

2014 Asia Pacific Supplies Collection and Recycling Study

December 2014

Executive Summary

This study investigated the supplies and collection programs of 29 remanufacturers (remans), 3 brokers and 32 refillers in the Asia Pacific region.

The study found that China has created more pressure on remanufacturers with an increase preference for virgin cartridges. InfoTrends believes that the demand for virgin cores comes from the combined effect of expanded production to serve the US to satisfy the requirements of the First Sale Doctrine, and that remanufacturing virgin empties are less costly to remanufacture, and require fewer parts replacement to meet the quality desired.

The added capacity for remanufacturing virgin cores is also being used to serve the Asia market and fill a need among remanufacturers to differentiate their products from cheap newly made compatibles (NMC). Nonetheless, China has negatively impacted local country remanufactures which highlights its power in the region. South Korea and Australia report that their domestic industry has largely been wiped out by product from China.

The independent brokers support China, and their need for virgin empties, at the expense of the local remanufactures. An example, is in Australia where the domestic reman market is only about 10% of the reman market and all of the brokers remaining in Australia serve the Chinese producers nearly exclusively. The refill industry is far less impacted by the imports from China than the reman market. This is primarily because refill is not only a product, but a service.

Because NMC are priced below remans, we see them competing in what was once the refill space in the market – very low priced. Refillers see more customers bring in NMC empties to refill, yet they are reluctant to do so because they are perceived to have lower reliability.

For both reman and refillers, there is a significant number of cartridges that go to the landfill. Remanufactures preference for virgins and their lack of collection of non-virgin empties means customers and remanufactures send cartridge to the landfill. A far larger share of refilled cartridges end up in the landfill compared to remanufactured cartridges. Refillers are small, walk-in business and are less likely to enjoy pickup services provided by the independent recycling industry, and, therefore, typically return a bad cartridge to the customer if they cannot refill it. While there is a large recycling industry in China, India and Australia are beginning to see this trend too, but there is much room for improvement.

About InfoTrends

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Survey Methodology

InfoTrends conducted this research by in-depth interview with 64 toner and/or ink remanufacturers, refillers and cartridge brokers across, Australia, China, India, Thailand, Indonesia, Malaysia and South Korea by knowledgeable researchers local to each country. The interviews, some by telephone and some in person, followed a strict interview guide with a series of quantitative and qualitative questions. The interview results provide the basis for these findings. . Remanufacturers, refillers and brokers were also asked about their understanding of what customers do with their empty remanufactured or refilled cartridges when they are not recollected by the remanufacturer or refiller. Based on previous research studies, InfoTrends has observed that final users will not generally answer such questions accurately and vastly overstate behaviours that they think that they should be doing while understating what they actually do, making such research often useless. Remanufacturers and refillers have knowledge of their customer behaviours and their access, or lack of access, to independent recycling services. Through our candid conversations with remanufactures and refillers InfoTrends believes that we received much more accurate information on what users do with their empty remanufactured and refilled cartridges than we asked the users themselves.

Glossary

- **Broker:** A company that buys and sells empty cartridges.
 - A captive broker is owned by a remanufacturer. They are a profit center to the parent company and will supply primarily to the parent company as well as the aftermarket when excess empties are on hand.
 - Independent brokers are an independent business and serve the reman industry overall.
- **Clone:** A replacement cartridge that does not use an empty cartridge from an OEM, but rather uses a newly moulded cartridge shell. Also referred to as new built, newly made, newly manufactured, or compatible cartridge.
- **Empty:** A used cartridge that might be suitable for re-use or recycling. Also known as a core.
- **Extra - Wrong Vendor:** Cartridges from vendors that the remanufacturers do not accept.
- **Final Disposition:** What happens to a cartridge at the end of its life (sent to landfill, recycled, etc.)
- **First Sale Doctrine/Patent Exhaustion:** A U.S. legal doctrine that limits the extent to which patent holders can control a patented product after an authorized sale. Once an authorized sale of a patented product occurs, the patent holder's exclusive rights to control the use and sale of that product is exhausted and the purchaser is free to use or resell that product without further restraint from patent law.
- **Hulk:** An empty cartridge of any kind.
- **Landfill:** Use of municipal waste. Municipal solid waste is commonly known as trash or garbage in the US or refuse or rubbish in the UK, and it is a waste type consisting of everyday items that are discarded by the public.
- **Newly Made Compatible (NMC)** is a term that is often interchangeable with clone. It has a newly made shell and usually newly made parts.
- **Non-Virgin Empty:** An empty cartridge that has previously been remanufactured
 - Bad Non-Virgin Empty: A non-virgin empty that cannot be successfully remanufactured or one for which there is no market. Also known as an unusable non-virgin empty.
 - Good non-Virgin Empty: A non-virgin empty that can successfully be remanufactured.
- **Recycling:** Crushing or melting components for use in other products or industries.
- **Refill:** A practice of refilling a cartridge with ink or toner without opening the cartridge to refurbish or replace critical components.
- **Reman:** Remanufactured cartridge or remanufacturer, depending on context. Remanufactured cartridges are opened such that critical imaging components or damaged parts can be replaced.
- **Reman Recycling Ratio:** Share of reman waste that is recycled rather than sent to a landfill or incinerator.
- **Remanufacturing:** The practice of cleaning, servicing, refilling, and re-using cartridges.
- **Virgin Empty:** An empty cartridge that has not been remanufactured
 - Bad Virgin Empty: A virgin empty that cannot be remanufactured or one for which there is no market. Also known as an unusable virgin empty.
 - Good Virgin Empty: A virgin empty that can successfully be remanufactured.

Remanufacturers and Brokers

Chinese remanufacturers have shifted their preference to using virgin empties for remanufacturing laser cartridges versus using non-virgins. InfoTrends believes that there are two reasons for this. First, is that many Chinese remanufacturers also serve the US market where the First Sale Doctrine requires that cartridges sold in the US must be remanufactured from a cartridge that was first sold in the US. To satisfy this requirement, Chinese remans have been buying more virgins in the US and remanufacturing them in China. Generally virgin cores and non-virgin cores require separate manufacturing lines, quality control, and parts replacements protocols. Shipping remans made from virgin empties has caused an expansion in that capacity in China and it's assumed that that capacity could expand to Asian sales. Second, because NMC are so cheap to make and they flood the Asian market, remans need to compete. Therefore, they prefer to work with the virgin empties because it differentiates them from the NMC because remanufactured virgin cores are generally seen as higher quality than the NMC. In addition, it is generally less expensive, and therefore more profitable, to remanufacture a virgin empty because fewer parts need to be examined and replaced and expected outcomes are more predictable leading to fewer failures.

Taken together these trends have tightened the market for virgin empties and reduced the recollection of non-virgins. This trend impacts the entire region because of the immense influence and power China has on the Asia economy.

First Sale Doctrine/Patent Exhaustion: According to US case law, a product that is originally sold in the US has had its patents exhausted. This means that a customer is free to use or dispose of product as the customer wishes without worry that the patent holder will exert patent claims on the use of the product. For toner and inkjet cartridges this means that a customer is free to give or sell the empty cartridge to a reman and they are free to remanufacture them under the "Right of Repair". However, if a toner or ink cartridge was originally sold and used by a customer in a country other than the US, the patents are not "exhausted" in the US. In that case, if that cartridge is remanufactured and sold into the US, the cartridge can violate patent rights.

It is legal to collect cartridges used in the US and remanufacture them overseas and then ship them back to the US for sale. In order to be legal, if challenged, remanufacturers who ship cartridges to the US, must show that the reman cartridges they sell for use in the US were made from original OEM cartridges that were first used in the US; those remanufacturers, however, are particularly challenged to demonstrate this.

Empties and End-of-Life

Supply of virgin empty toner cartridges is viewed as tight, and we would expect the demand for non-virgin cores to increase, but this is not the case. Remanufacturers and refillers prefer to work with virgin cartridges over previously remanufactured cartridges. When remanufacturers do remanufacture a non-virgin that tends to be when virgins of the same model cartridge are in short supply as remanufacturing non-virgins is not their first choice. Additionally, individual remanufacturers across the region are less willing to remanufacture a cartridge that they did not originally remanufacture themselves. This is because different manufacturers may use different parts and processes which would complicate remanufacturing of those cartridges and further increase cost.

The desire for virgin empties puts pressure on all remans, though it seems the Chinese remans are prevailing due to the size, and influence they have in the region. Chinese remanufacturers are collecting virgins, and to a degree non-virgins from all over the world but their shifting preference for virgins has meant that there is less desire to recollect non-virgins. This leaves more remanufactured cartridges ultimately uncollected. This shift has cause a small increase in the remanufactured toner cartridges that ultimately end up in landfill.

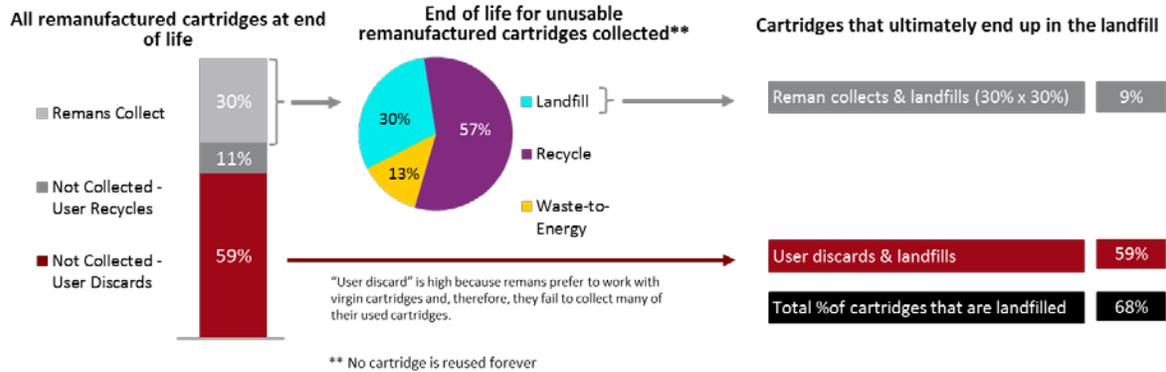
There does exist in China, and to an increasing degree in India, a large independent post-consumer recycling industry which will collect all types of plastic and metal waste and provide pickup services for large organizations. Depending on the country and size of the reman or refiller, this provides remans and refillers with access to affordable waste recycling. While materials recycling is slightly increasing, the remans increased desire for virgin cores does mean that a declining share of non-virgins are collected and thus are less likely to be sent to material recycling.

On average remanufactures report that they collect only 30% of non-virgin toner and 35% of non-virgin ink cartridges that have reached end of life. This is because remanufacturers prefer to remanufacture virgin cartridges. Of those the non-virgin toner and ink cartridges that remanufacturers collect at end of life, 30% of non-virgin toner and 42% of non-virgin ink cartridges go to landfill. This is because in many countries in the Asia Pacific region, there is a lack of recycling infrastructure and it's less expensive to throw the cartridges away at end

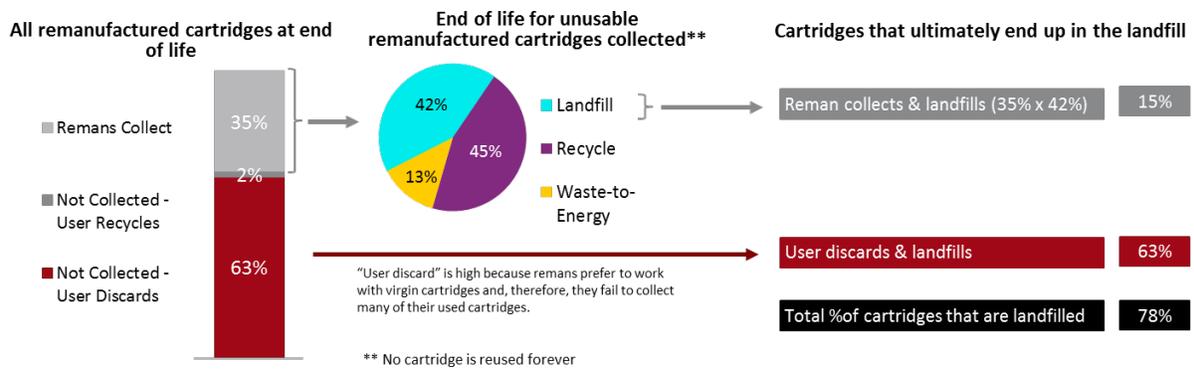
of life. The overall share of remanufactured cartridges that end up in the landfill remains quite high. In the end, 68% of reman toner and 78% of reman ink cartridges ultimately end up in landfill. These estimates are the sum of what the user landfills and what the reman landfills (see illustration below). More ink cartridges go to landfill than toner cartridges because of their small size, but also because toner cartridges are seen as a more attractive source of raw material.

Remanufactured Cartridges at End of Life

Toner Cartridge



Ink Cartridges



Because of the existence of a large independent waste recycling industry in China, and increasing in India and Australia, there is some collection of non-virgins at end of life even when the remanufacturer does not recollect the cartridge. However, if the remanufacturer or refiller does not recollect, the probability of the cartridge being recycled drops significantly.

When a reman collects a virgin empty, they take ownership of that empty. InfoTrends believes that remans have a responsibility to have an end-of-life solution available for their non-virgin, already remanufactured cartridges. All OEMs have an end-of-life program for their cartridges and we believe that remanufacturers should also offer a program, but we don't see that action bearing out in the market.

Refillers

The refill industry is highly localized, dominated by small operations where refillers compete at the lowest price points. Refillers rely almost entirely on their customers to bring empties for refilling. Collection of empties for use as spares is miniscule. A slight increase in the recycling infrastructure has increased the availability of recycling services to Indian refillers but this only slightly impacts overall landfill rates which remain quite high. Far more often than not, when a customer brings in a cartridge that can no longer be refilled, the refiller will return the cartridge to the customer to dispose of. While refillers believe that they see and inspect the large majority of refilled cartridges to determine if they are at end of life, refillers estimate on average that they take into their possession from the customer only 20% of all end of life refilled cartridges, and 80% remain with the customer for disposal. Unlike remanufacturing, where remanufacturers own the cartridges that they collect, and sell a product, branded or unbranded, to the customer, refilling is primarily a service business and refillers almost never

take ownership or physical possession of the cartridge though the entire lifecycle of a refilled cartridge. The cartridge is nearly always the property of the customer and has never been the property of the refiller.

Customers who bring NMCs to be refilled has increased the proportion of cartridges that cannot be reliably refilled. Refillers express reluctance to refill an NMC as they view NMCs as cheaply made and are not confident that the NMC will survive a second cycle. This applies to both toner and integrated ink cartridges. In most cases, when the refiller declines to refill a clone it's for the customer to dispose of the cartridge. In some cases refillers will attempt to refill a clone but this has increased the refiller's failure rate vs. all of the cartridges that customers bring to them by 2% and represents 7% of the refillers failed cartridge attempts.

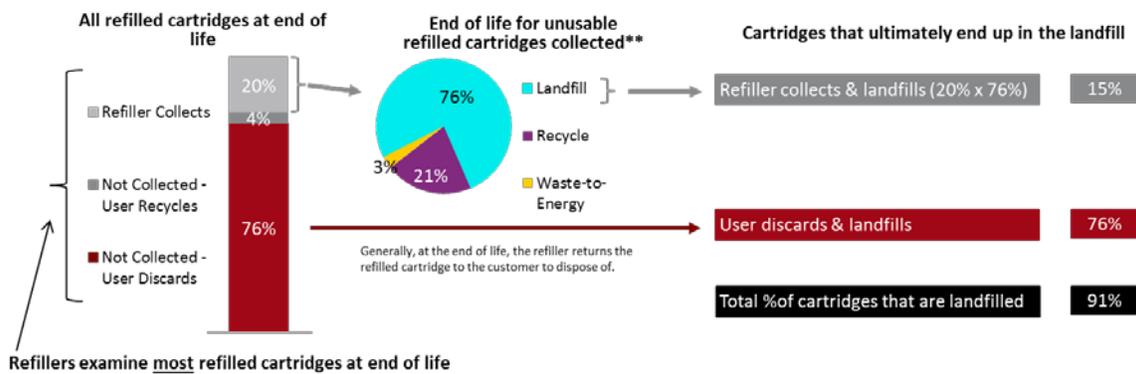
Empties and End-of-Life

Refillers have less access to independent material recycling enterprises due to their small scale. While many remans are able to charge the materials recyclers to pick up their waste cartridges, refillers often can't and it's more economical for them, if they accept end of life cartridge from the customer, to throw the waste away, or, even more frequently, hand the bad cartridge back to the customer for disposal. As a result, a much higher proportion of refilled cartridges ultimately end up in landfill than do remanufactured cartridges (See table below). However, refillers examine most ink and toner cartridges that have reached their end of life, but on average, they only collect 20% of each. Of those, 87% of ink and 76% of toner cartridges go to landfill. This is because it is difficult for refillers to provide recycling services and so most do not because they are small operations, with small volumes for pickup and/or there is no significant independent recycling industry in their countries.

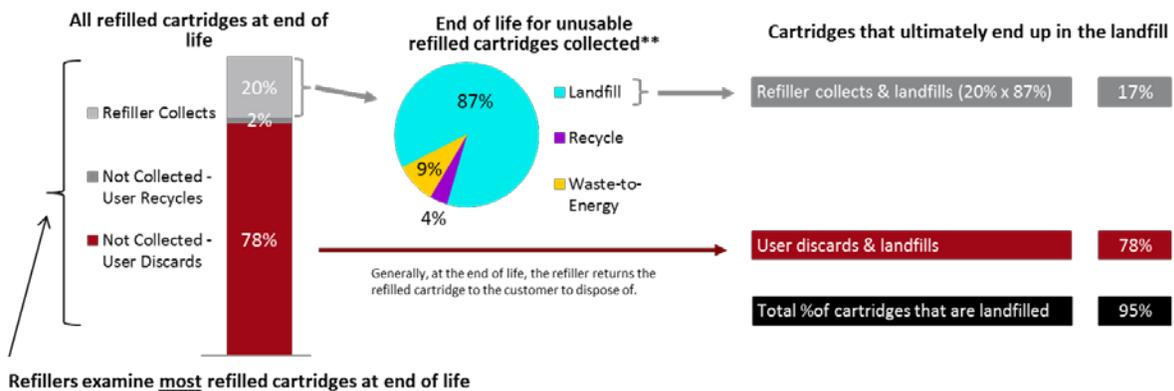
This appears to be a lost opportunity to provide value to the customer and to protect the environment. It stands to reason that since refillers examine the large majority of end of life refills, they could accept end of life cartridges from the customer in far greater numbers than they do and in doing so increase their own access to the independent recycling industry.

Refilled Cartridges at End of Life

Toner Cartridges



Ink Cartridges



While respondents expressed a desire to “be Green”, recycling of non-virgin cartridges is a matter of economics and collections are a large cost. Concentrated sources of collection are more economical than are small and disperse sources such as individual customers and refillers.

Key Findings: Reman

- 70% of toner and 65% of ink cartridges are remanufactured only one time, which means that 30% of toner and 35% of ink cartridges are remanufactured more than once.
- Remanufacturing a cartridge more than once is more expensive than using a virgin cartridge because more parts need replaced, quality control procedures differ, and they usually need a separate production line.
- To successfully remanufacture one cartridge, remans need to collect 1.1 virgin toner cartridges and 1.2 virgin inkjet cartridges. Although they are not as desirable, remans do collect their own non-virgins, mostly to fill demand when supplies of virgins of a particular model are in short supply, and this changes the metrics. Some non-virgin collections are damaged or otherwise too worn out to be cost effectively remanufactured. Furthermore, remans often cannot control whether the non-virgin that they collect is their own product or that of a different remanufacturer. Cartridges from a different remanufacturer may have a number of foreign components, or have undergone a different disassembly/reassembly process making them less reliable for remanufacturing. To successfully reman one non-virgin cartridge, remans need, on average, 1.3 non-virgin toners and 1.35 non-virgin ink cartridges.
- 68% of toner and 78% of ink cartridges sold by remanufacturers will ultimately be thrown away because most remans fail to collect their own product because they prefer to work with virgin cartridges. Most remanufacturers still do not want their own cartridges back but in situations where virgin empties are in short supply for specific models they will attempt to recollect their own cartridges for remanufacturing again.
- Remans collect only 30% of non-virgin toner and 35% of non-virgin ink cartridges that have reached end of life. Of these,
 - 30% of toner and 42% of the ink cartridges go to landfill.
 - 57% of toner and 45% of ink cartridges are recycled into new products or raw materials.
 - 13% of toner and 13% of ink cartridges go to waste to energy.
- For inkjet, over half of the unusable cartridges that remans collect are cartridges from the wrong vendor. This is significantly higher for ink than for toner because ink tanks are not remanufactured due to NMC cheap prices inhibit this practice. Integrated NMCs are also largely not considered to be able to be remanufactured.
- Despite the remans effort, they are bound to collect some products that they don't want. In terms of laser products, they receive toner kits, bottles, and cartridges that for multiple reasons may not be remanufactured. Aside from damage, a cartridge may not be remanufactured if there are NMC on the market for which a reman is too costly to compete in large volumes. Some of those cartridges may ultimately be sold but some may not. Most toner kit type cartridges still are not remanufactured. Remans also nearly universally do not remanufacture NMCs due to a perception of low quality parts and that unlike virgins, the parts may not be standardized.
- For inkjet, they receive a lot of cartridges that are damaged or dried out and consequently cannot be remanufactured with any confidence in quality. Non-virgin integrated inkjet cartridges have a very high failure rate, in excess of 30%, due to damage and dry out issues.
- Large remanufacturers are more likely to have access to raw materials recycling pick-up services. At minimum, some remans are not charged to have their waste picked up, while some are paid by the materials recycler to collect their waste.
- Toner parts replaced most often include the drum, charge roller, wiper blade, and magnetic sleeve. For inkjet, the sponge is sometimes replaced. Smaller remanufacturers rarely replace more than the drum and often allow the replacement drum to run several cycles. As a result, the smaller remanufacturers are somewhat more focused on virgin hulks than are the large remanufacturers as they are less positioned to have separate processes for non-virgins.
- Empties from brokers are sorted by brand, model and type (virgin or non-virgin) and are not certified for use.
- Independent brokers across the region are increasingly serving Chinese remans preference for virgin empties.

- On average 60% of cartridges used by remans are sourced through brokers and 40% by their own collection programs.

Key Findings: Refill

- 25% of toner and 30% of ink cartridges are refilled only one time, which means that 75% of toner and 70% of ink cartridges are refilled more than once. Refillers depend almost entirely on walk in customers to bring their own cartridge for refill, and continue to refill until it can't be refilled again.
- Refillers report that 80% of the cartridges that they sell was received from walk in customers with the cartridge in hand.
- Refillers prefer to refill virgins or previously refilled cartridges and prefer not to refill remans or NMCs as it's their experience that they are more likely to have failures.
- 91% of refilled toner and 95% of refilled ink cartridges sold by refillers will ultimately be thrown away. Refillers report that if a cartridge cannot be refilled they will most frequently return the cartridge to the customer for disposal. Some refillers attempt to sell as scrap but refillers are small, local operations and their volume is so small that it is not attractive to materials recyclers for pickup service. Customers are even less likely to have access to pickup service than refillers, however, some customer cartridges will be scavenged for sale to material recyclers. So, refillers often throw out cartridges that reach their end of life and that customers do not want.
- Because refilling is a service where the customer repeatedly brings the cartridge back to the refiller until it cannot be refilled again, refillers report that they see or inspect most refilled ink and toner cartridges that have reached their end of life, but they only collect 20% of each. Of those,
 - 76% of toner and 87% of the ink cartridges go to landfill.
 - 21% of toner and 4% of ink cartridges are recycled into new products or raw materials.
 - 3% of toner and 9% of ink cartridges go to waste to energy.
 - Refillers largely report that it's difficult for them to get pickup service for unusable cartridges, thus, many are thrown in the trash if they accept the bad cartridge from the customer. Therefore, most refillers report that if a cartridge is unusable they are likely to return it to the customer for disposal. Because refilling is a service, refilled cartridges are always the property of the customer unless the refiller takes ownership from the customer at end of life.
- Inkjet refillers report that a lot of the cartridges that customers bring in to them are damaged or dried out and consequently cannot be refilled with any confidence in quality.
- Refillers report that they rarely collect empties to have as spares. When a cartridge has reached its end of life, refillers attempt to sell a customer a new OEM cartridge so the refill cycle will continue. If an OEM is priced too high, a NMC may be sold, but refillers tend not to sell remans.
- Refillers report that they change the drum in a toner cartridge about 25% of the time, and sometimes will change other parts. For the large majority of their business, however, they do not open the cartridge to replace parts.
- Refillers report very little use of brokers for spares. Brokers focus on higher cost virgin empties that are in demand by remans. The non-virgin empties are more likely to be remans which refillers prefer not to refill.

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