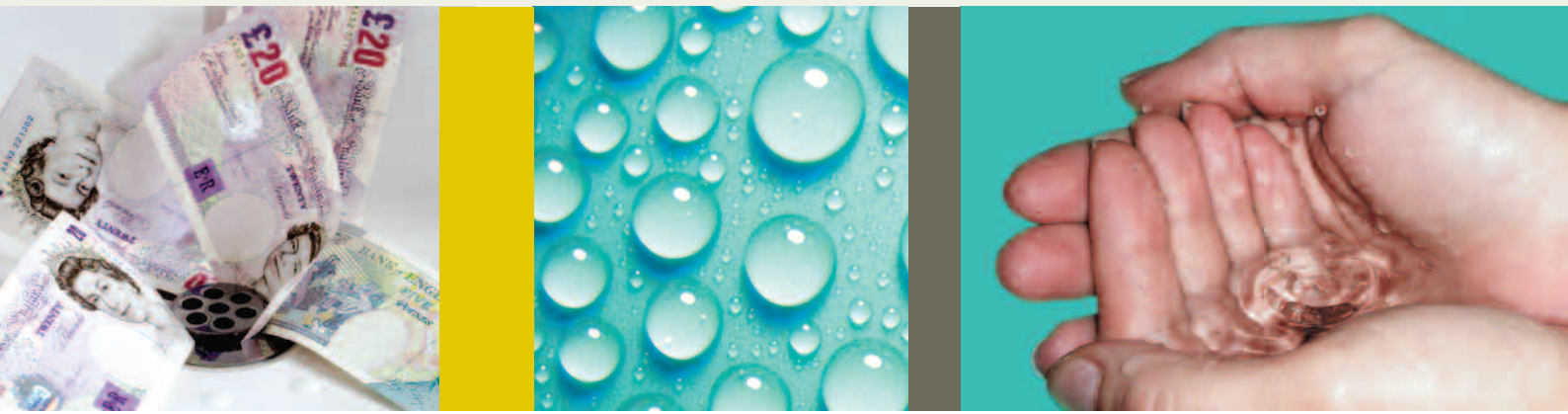


PRODUCT RECOVERY - REDUCING WATER USE AND IMPROVING RESOURCE EFFICIENCY



overview

This leaflet targets any business where cleaning pipework is an issue. It details the benefits of using product recovery systems and highlights the cost savings that can be achieved through their implementation.

In principle, any product that can flow in a pipeline can be recovered and, where possible, re-used. The cleared pipework then requires significantly less cleaning with water and/or chemicals.

A product recovery system uses a 'pig' which is typically an engineered plug or ball that fits inside the pipe and is pushed through by either the product itself or some other propellant (such as water, nitrogen or compressed air). The pig empties the pipe and removes deposits adhering to the walls.

In most cases this recovered material can then be re-used.



TIP: Rigid 'pigs' require perfect pipes and cannot tolerate misaligned joints, invasive welds, flexible pipes or damaged and dented pipework and will get stuck - retrieval of the pig may require removal of some of the pipe, which can be costly. However, it is possible to negate this by using a flexible pig. Furthermore, flexible pigs can negotiate tight bends.




In summary, the benefits of product recovery include:

- valuable product/raw materials are recovered for re-use;
- reduced water and chemical use required for pipe cleaning;
- reduced effluent load (chemical oxygen demand (COD) and suspended solids) of wash water;
- reduced effluent costs;
- reduced energy costs as less hot water and hot caustic is used to clean the pipes;
- reduced production downtime.

In one factory, removing product from filling lines using a pig recovered 12 kg of syrup from a short, self-draining line on every batch change. This saved £4,000/year.

This technology can also be used to remove water after sterilisation, cleaning-in-place (CIP) or manual rinsing. The removal of water often ensures that the next batch of product can be processed without the need to purge the line first with product, thus maximising raw material use.

 **TIP: A rigid pig will leave internal pipe surfaces dry and free from lubricant and, therefore, is not suitable for use if product recovery requires the pig to travel back through the same line; lack of lubricant may cause the rigid pig to get stuck in the pipe.**

Product recovery can be controlled from an existing PLC¹/SCADA² system (used to display information, log data and show alarms), or an operator push button.



TIP: For best results, consider product recovery at the design stage rather than retrofitting into existing pipework; where possible reduce pipe runs and bends. However, whether at the design stage or retrofitting, it is important that the product recovery system is designed specifically for the intended use. Using an off-the-shelf system that is not fit for purpose can result in inadequate cleaning and damaged pipework, which will require significant additional costs to rectify.

When using rigid pigs, typically, valves must be 'full bore' to allow the pig to pass through and any butterfly or diaphragm valves will need to be changed.

A jam manufacturer used around 10 m³ of water each day to wash vessels and pipework between batches. During cleaning, product was being discharged to drain; this has a high COD, resulting in high trade effluent charges. Fitting a product recovery system to the pipework **reduced water use by 2,000 m³/year, reduced effluents costs by £104,000/year** (80% reduction in effluent COD) **and product loss by £134,780/year (173 tonnes of jam)**. The capital cost for the product recovery system was just over £19,000, representing a payback period of around one month.

BENEFITS

The benefits of product recovery are:

- The 'pig' removes the majority of product (or raw material) in the pipe which can then be collected for re-use.

A manufacturer of salad dressings and sauces undertook a waste review and identified that large volumes of product were being lost when the production line pipes were being cleaned, resulting in high effluent charges. The introduction of a compressed air-driven product recovery system reduced the waste by around 50%, representing an **annual saving of £192,000 in recovered product and an £88,000 reduction in trade effluent charges**. An investment of £15,000 meant a payback period of one month.

- Flushing out pipework uses considerable quantities of water (often hot) and chemicals. A product recovery system will reduce water usage; the cleared pipework requires considerably less effort to clean. In some cases, it may not require any additional cleaning.
- Cleaning after product recovery produces low strength wash water, which will reduce effluent loads and disposal costs and may also avoid the use of an on-site effluent treatment plant prior to disposal to sewer.

¹ Programmable Logic Controller

² Supervisory Control and Data Acquisition



- In general, product recovery systems can clear pipework more quickly than cleaning with water and thus reduce production downtime.

TERMINOLOGY

The pig is sent from the **launch station** (front end of the pipe) to the **receiving station** (end of the pipe).

Propellant - refers to the substance that pushes the pig through the pipe. Propellants can be product (or raw material), water, nitrogen or compressed air.

Uni-directional - the pig is removed once it has arrived at the receiving station

Bi-directional - the pig can be propelled back to the launch station for the next cycle. The propellant can be liquid or air-based.

In some instances, there may be a need for two pigs (**dual pigging** operation): the first pig is pushed by the product to the receiving station.

This allows the product to be de-aerated and isolated. The second pig is then used to push the product from the line. Applications include the prevention of air mixing with the product (eg shaving gels) or preventing the release of CO₂ from the product (eg sparkling wine).

Cassette traps - specialised sections of pipework used to load and unload pigs to allow off-line manual cleaning.

Cleaning chamber - can be used to clean the pig in-situ at the launch station.



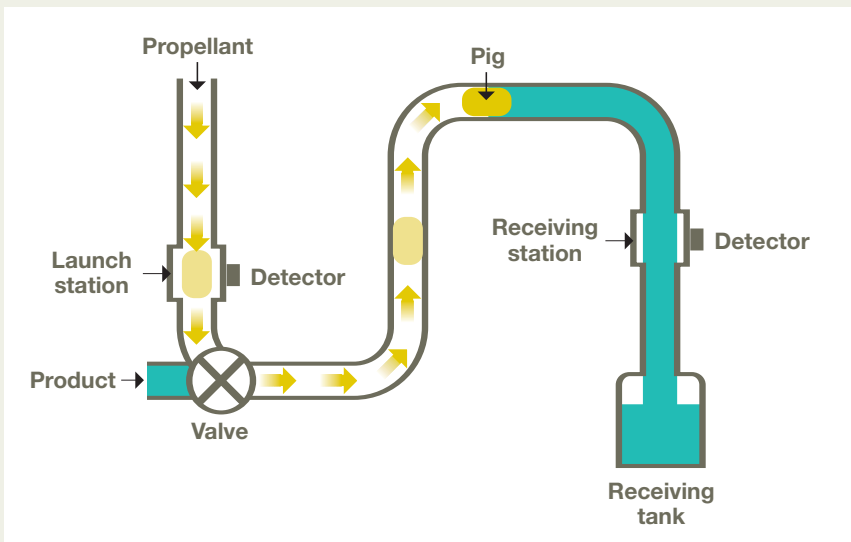
DETECTING THE PIG IN THE PIPE

Windows - these can be installed at either end of the pipe (ie launch and receiving stations) so that the operator can see the pig. This does not require a detection system and, as such, is low maintenance.

Magnetised pig - it is possible to magnetise the pig so that it can be detected at either end of the line. Detectors can be non-intrusive to the product lines and can detect the pig's magnetic field through the stainless steel pipe.

Schematic of product recovery

The pig is propelled from the launch station, through the pipe, pushing the product into the receiving tank. The pig stops once it reaches the receiving station. The pig is either manually removed from the receiving station (uni-directional pigging) or returned to the launch station using a propellant (bi-directional pigging). The pipework can then be washed, as required, before the next batch is processed. Detectors can be installed at the launch and receiving stations so that the pig can be easily located.



FURTHER INFORMATION

- Envirowise water pages www.envirowise.gov.uk/water
- Use WaterNet (www.envirowise.gov.uk/waternet) to identify the most relevant publications for your requirements.

Envirowise publications:

EN660 Reducing water use in catering establishments

EN661 Reducing water use in laundries

EN662 Understanding leaks, water pressure and meters

EN663 Reducing water use: showers

EN664 Reducing water use in washrooms: taps

EN665 Understanding water and wastewater bills

EN666 Reducing water use in washrooms: urinals

EN667 Reducing water use in washrooms: WCs

EN894 Reducing water use through cleaning-in-place (CIP)

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