouse gasses and lessen our dependence on foreign oil. Reclaimers simply place the compacted material into a grinder, which feeds an extruder. The extruder is similar to a Play-Doh machine in that the ground material goes into the machine, melts, and comes out the other end like spaghetti. The spaghetti is then cooled and chopped into small pieces (pellets). Once it is in the form of pellets, it then can be used to make useful new products.

¹ *Municipal Solid Waste in the United States 2008 Facts and Figures*, U.S. Environmental Protection Agency, November 2009



Schematic of a typical foam recycling facility

Not only is foam recycling good for the environment, it also helps businesses that use it to make new products practice good environmental stewardship while maximizing their profits at the same time. Recycled foam costs significantly less than virgin material and will perform well in a variety of applications ranging from premium interior molding and picture frames to horticultural materials like “pony packs” used for flowers at nurseries across the country. As a result, demand for recycled foam from domestic markets is growing. In the event that the material is exported, a study by England’s Waste & Resources Action Program suggests the process of shipping materials such as plastic bottles to China only uses 10% of the carbon saved by recycling.²



Premium interior moldings and picture frames

²

http://www.essexcc.gov.uk/vip8/ecc/ECCWebsite/content/binaries/documents/CO2_Impact_of_Exporting_Recycling_to_China.pdf?channelOid=null

II. How to make recycling foam #6 viable in municipal programs



Education piece used by the Los Angeles Bureau of Sanitation

How should communities implement a recycling program? They should take advantage of existing infrastructure. Whether your community has a drop-off or a single stream curbside recycling program, both types are terrific vehicles for a successful foam recycling program. Here are the key ingredients:

Education- Once foam is accepted in a community program, the community will need to be educated. Using pictures along with physical descriptions will help inform the public what foam #6 looks like.



Types of Foam Accepted- Fortunately, most foam #6 items can be identified by the chasing arrows triangle with the number “6” in the center. The symbol is usually embossed on the material. Depending on the available markets for foam, however, the accepted types of foam might need to be restricted.

- **Colored Foam-** Some markets do not want colored foam, so check with your buyer prior to creating your program.
- **Flame Retardants-** Some markets do not want foam with flame retardants either. Typically flame retardants are only found in foam board insulation, which is often used in construction.
- **Packaging Peanuts-** Unless you are certain that the packaging peanuts are foam #6, ask the public to call 800-828-2214 or go to www.loosefillpackaging.com for drop-off sites to find a home for them. Packaging peanuts are made with a variety of materials. Mixing non-foam #6 materials with your #6 can potentially ruin your load. Moreover, packaging peanuts are usually readily reusable so it is better for the environment to keep them in their current form. (You might want to consider re-selling them.)
- **Quality-** While food service foam is recyclable even after it has been used for food, it is important that the public understands that the material needs to be in a recyclable condition.
 - **Food Service Foam-** Coffee and soda cups do not need to be rinsed; however, containers used for food need to be wiped or rinsed to rid them of food residue.
 - **Packaging Foam-** Labels and tape should also be removed from all foam, as it clogs the contaminant prevention screens on extruders.

Compaction- Whether the material winds up in a material recovery facility (MRF) or at a drop-off site, the material will need to be compacted. This process makes transportation efficient and is critical for a successful program. After all, a 48’ truckload of loose foam only weighs about 1,000 lbs. While traditional balers will compact the foam, they are not very efficient because foam has memory. (It will expand once the compression is released.) Because a bale of foam

weighs an average of 400 lbs, a truckload of baled foam will only weigh about 16,000 lbs. If this does not satisfy your needs, a grinder and “densifier” can be used to generate a 40,000 lb load. Here is a description of three common densifiers:

- **Hydraulic Densifier-** This machine uses hydraulic pressure to compact foam. A series of rams compress the foam until the memory is gone. With a continuous operation model, the foam is extruded into a dense log. This machine does not use heat to compact the material so it does not produce smoke or odors. It can also effectively process various densities of foam at the same time (without melting in the machine). Since community foam recycling programs receive a mixed stream of foam materials, this feature makes hydraulic densifiers ideal.
- **Thermal Densifier-** This machine uses heat to melt the foam into a taffy-like state. The “taffy” is extruded in the form of a rope. This material then needs to be placed in a container so it can be molded into a shape that is conducive to stacking on a pallet. These machines work very well; however, the smell of the “taffy” bothers some people. Additional labor is also required to mold the extruded “taffy.”
- **Screw Drive Densifier-** This machine uses an auger to push foam through a chamber. This process compacts the foam into the form of a log/block. Typically, the speed and pressure need to be adjusted based on the density of the foam being processed. If not adjusted properly, the log will be too light or it will melt in the machine and cause it to stop working. It can prove difficult to operate this type of machine if different types of foam are being processed.



32 lbs of loose foam compared to 32 lbs of densified foam

Equipment Design- Equipment for foam recycling has become much more sophisticated over the last ten years. These machines have also reduced the labor involved in foam recycling. With the right equipment, an MRF can have one person dump the foam on a conveyor, which will automatically feed the foam to a grinder, which will then feed a hopper. Once the hopper is full, the densifier will turn-on automatically and start generating logs of densified material. This material can then be stacked on a pallet. Thus the only labor required is to unload the collected foam, remove the contaminate, and then stack the densified logs on a pallet. This process does not need to occur until a satisfactory amount of foam has been collected.

Grinder, hopper and densifier system



Space- An efficient system can require as little as 85 sq. ft. of space. If space is limited, some grinders can be housed separately from the densifier. A blower can then be used to transport the ground foam through a tube to a hopper up to 100 feet away from the grinder.

Permits- Depending on the location, permits may be required to operate the densification equipment. Your local public works department should be able to provide guidance.

Costs- The costs for densifiers have also declined in recent years. Equipment that will process 500 lbs per hour is now available in the neighborhood of \$40,000. This makes entry into this market relatively inexpensive.

Markets- The markets for foam typically want to buy truckload quantities of thirty-five to forty thousand pounds of densified material. Epspackaging.org has a downloadable .pdf of markets for foam all over the U.S. www.earth911.com has a search engine for markets (Search "#6 Plastic (Polystyrene)" and "Styrofoam.")

Funding- Check with governmental agencies to see if they have low-interest loans or grants to help pay for equipment. For instance, CalRecycle in California offers low interest loans to businesses located in Recycled Material Development Zones (RMDZ) that are engaged in various recycling activities. In addition, check with the buyers of foam. Some have programs where they will lease a densifier and accept the densified material as a form of payment. Once the debt has been retired, they will pay cash for the densified material.

Large Sources- Once an investment has been made in a foam recycling program, high volume generators of used-foam will need to be identified. Typical generators include furniture stores, electronic manufacturers/retailers, and architectural firms.

Material Recovery Facility (MRF) Considerations-

Value-The value of foam recycling at MRFs is convenience. Single stream recycling is easy for the public and increases their participation.

Hauler- Once a community decides to add foam to its list of recyclable materials, both the hauler and the MRF will need to agree to accept it. A common concern for the hauler is that the foam will fillup their truck or windup blowing around the neighborhoods they serve. The reality is that the foam rides free. Most hauling trucks leave their routes when their trucks are full by weight, not volume. Since foam is 95% air and is not a



A curbside program with 3 bins: Green Waste, Recyclables, and Trash

significant portion of the waste stream by volume, it will not fillup the trucks by weight or volume. In terms of the concern for the foam blowing around, if the foam is not currently blowing around, it is not likely to do so in the future. The reason is simple. The material is already being collected by the hauler. Due to the chasing arrows on foam, many residents

already place the material in their recycle bins; for those that don't, they place it in the trash bin. Both bins are serviced by haulers.

Sorting- Once at the material recovery facility (MRF), the foam can be sorted from the conveyor system. It is best to sort the material prior to it entering the "sorting discs" section. Since there generally is not very much of it, additional sorting personnel are not necessary to collect this



Educational Display for Employee Training

material off the sort line (additional labor is required to run the densification equipment). Its popular bright white color makes it easily identifiable. With minimal training, a sorter can quickly recognize Foam #6. The sorter can then place the material in a chute or bin.

MRF Benefits- In addition to the monetary value of the material collected, foam recycling also presents additional benefits to MRFs. First, cities and their residents usually have the perception that foam is a much larger portion of the waste stream than it truly is, so by providing a solution, the MRF can enhance their relationships with the cities they service as well as their residents. Second, with waste diversion goals continuing to ramp up, the MRF that sorts the most materials is going to be more attractive to municipalities and haulers. Third, MRFs are already getting the material anyway. Virtually any MRF that accepts plastics 1-6 is going to receive foam whether

it is on their list of accepted materials or not. Rather than incurring the cost of transporting the material to a landfill and paying any related tipping fees, MRFs can choose to sort and sell the material.

Additional MRF Considerations-

- Foam recycling may prove difficult if it goes to a transfer station prior to arriving at an MRF. The loading and unloading can result in the foam breaking into smaller pieces and heavy contamination. With this in mind, it is best to analyze foam from a transfer station prior to committing to recycle it.
- Foam densifies best if it is dry. Outdoor collection bins should have lids, and loose foam that is stored outside should be covered.
- Curbside recycling participants need to be educated on the importance of only recycling relatively clean foam material. Otherwise, the value of other recyclables is jeopardized. This is true with all food service containers and not unique to foam.
- As with all commodities, the cleaner the material, the higher the value. While it is not critical, consideration should be given to requiring foam to be placed in a clear bag prior to being placed in the recycling bin.

Drop-off program Considerations-

Value- While these programs are less convenient for the public and capture less material, the quality of the material collected is high so it will garner a higher price than foam sorted at an MRF. Another benefit is that the material is already sorted and ready to go in a grinder so there is less labor, which reduces costs.

Guidelines-

- Request that members of the public place their foam in clear, sealed bags. This will prevent contaminated foam from ruining clean foam. The clear bags will also make it easy to monitor contamination within each bag.
- Request that packaging foam and food service containers be placed in separate bags.
- Specify that food service containers be clean and rinsed. While rinsing is not mandatory for all food service foam, it will improve the value.
- Clarify that the material needs to be contaminant free: No labels, packaging tape, straws, lids, etc. This will reduce your processing costs.
- If an unattended collection bin is part of your program:
 - The collection area should house two bins. One for post-consumer food service and another for transport packaging foam. This will help reduce contamination.
 - The collection area should have barriers that will prevent loose foam from becoming litter.
 - The bins should have lids to prevent the wind from blowing the foam out and to prevent the foam from getting wet.
 - Reference your local building codes prior to designing your collection center.
 - This location should be in a highly visible area to minimize illegal dumping.
 - Include signage that informs residents of your recycling guidelines.



Drop-off/Collection Center