



Toner cartridges in containers.



Layout of the dismantling cabin at the conveyor belt to the cartridge shredder.

Safety first with toner cartridge

Under the requirements of EU Directive 2002/96/EC, toner cartridges must be removed from printers and copiers prior to treatment in recycling plants. This directive is relevant in South America too and its contents have been integrated into manufacturer obligations in Brazil, a country in which URT of Germany has played a central role in creating a dedicated recycling plant.

A considerable proportion of used toner cartridges cannot be refilled owing to their design or to damage. Against

this background, an entrepreneur in Brazil decided to build a recycling plant and asked URT Umwelt- und Recyclingtechnik GmbH of Karlstadt in Bavaria to assist with planning and construction. The plant was commissioned in June this year.

MATERIAL COMPOSITION OF TONER CARTRIDGES

Material	share
plastics PS	37.1 %
plastics PPE	1.3 %
plastics PET	0.3 %
plastics PC	2.1 %
plastics PE	0.5 %
plastics PE	0.7 %
plastics ABS	4.1 %
plastics POM	2.4 %
plastics PS cristal	0.2 %
foam	0.4 %
chip	0.3 %
aluminium	3.5 %
copper	0.0 %
ferrous	41.0 %
toner powder	6.1 %
total	100 %

In the early planning stage, URT's technical director Bernhard Biener was confronted with the requirement that the cartridges should not be shredded as a complete unit; the aim was, at least for certain cartridge series, to dismantle some of the components manually. For this reason, Biener developed special disassembly work benches in order to protect personnel from toner dust emissions. Suction has been used to capture the escaping toner dust for transfer to appropriate collection containers.

Removal of toner powder

Subsequent to component disassembly, the toner powder is removed from the cartridge while still within the disassembly cabin. For this purpose, every individual cartridge is placed in a vibration chute which is sealed with a tight-fitting cover.

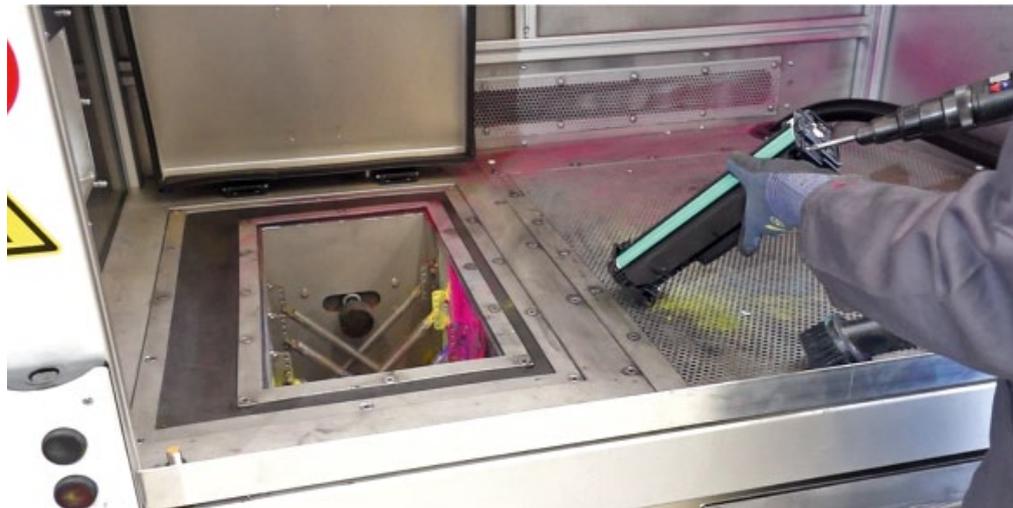
After automatic closure of the emptying unit, the toner dust is removed from the cartridge by vibration. The dust is then collected via a mechanical conveyor system in order to avoid the danger of explosion. Every hand-picker uses a flexible suction hose in his cabin so as to remove dust residues.

Shredding and material separation

Emptied cartridges from the six disassembly cabins are transferred to a four-shaft UNTHA rotary shear where all the fractions are shredded into pieces measuring approximately 30 mm. Steel shafts have not been removed in advance. Separation of the steel takes place on a vibration chute transverse to the conveying direction. All connection points between the components are fitted with tight-closing compensators in order to prevent any dust



Conveyor belt for circuit boards.



Dismantling cabin with opened vibration chute towards toner dust clearance.

recycling in Brazil

from escaping. Following separation of the steel, an eddy-current stage serves to take out the non-ferrous metals.

Separate suction ventilators and dust filters are applied to the shredder as well as to all the separation and conveying units. As a result, no explosive dust-air mixture can arise in any suction streaming.

Wet process development

Biener and his team at URT have developed an additional process whereby complete and full toner cartridges are shredded in combination with water injection so as to avoid dust-related explosions. During the subsequent two-step washing process, the toner powder is separated from the solid fractions (ie metals and plastics). Ferrous and non-ferrous metals are then separated. The toner powder is separated by flocculation from the wash water and is discharged via chamber filter presses.

The washed solid fractions resulting from this process are highly suitable for marketing while the toner powder is bonded and no longer atomised. The wash water can be recirculated, with evaporation losses compensated by fresh water.

Multiple-use plant

The plant in Brazil has more than one use: for example, printed circuit boards can be shredded by incorporating a further feeding conveyor. This is particularly effective with printed circuit boards with a low precious metals content for subsequent separation of ferrous metals (approximately 20%) and aluminium (approximately 10%). The remaining printed circuit board concentrate can be sold, for example, to copper smelters in Europe where precious metals are recovered. The separated metals, however, are marketed directly in Brazil.

As the accompanying table shows, toner

PROJECT HIGHLIGHTS

Project

Development of a recycling plant for toner cartridges and printed circuit boards

Company

URT Umwelt- und Recyclingtechnik GmbH

Implementation

Plant commissioned in June 2015

Value of the project

1 million euro

Main goals of the project

The safe recovery of material components from toner cartridges for recycling



Aluminium from shredded toner cartridges.



Mixed plastics after separation and shredding.

cartridges comprise three main fractions – polystyrene (37.1%), aluminium (3.5%) and steel (41%) – which together account for a mass share of approximately 80%. As a result, high recycling rates can be achieved.



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Overview of the plant with dismantling platform, shredder and separation unit.