



## Closed Loops And Service Systems in High Value Manufacturing

HVM CLASS of 2008

## Reducing Waste to Increase Profits

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22 April 2008

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## What is Closed-Loop Manufacturing

The classic supply chain is considered to be 'Open Loop'  
In fact, the anthrosphere is part of a vast Closed Loop linked to the ecosphere

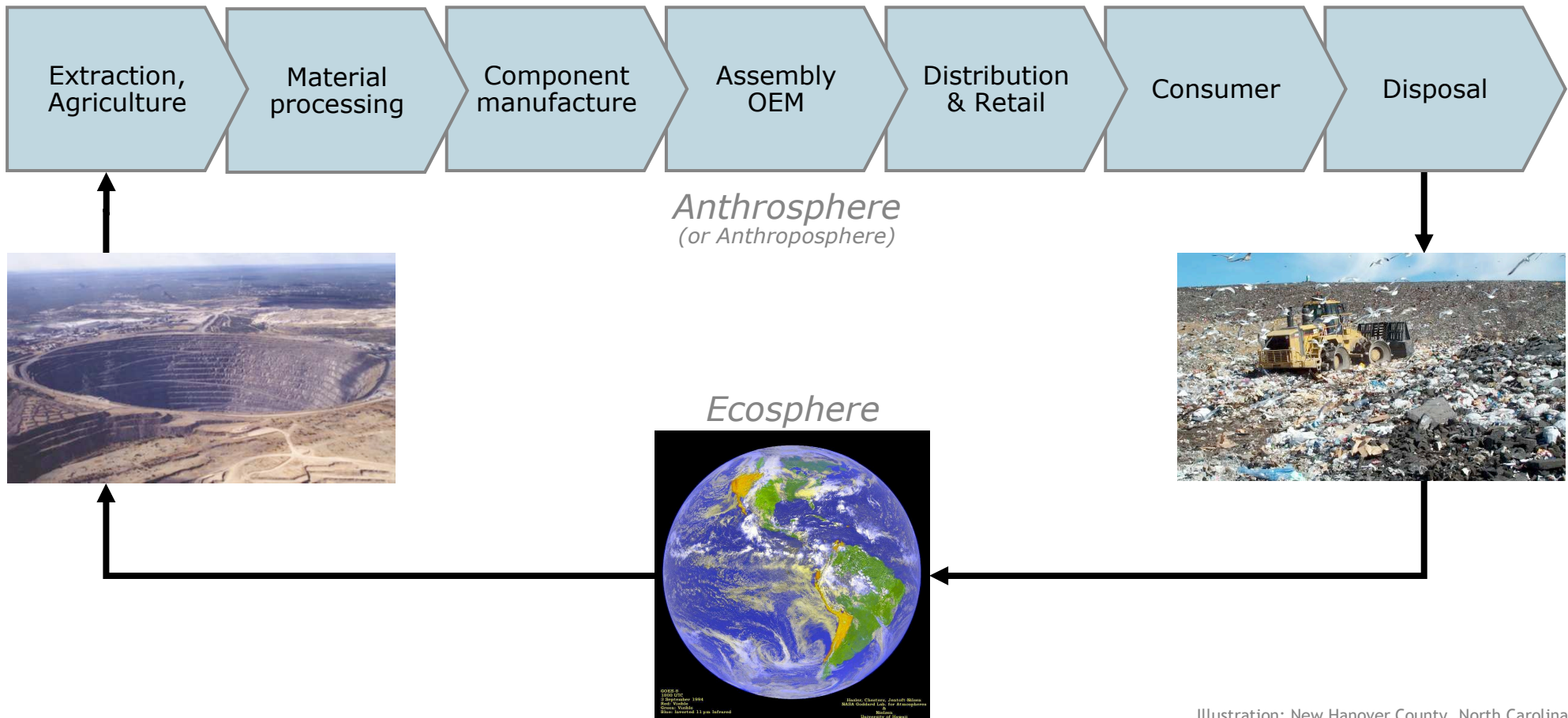
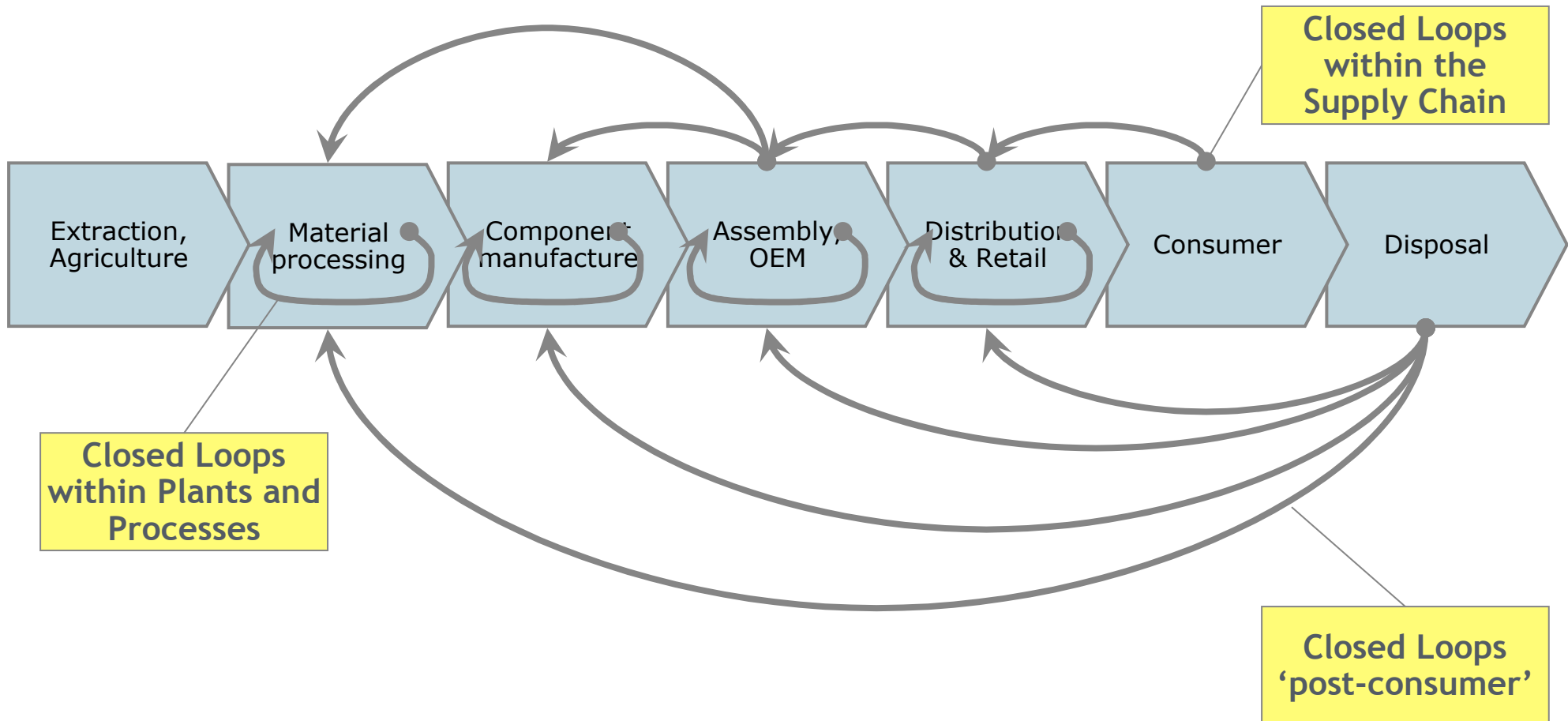


Illustration: The Palabora open pit, South Africa's leading copper producer

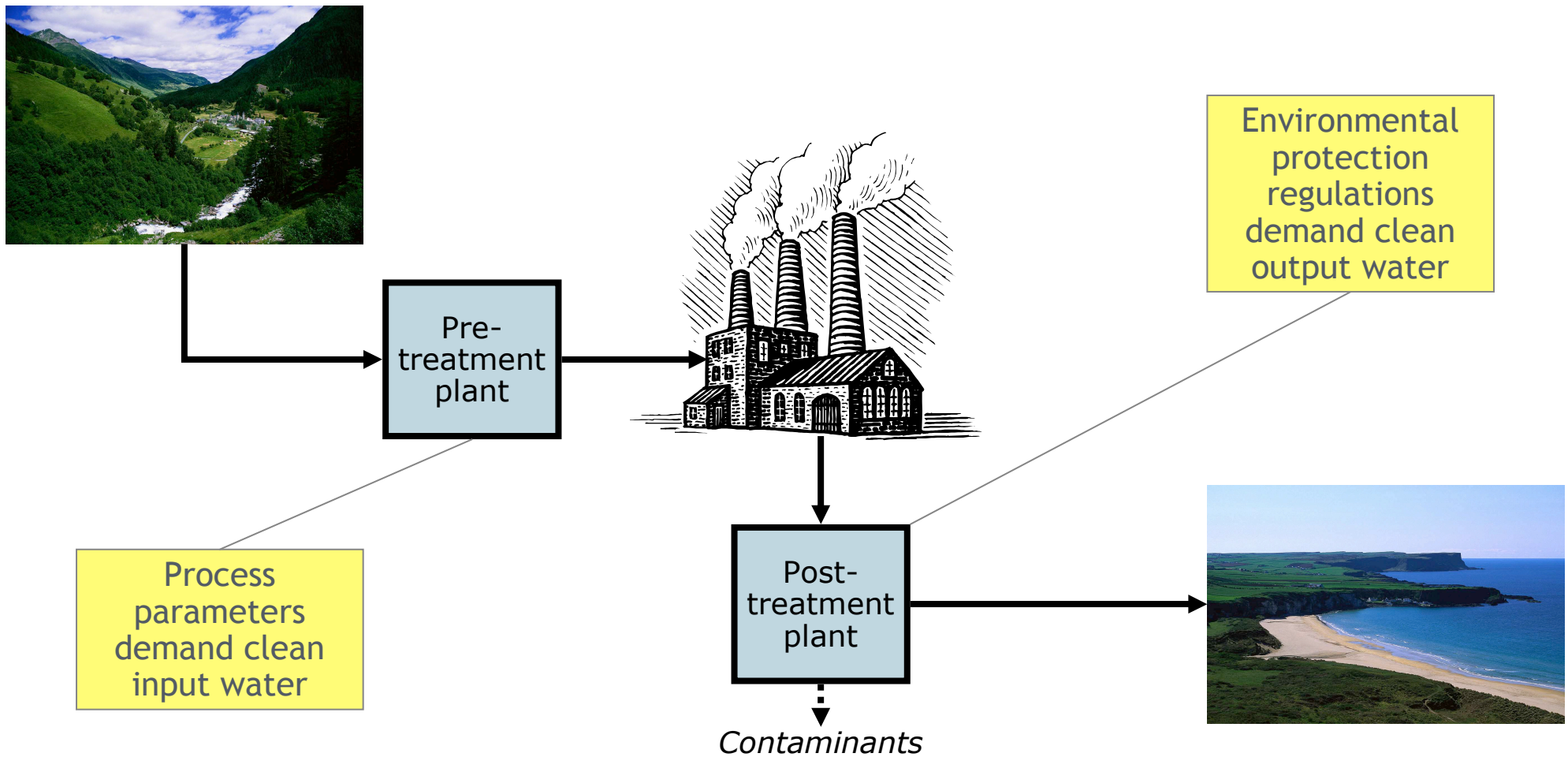
Illustration: New Hanover County, North Carolina Secure Landfill opened in 1981 as the first lined landfill in the state

## What is Closed-Loop Manufacturing

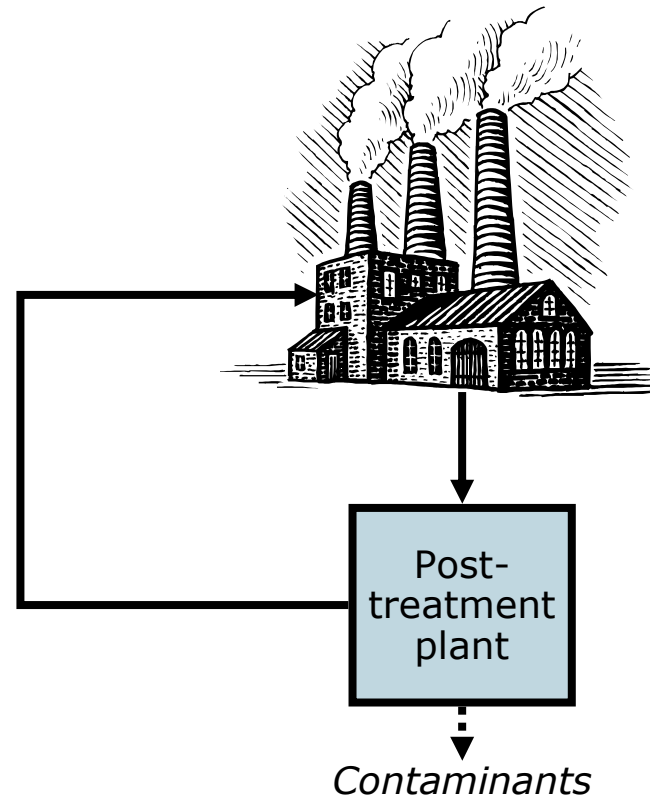
Closed Loops can allow the value invested in materials to be conserved



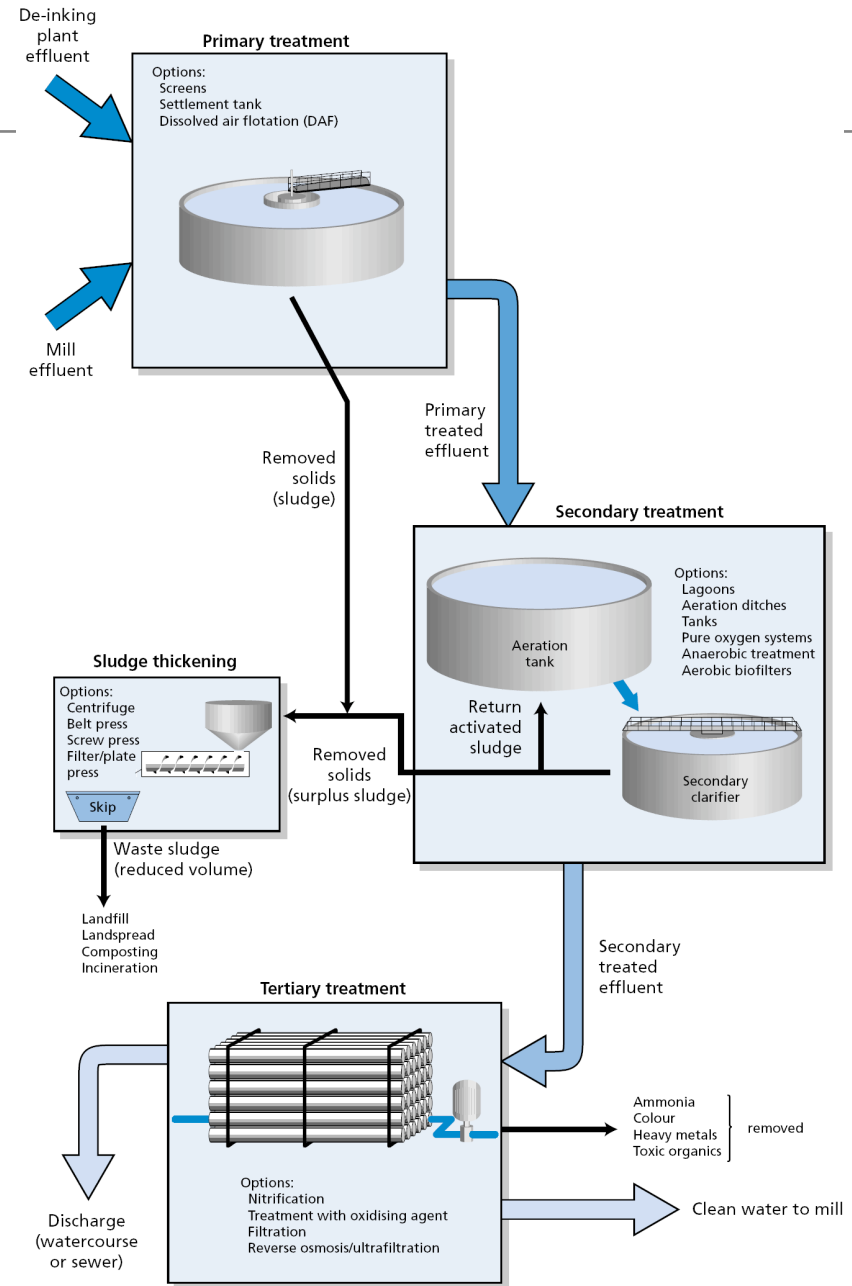
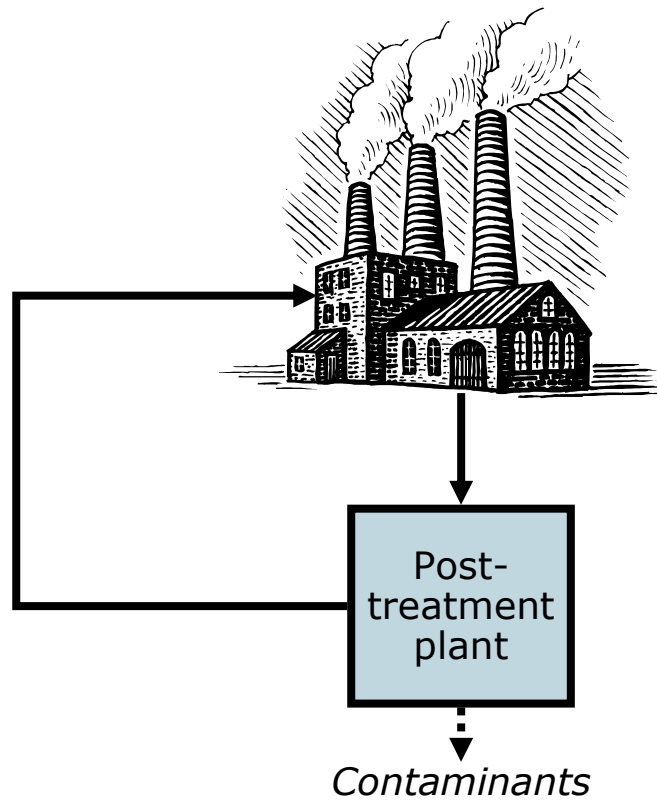
## Closed Loops within Plants and Processes Water use



When the cheapness and availability of water are not the main consideration, process designers are free to select a better solvent



# Closed Loops within Plants Water use



Source: Environmental Technology Best Practice Programme 'Cost-effective Effluent Treatment in Paper and Board Mills' GG156 Fig. 1 Effluent treatment overview

## Reusable transport packaging works well in closed loop shipping systems

- Reusable transport packaging works best in a closed- or managed open-loop shipping system
- A reusable transport packaging system is easier to plan when there are large volumes and a consistent flow
- Large or bulky products or those easily damaged or high value items are good candidates for reusable transport packaging
- Reusable transport packaging works well when suppliers and customers are grouped near one another
- Packaging may be more costly, but should last longer, protect products better and provide other savings and benefits



Plastic crates



JT9D Turbine Engine Container



IBC container (for liquids)



FoldyPac wooden containers

Sources: ORBIS Corporation [www.orbiscorporation.com](http://www.orbiscorporation.com)  
FoldyPac [www.foldypac.com](http://www.foldypac.com)  
EKO-Container Service, Ltd [www.ecs-obaly.cz](http://www.ecs-obaly.cz)  
Plastics Research Corporation [www.prccal.com](http://www.prccal.com)

## Reusable packaging can offer savings and benefits that must be carefully assessed

### Benefits of Reusable Packaging

- Reduced waste management costs
- Lower labour costs e.g. carton erection
- Better product protection
- Less product damage
- Longer useful life of packaging
- Lower packaging costs over time
- Better ergonomics for employees
- Better use of line space, 'visual impact'
- Improved worker safety and ergonomics
- Less waste to landfill
- Reduced greenhouse gas emissions



Shallow plastic crate with lid



Plastic crates



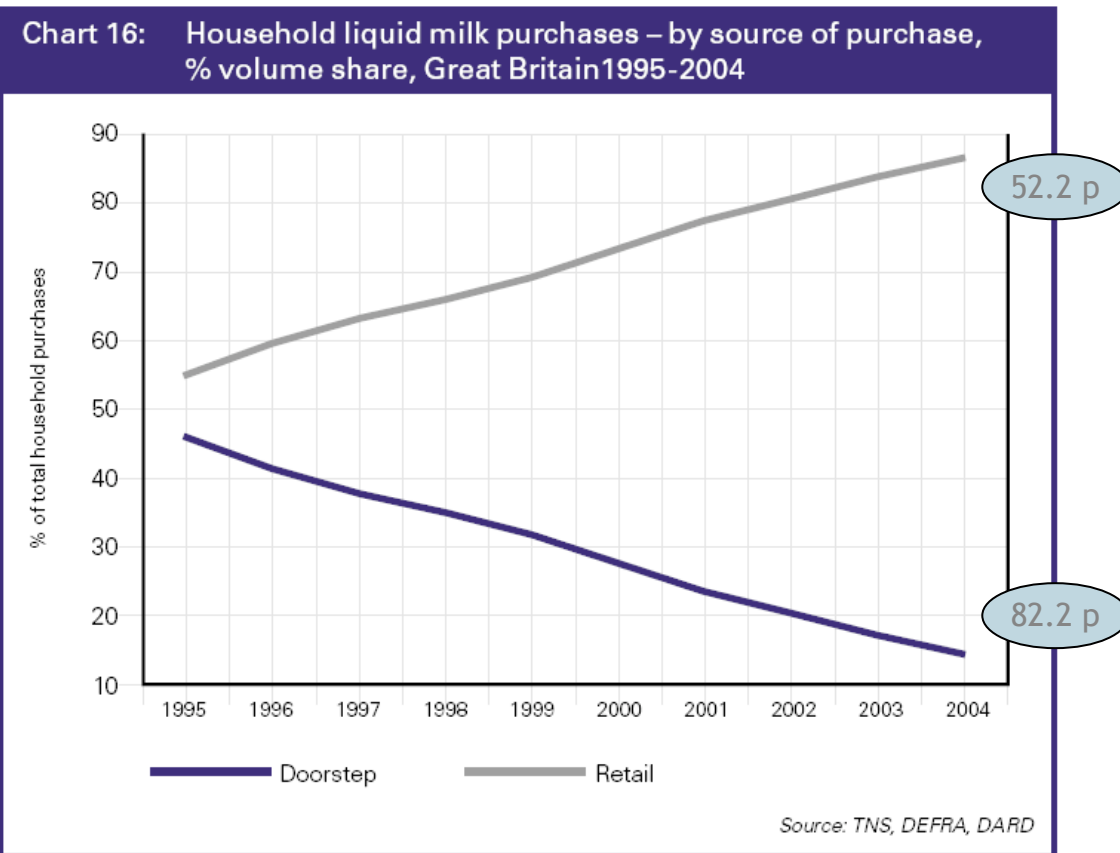
Plastic crate with drop down side



Open-head plastic drums (for solids)

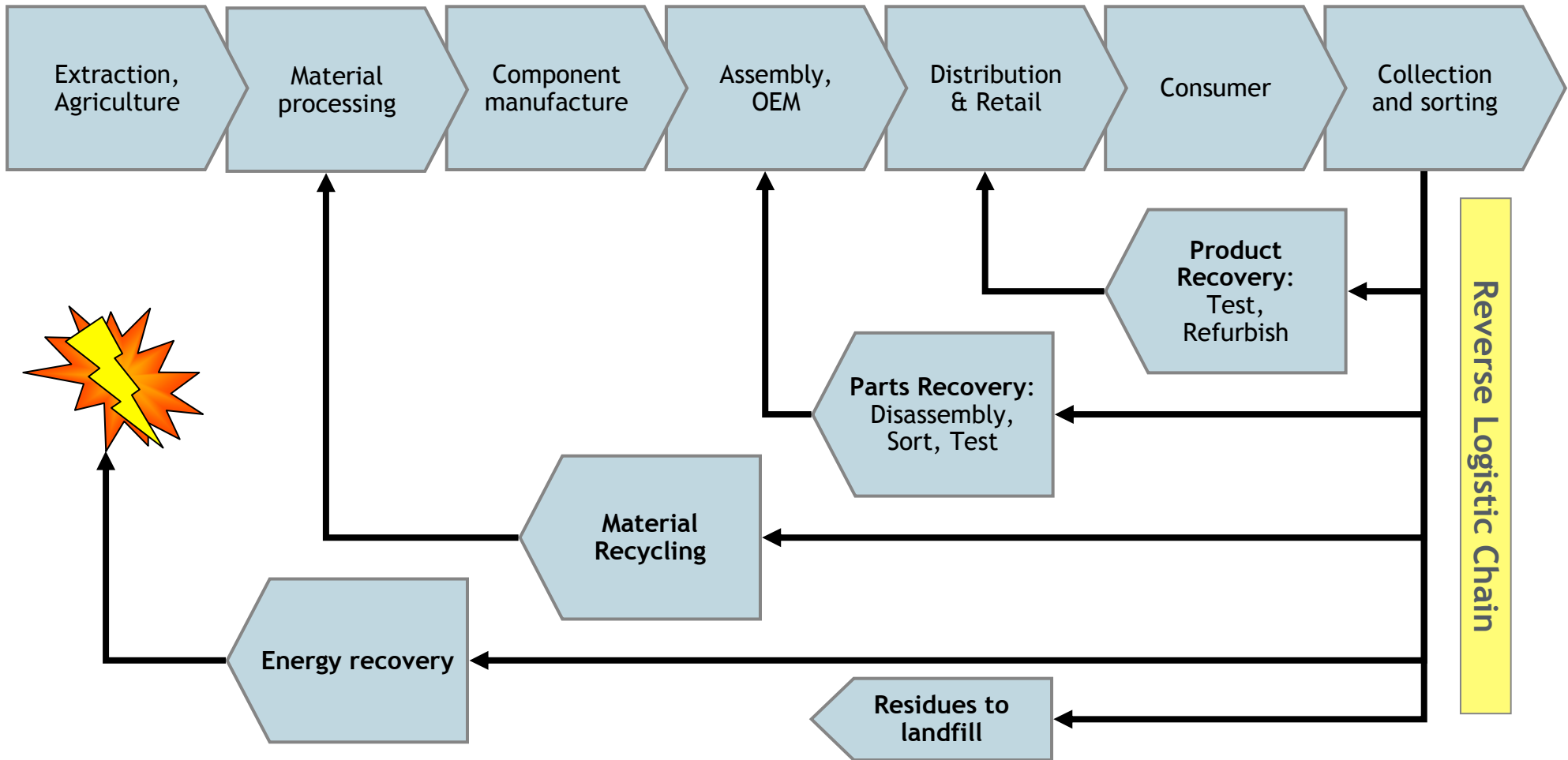


As doorstep delivery of milk has declined, reusable glass bottles have been replaced by one-trip polythene containers



Source: Milk Development Council 'Dairy Facts and Figures 2004'  
Prices per litre at January 2006

Reverse Logistic Chains are difficult to manage, as variability can lead to high labour intensity, high inventory, poor plant utilisation and low recovered value



Many different ownership transfer models exist to provide incentives to return materials for recycling

**EXAMPLES**

<b>Donation model</b>	Users give items for recycling at end of life	Bottle banks
<b>Coercion model</b>	Legal penalties and charges force users to sort and submit items for recycling	'Chipped' wheelie bins
<b>Deposit model</b>	Items remain the property of supplier. A deposit is charged that is forfeited if lost	Returnable packaging
<b>Buy-back model</b>	Supplier pays for items at end of life	Car batteries, trade-in discounts on white goods, cell phones
<b>Mandatory take-back model</b>	Law requires maker to take back items at end of life and carry the cost of disposal in an acceptable way	German Packaging Ordinances for extended producer responsibility
<b>Dustman model</b>	Third party is paid to dispose of items, perhaps recovering value by recycling	Tyres, scrap cars, skip hire, domestic refuse
<b>Steptoe model</b>	Third party recycler buys items and recovers value by recycling	Waste paper, toner cartridges, rags-and-bones
<b>Lease model</b>	Goods are leased or hired to user. Ownership is retained by supplier	Photocopiers, electric vehicle batteries, construction plant
<b>Service model</b>	User purchases a service not an item. Ownership of the 'tools' for supply is retained by supplier	Public transport

## Multiple ownership models can be found for one commodity

<b>Non-returnable bottle: UK</b>	Ownership passes from supplier to customer. No incentive to return ownership to supplier. Scrapped, maybe recycled.
<b>Returnable bottle: Germany</b>	Ownership passes from supplier to customer. Deposit provides an incentive for return to supplier. Reused. Reverse logistics!
<b>Glass in a pub</b>	Ownership remains with the supplier. Supplier is responsible for 'maintenance'. Reused.
<b>Glass at the Beer Festival</b>	Ownership passes from supplier to customer at entrance. Supplier is <u>not</u> responsible for 'maintenance'. Retained as a souvenir
<b>Jug filled for pub 'take-out'</b>	Ownership remains with the customer (or may be sold by pub to customer) Customer is responsible for 'maintenance'. Reused.

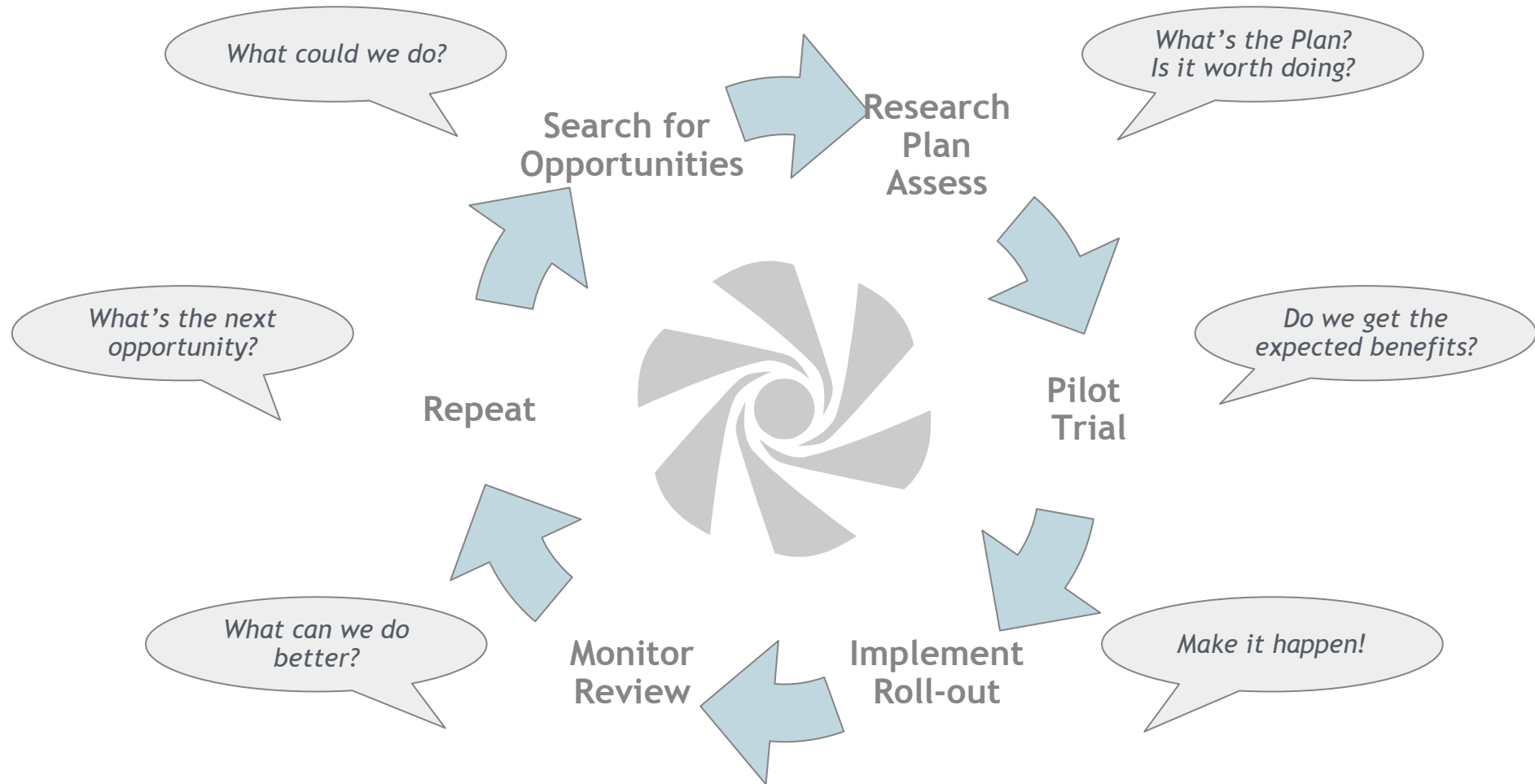


Illustration: The bar at the Eight Bells, Chipping Campden

Closed Loops are just one way to improve resource efficiency; some of the alternative approaches are contradictory

<b>Reduce</b>	<ul style="list-style-type: none"><li>• Eliminate the use (<i>removes need to reuse</i>)</li><li>• Use less material (<i>may reduce value for recycling, weaken for reuse</i>)</li><li>• Greater simplicity</li><li>• Substitute cheaper, lower environmental impact materials (<i>may reduce value for recycling</i>)</li><li>• Manufacture more cheaply, with less environmental impact</li><li>• Extend the product life (<i>invest more materials?</i>)</li></ul>
<b>Reuse</b>	<ul style="list-style-type: none"><li>• Promote secondhand use</li><li>• Repair - Design for repair, establish repair infrastructure</li><li>• Refurbish</li><li>• Design for Disassembly and Remanufacture, establish salvage infrastructure</li></ul>
<b>Recycle</b>	<ul style="list-style-type: none"><li>• Design for easy recycling<ul style="list-style-type: none"><li>– Markings</li><li>– Segregate materials so separation is easier)</li></ul></li><li>• Substitute materials that recycle</li></ul>
<b>Reduce impact of disposal</b>	<ul style="list-style-type: none"><li>• Design so that energy can be recovered</li><li>• Select materials that degrade easily and benignly</li></ul>

Businesses should systematically and persistently seek opportunities for savings



**Closed Loops offer scope for financial and resource savings, but there is no single approach that is right for every situation**

- The classic Open Loop supply chain is part of a vast Closed Loop connected to the 'ecosphere'
- Closing the loop within a process can enable new ways of doing things
- Within a supply chain, reusable packaging can offer benefits in the right situation
- Product refurbishment and reuse; parts dismantling and salvage; materials recycling and energy recovery all play a role in post-consumer Closed Loops
- A wide variety of Ownership Models exist to provide incentives to participate in the Closed Loop
- The Reverse Logistic Chains is a key challenge
- Closed Loops are just one way to improve resource efficiency
- Action should be systematic and persistent



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