Waste Management in Footwear
Waste from Shoe Supply Chain

Solid: raw material by-products, refuse, excess materials, disposed packaging materials, disposed end-of-use products, etc.

Liquid: wastewater, chemicals, oil, etc.

Gas: Air Pollutants
Material Input and Waste Diagram

Input Materials
Leather (natural and synthetic)
Fabric/Textiles (natural & Manufactured)
EVA, PU, Latex, Rubber, Components
Laces, labels,
Chemicals (adhesive/cement, primers)
Packaging (carton, boxes, wraps, etc)
others

VOC,
Green House Gas, Ozone Depleting Substances,
Sox, NOx, etc.

cutting waste;
injection waste from mold leakage;
dust from roughing/buffing;
Chemical containers;
Residual chemicals;
written of materials/components;
Worn out spare parts;
employee living waste;

Wastewater (toilets, cleaning)
Chemical spills
Oil spills (lube, Fuel)
Figure 1: A diagram showing a typical factory and the fate of its wastes

- Fugitive emissions to air
- Chemical storage
- Spills/leaks
- Drain
- Pollution of groundwater
- Illegal discharge to river (via drain or direct)
- Discharge to sewer
- Liquid Waste
- Consented discharge to river
- Solid waste to disposal elsewhere

Process
The largest quantity of waste is generated at the cutting processé

Å e.g. waste rate from cutting of natural leather (e.g. cow hide) = 25 ï 35%  
  (14th Meeting of UNIDO Leather Panel, 2000)
  ï a leather skin is never homogenous and rectangular
  ï the quality of the leather at the side of the skin is generally poor
  ï The shape of the pieces to be cut is scarcely the same and the production delay
does not allow the optimization of their arrangement

Å For textiles or fabric, cutting waste is generally lower
because the material is more homogenous = 20 ï 25%

Å Waste from upper = 132.6 tons/M pairs
Å Waste from sole = 118 tons/M pairs
Å Adhesives, oils, solvents = 4.6 tons/M pairs
Å Household type waste = 10.8 tons / M pairs
> Worldwide Footwear Consumption: From an average 1 pair of shoes/person/year in 1950, to 2.6 pair /person/year in 2005
> In UK, 2003 retails figure was 338 M pairs of shoes sold and waste arising from post consumer used was estimated to reach 169,000 tonnes

Recycling of Footwear Products, Center for SMART, 2007

![Graph showing the global footwear consumption from 1950 to 2015](Figure 2: Global Footwear Consumption)
Sample Waste Inventory from a Puma Factory

<table>
<thead>
<tr>
<th>Materials</th>
<th>% waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leather, Natural</td>
<td>4.1%</td>
</tr>
<tr>
<td>Leather, Synthetic</td>
<td>3.6%</td>
</tr>
<tr>
<td>Outsole</td>
<td>17.2%</td>
</tr>
<tr>
<td>Midsole</td>
<td>11.8%</td>
</tr>
<tr>
<td>Insole</td>
<td>2.7%</td>
</tr>
<tr>
<td>Fabric/Textile</td>
<td>6.8%</td>
</tr>
<tr>
<td>Inner Box</td>
<td>2.3%</td>
</tr>
<tr>
<td>Corrugated Outer Box</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

2008 PUMA SAFE E-KPI survey
## Other source of waste in Footwear

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injected outsole</td>
<td>Thermoplastic material can flow out between two parts of mold due to pressure. The carrots are considered waste. Purges of materials from machine during turn over of operations / shutdown.</td>
</tr>
<tr>
<td>Sole preparation</td>
<td>Buffing/roughing dust before cementing.</td>
</tr>
<tr>
<td>Components and accessories (eyelets, laces, etc)</td>
<td>Unused, old stock written off from inventory and become waste; <strong>Reduce:</strong> purchase <strong>Just in Time</strong>.</td>
</tr>
<tr>
<td>Materials and supply packing waste</td>
<td>Paper or plastic wrappings of materials, containers, chemical cans and drums, cartons, wooden pallets, etc. <strong>Reduction:</strong> Returnable and reusable containers can be offered by suppliers.</td>
</tr>
<tr>
<td>Residual chemicals, maintenance and housekeeping</td>
<td>Worn out spare parts. <strong>spent lube oil (e.g. cutting machines, etc.)</strong>.  <strong>workshop rubbish and dust</strong>.</td>
</tr>
</tbody>
</table>
Integrated Waste Management

• Prevention
• Minimization/Reduction
• Reuse
• Recycling
• Energy Recovery
• Disposal
Reuse

Pro\$
- Extending the "use" life of shoes
- Establish collection method via recycling banks and charity shops
- Creation of jobs in less developed countries

Con\$
- Transportation (carbon miles)
- Diverting waste from developed world to developing countries
- Economic Impact (restricting the development of local footwear industry)

Center for SMART, 2007
Material Recycling

**Pros:**
- Proven technology for the recycling of athletic shoes (more than 20 million pairs of post-consumer athletic shoes have been recycled)
- Established market for shoe recycled materials (surfacing)

**Cons:**
- Limited application to athletic shoes only (with no metallic parts)
- Recycling of post-consumer finished leather is not currently available

Energy Recovery

**Incineration**

**Pros:**
- Established method (municipal incineration plants, co-combustion in rotary/cement kilns etc.)
- High calorific value of leather

**Cons:**
- Harmful air emissions
- Low public acceptance in the UK

**Gasification**

**Pros:**
- Applicable to a variety of waste types
- No harmful air emission released

**Cons:**
- Expensive technology (approximately £165/tonne)
- Not proven for post-consumer shoe waste
Sample End-of-Life Analysis

<table>
<thead>
<tr>
<th>Gross Emissions</th>
<th>Phases for recycling</th>
<th>GWP (kg CO₂ equiv.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disassembly</td>
<td></td>
<td>2.21</td>
</tr>
<tr>
<td>Transport Simple to Recycler</td>
<td></td>
<td>0.11</td>
</tr>
<tr>
<td>Recycling</td>
<td></td>
<td>0.44</td>
</tr>
<tr>
<td>Transport Recycler to China</td>
<td></td>
<td>0.07</td>
</tr>
<tr>
<td>Avoided Emissions</td>
<td>Avoided Landfill</td>
<td>-0.27</td>
</tr>
<tr>
<td></td>
<td>Avoided Production</td>
<td>-1.62</td>
</tr>
<tr>
<td>Net Emissions</td>
<td></td>
<td>0.94</td>
</tr>
</tbody>
</table>

GWP – Global Warming Potential, 100 years, Kg-CO₂ equivalent. Measures the radiative forcing (W/m²) of greenhouse gas emission relative to CO₂ over the course of 100 years, EPA.
Reduce

Reducing the amount of waste you produce is the best way to help the environment. There are lots of ways to do this.

Reuse

Instead of throwing things away, try to find ways to use them again!

Recycle

Many of the things we use every day, like paper bags, soda cans, and milk cartons, are made out of materials that can be recycled. Recycled items are put through a process that makes it possible to create new products out of the materials from the old ones.