



# Laboratory Products Focus

## LABORATORY CONSUMABLES DON'T HAVE TO COST THE EARTH

Carole Staniford

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*Laboratories have unique waste management problems. Waste volume is not large compared to the typical industrial operation, but the diversity of wastes is considerable. It may include hazardous chemicals, biological materials, glass and sharps that require specialist means of disposal. However, the more basic issues of paper and plastic disposal are also paramount as these usually end up in landfill sites. Pollution prevention should be as much a part of laboratory work as scientists' safety and experimental quality are. Successful pollution prevention begins with a strong commitment to prevent generation of wastes at source.*

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We all have an obligation to safeguard our environment for future generations and there are many ways, both at home and at work, that we can make small changes to contribute to environmental protection.

Disposal of waste is one of the major environmental issues that we face. England and Wales produce 400 million tonnes of waste every year from the rubbish people at home and work discard. Much of this waste ends up in landfill sites. About 100 million tonnes of waste is land filled each year. In the past it was an easy route for waste disposal because it was cheap and space was often available in old quarries. However, space approved for landfill is set to run out in the next five to ten years.

Careful management is needed so the effect of waste on the environment and human health is minimised. Waste management and disposal have improved over the past 25 years as a result of better regulation, using the law to set tighter controls and higher standards, and from the waste management industry's positive response to this regulation. Government policy is to reduce and reuse wastes. Some disposal is necessary, but it should be the last resort. The emphasis is on managing waste in more sustainable ways - conserving raw materials but still protecting the environment and public health.

Today, products and services are increasingly designed with reuse or recycling in mind and businesses are encouraged to operate in the most environmentally conscious way. The Environmental Management System ISO 14001:2004 is a quality standard introduced to award companies for their environmental consciousness, following auditing of their environmental practices throughout their operations. This includes everything from use and disposal of hazardous materials, reduction in power usage, recycling of materials to minimisation of carbon emissions.

### LABORATORY WASTE

Increasing responsibility is being placed on laboratories to reduce the amount of waste that they dispose of. The adoption of waste minimisation by the research and educational community carries with it a tremendous potential for designing pollution out of future industrial processes, right in the lab. Good pollution prevention practice will develop an awareness of proper waste management and help raise a new generation of environmentally conscious scientists, technicians, clinicians and engineers.

Laboratories have unique waste management problems. Waste volume is not large compared to the typical industrial operation, but the diversity of wastes is considerable. It may include hazardous chemicals, biological materials, glass and sharps that require specialist means of disposal. However, the more basic issues of paper and plastic disposal are also paramount as these usually end up in landfill sites. Pollution prevention should be as much a part of laboratory work as scientists' safety and experimental quality are. Successful pollution prevention begins with a strong commitment to prevent generation of wastes at source.

Over several decades changing techniques, new technologies and the requirement for higher throughput assays has led to an increased usage of disposable plastic laboratory products, primarily made of polypropylene. These include disposable tubes, plates, racks and of course pipette tips.

### PIPETTE TIPS

Pipetting is the most common laboratory activity and pipette tips are used in vast numbers. In the past all pipette tips were supplied loose. However, due to sterility issues, increased pipetting requirements and time demands, racked tips were introduced to provide a convenient, sterile, and ready to use option. This soon became the norm in many laboratories with more and more institutes routinely buying ready racked tips. Unfortunately, this advance results in a build up of empty polypropylene racks that are no longer required once the tips have been used (Figure 1). Due to the nature of the plastic material it is not degraded over time. A pipette tip rack placed in a landfill site will still look like a pipette tip rack in 100 or even 1,000 years. The environmental implications are considerable.

It is important to minimise the amount of plastic going into land fill and today it is so easily recyclable that everyone should make the effort to use this option.



Figure 1. STOP Tip Rack waste

- Recycling plastic saves twice as much energy as burning it in an incinerator
- Recycled materials can return to the marketplace in as little as 30 days
- The energy saved by recycling one plastic bottle will power a computer for 25 minutes.

Some tip suppliers, such as Anachem have implemented recycling schemes to minimise the impact of the growing waste from tip packaging. The process is made as easy as possible for end users in qualifying laboratories with Anachem providing colour coded wheelie bins, boxes and bags (Figure 2). This enables central collection points to be established within institutes for the two main types of plastic, polypropylene and PETE, used in pipette tip packaging. Filled bags are then collected.



Figure 2. Colour coded bins are provided for collection of different types of plastic from tip packaging, for recycling



Some of the empty tip racks returned are offered and despatched to other users for self racking of their loose tips. The majority, however, are recycled in partnership with a dedicated plastic recycling company. Following processing the plastic is used to manufacture new products, preventing dumping into landfill and reducing the consumption of further raw materials. (Figure 3).

Whilst this is a far better option than simply dumping the material in landfill, if we are truly environmentally aware we must consider the impact of transporting the material plus the energy requirements for its re-processing. A much better solution to the problem is to avoid generating the high number of waste racks in the first place. Once the plastic is manufactured it will always be there and there is no way to remove it from the environment. The material may be ground up and re-used four or five times but inevitably it will eventually end up in landfill.



Figure 3. The tip packaging recycling process

**REFILL AND REUSE**

In accordance with Government policy responsible pipette tip manufacturers have responded to the plastic waste issue by developing systems that reduce this mountain of empty tip rack waste. However, there is a balance between finding a 'green' option and maintaining a high quality product that still provides a practical solution for the scientist. Companies such as Gilson and Rainin have invested in reducing the amount of polypropylene used, by inventing automatic tip refilling systems. These enable a single robust polypropylene tip rack to be repeatedly refilled with tips and reused again and again. Their refilling systems are easy to use, robust and without the risk of tip spills presented by some refill designs. They reduce the amount of waste created but do not compromise the sterility or labour saving advantages of a racked system. Plus, the refill systems bring the added bonus of space savings in the laboratory. Anachem, also recently introduced its own brand of tips which not only includes a refill system but also provides racks that themselves are already made from recycled plastic.

Some users may be concerned that environmentally friendly tip packaging systems come at a higher price. Certainly in other aspects of life we have had to expect to pay a premium, for example for organic foods and eco friendly washing powders. In fact, tip refill systems are available at a lower cost than individual tip racks, enabling budget and environmental savings.

**TIP REFILL SYSTEMS**

For standard non-filter tips Anachem can supply refill systems from Rainin and Gilson, plus its own brand tip range. The Rainin SpaceSaver™ contains the same number of tips as ten individual racks but is manufactured from 91% less weight in

polypropylene. Figure 4a shows the stack of waste from standard racked tips (left) compared to what is left after using the equivalent number of tips from a SpaceSaver system (right). The stacked system dispenses 96 tips in seconds, into a Rainin removable cover rack. This is done automatically when you press down on top of the unit to release the tips (Figures 4b and 4c). Similarly, the Gilson Tower Pack™ also contains 960 tips but has 89% less weight in polypropylene than the equivalent standard racks. Tips are dispensed into the Gilson Universal Reload Rack that will accommodate tip sizes from 10µl up to 1000µl.



Figure 4a. Rainin SpaceSaver™ Stacked Tip Rack Refill System 91% less polypropylene waste from SpaceSaver system compared to standard racked tips

Both of these tip refill systems are also available in pre-sterilised formats for added convenience and to save time and resources autoclaving. These systems also reduce the amount of space taken up in the laboratory by up to 70% compared to standard racks.

Various suppliers have other refill options available, however when considering the system of choice it is important to look at the robustness of the rack that will be re-used numerous times to ensure that it will withstand repeated autoclaving and general laboratory wear and tear.



Figure 4b & 4c. SpaceSaver automatically dispenses 96 tips in seconds into a Rainin removable cover rack

**AEROSOL RESISTANT FILTER TIPS**

In recent years there has been a greater use of filter tips as standard practice within laboratories. These tips prevent aerosol contamination of samples and pipettes and were introduced due to the wider use of techniques such as PCR. Due to the sensitivity of the techniques for which they are used filter tips are usually required sterile and thus pre-racked. The filter prevents the tips being stacked within each other so they

could until recently only be supplied in individual racks. Thus a large proportion of waste racks are generated from filter tips and this is now a major cause of polypropylene waste.

A possible solution to this problem with the unique Rainin Green-Pak™ tip refill system (Figure 5). Each Green-Pak contains a pre-sterilised tray of aerosol-resistant filter tips that can be quickly and easily re-loaded into an empty Rainin rack. This reduces the weight of polypropylene created by 91% when compared to standard racks. Green-Pak is available with pre-sterilised filter tips or standard tips in all volume sizes and is the only option for reducing the polypropylene waste created by using filter tips. This unique refill option for filter tips creates less than a quarter of the amount of plastic waste compared to the only option of racked tips from other suppliers.



Figure 5. Rainin Green Pak™, unique refill system for filter tips

**BIODEGRADABLE TIP PACKAGING**

The latest development in 'green' tip packaging is the Anachem range of EarthSaver tips that offer the world's first biodegradable tip racks. Whilst fully recyclable, if these racks do find their way into landfill they will break down, safely and relatively quickly, by biological means, into the raw materials of nature and disappear into the environment. EarthSaver Tip racks have a biodegradability of 8-15 years depending on environmental factors such as exposure to sunlight and air. The racks are also tested for heavy metals to certify their ecological cleanliness.

Tips in Earthsaver packaging are thin walled with minimum retention and available in a wide range of volumes and packaging options, making them useful for all applications. Standard racked, racked filter tips, sterile racks, and reload system FastRack™ all provide colour coding for easy tip identification. EarthSaver tips are certified free from DNase, RNase and endotoxin contamination and have CE /in vitro registration.



Figure 6. EarthSaver logo

Next time you are buying pipette tips for your laboratory consider whether you are using the most environmentally friendly option available. As well as making your contribution to saving the planet you could also be making cost, space and time savings.

Environmental data courtesy of www.environment-agency.gov.uk