



**ENVIRONMENTAL  
TECHNOLOGY  
BEST PRACTICE  
PROGRAMME**

# WATER USE IN THE METAL FINISHING INDUSTRY

*As an operator in the metal finishing industry, water is essential to several of your processes. But are you using too much? The data and advice in this Guide can help you to:*

- **save money on water and effluent bills**
- **perform better than your competitors**
- **improve your environmental image**



**EG45**  
GUIDE

## THE SURVEY

A confidential questionnaire was sent to operators in the UK metal finishing industry to gather data on acid and water use in the general metal finishing industry including the galvanizing industry<sup>2</sup>. Data were collated and analysed to enable an industry profile to be built, and to give statistical information on resource use. Although the data showed a wide variation even between similar organisations, possibly due to the use of different monitoring methods, useful comparisons can still be made and conclusions reached.

### General Metal Finishing Industry Profile

The profile from the respondents can be summarised as follows:

- approximately 50% of sites have fewer than 20 employees;
- 40% of sites have an annual turnover of under £1 million;
- under half the sites had readily available data relating water consumption to production;
- the majority of operators serve more than one sector of industry, with general engineering, automotive, architectural/construction, aerospace and domestic product sectors being the most common markets for goods;
- over 90% of all water used by the metal finishing industry is used in rinsing, with no sites metering rinse water separately.

### Specific Water Consumption Related to Production

The results of the survey show that specific water consumption varies greatly, with the least economical sites using several hundred times more water than the best. Data collected have been interpreted on the basis of  $m^3$  of water per  $m^2$  of product treated (Fig 1) and  $m^3$  of water per tonne of product treated (Fig 2). For those sites measuring production in  $m^2$ , 50% use less than  $0.175 m^3/m^2$ ; for those measuring production in tonnes, 50% use less than  $2 m^3/tonne$ .

### Specific Water Consumption Related to Site Size and Turnover

Data from the survey show that the amount of water used does not increase directly in line with site size,

Fig 1 Specific water consumption:  $m^3/m^2$  of product treated

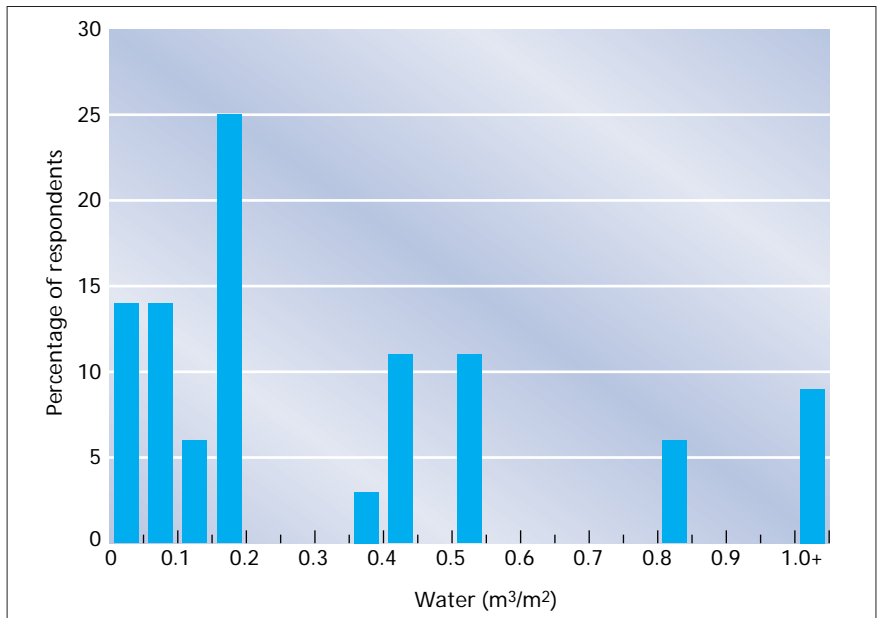
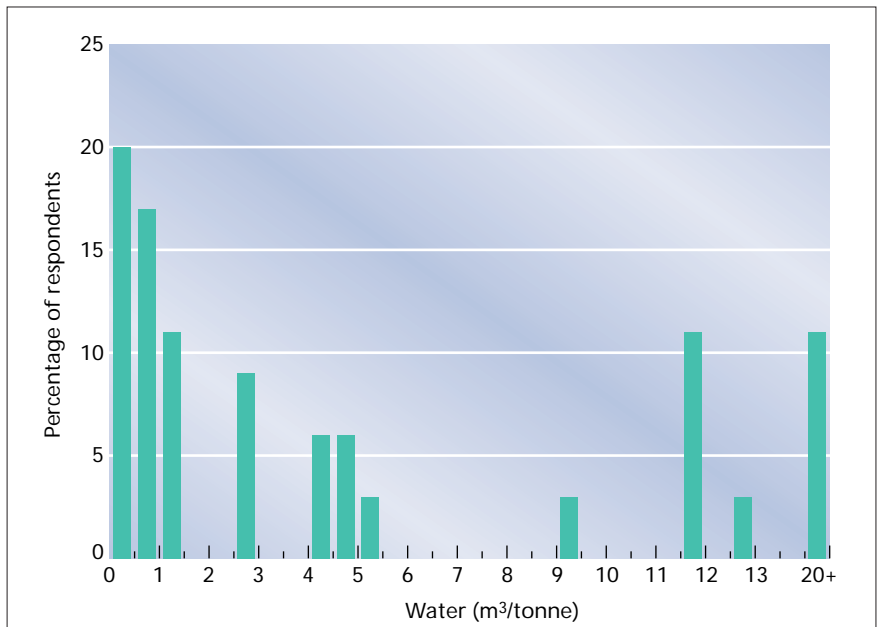


Fig 2 Specific water consumption:  $m^3/tonne$  of product treated



as estimated by the number of employees on site. Generally, smaller sites were found to use more water to process the same surface area than larger ones.

Average annual water consumption does, however, appear to be proportional to turnover (Fig 3), except for sites with the largest turnover. Possibly these largest sites invest more in water conservation or part of their turnover does not involve water use. The average water costs given in Fig 3 are based on typical water costs for an industrial area of  $\pounds 1.20$  per  $m^3$  (supply and discharge) and show that water costs amount to some 1% of turnover.

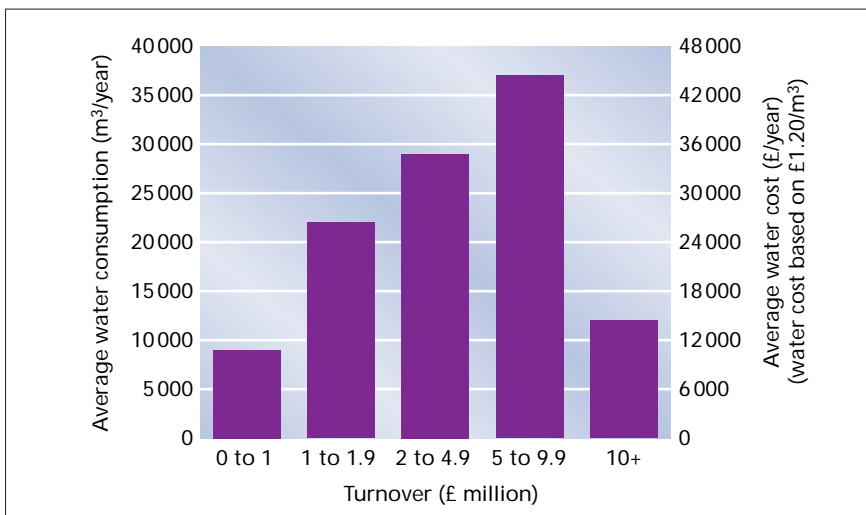
### Rinsing Methods

Dip tank rinsing is the most common rinse method used (over 60% of respondents). However, using dip tank and spray, or dip tank, spray and fogging spray are more economical in water use, with data suggesting potential water savings as high as 75%.

Dip tank water consumption is improved if two or more rinse stages are used, with survey data indicating water consumption savings of around 10% in sites using at least some multi-stage rinsing. Improved product quality can also result.

<sup>2</sup> This Guide contains information relating to water use in the general metal finishing industry only. Details of acid use in the general metal finishing industry are covered in EG44, while EG46 covers acid and water use in the galvanizing industry. Copies of these related publications can be obtained, free of charge, through the Environmental Helpline on 0800 585794.

Fig 3 Water consumption and its cost related to turnover



### Effluent Sludge Production

Increasing costs for effluent treatment and disposal of effluent sludge have made effluent control a key area for saving money. The costs can be high, reaching 90 pence/m<sup>3</sup> in some industrial areas. Trade effluent charges tend to be based on the volume of fresh water supplied, as well as the extent to which the effluent is contaminated, so **reducing the consumption of fresh water has a direct bearing on effluent costs.**

Sludge in the effluent (as slurry or filter cake) is usually sent to landfill, an increasingly expensive option. The survey showed that sludge production is not directly proportional to water consumption. In fact, sites using water more economically, for example those using two-stage rinsing, produce more sludge per unit volume of water consumed, because the contaminants from rinsing are concentrated into a smaller volume of effluent. Using a filter press to remove excess water, which is returned to the effluent treatment plant, increases the sludge to water concentration and significantly reduces the amount of sludge sent to landfill. **Data from the survey show that major reductions in sludge volume are being achieved in sites using filter presses, although fewer than one-third of sites currently use the devices.**

### Adoption of Water Conservation Methods

77% of respondents have already adopted some water conservation measures, with countercurrent wash systems and flow restrictors proving most common. **Savings of over 50% of fresh water demand have been achieved through the introduction of conservation measures, reducing both water supply and disposal costs.** Sites surveyed which use no conservation techniques all have a specific water consumption higher than average.

## REVIEWING WATER PERFORMANCE

### Monitoring

Measuring is vital to any review of performance. Unless you know where and how much water you are using, you cannot manage it effectively. Continued monitoring will reveal when savings occur, thus encouraging you to look for further improvements.

The water consumption table (Table 1) at the top of the next page allows you to calculate your specific water consumption. You can judge how well you are doing relative to your competitors by finding where your performance fits on Fig 1 (m<sup>3</sup> per m<sup>2</sup> of product treated) or Fig 2 (m<sup>3</sup> per tonne of product treated). **The columns to the left of your position indicate those companies with a better specific water consumption than yours.**

If you do your monitoring over a year, you will be able to use the water economy diagrams (Fig 4) to gauge how well you are performing against others in the industry. If you do your monitoring over any other period, you will have to adjust A, B and C in Table 1 to reflect annual values before you use Fig 4.

To use Fig 4, locate the value of either B (for area treated) or C (for quantity treated) on the appropriate horizontal axis, and A on the appropriate vertical axis to see which band you are in. Even if your performance matches the best 25%, there may still be areas for improvement and you will need to be vigilant to maintain your current position.

### Commitment

To make savings, the whole company needs to be committed to any water-saving strategy.

- Involve all operators in establishing the strategy, instead of just presenting them with your ideas and 'extra work'.
- Make sure that everyone is aware of the amount of water being used and what it costs.
- Invite suggestions for making savings, perhaps offering an incentive for the best idea.
- Set realistic targets for savings.
- Keep everyone up-to-date on progress being made.
- Recognise the contribution of operators in achieving savings.

### Considerations When Developing a Water-saving Strategy

Savings can be achieved in a number of ways, many involving little or no financial investment. The following list covers some of the most commonly used water conservation measures which may help you to establish a water-saving strategy.

#### Good Housekeeping

Surprising savings can come from simple good housekeeping. Allowing products to drain, both before and after rinsing, can save considerable amounts of reagent and rinse water. **Encouraging good practice will not only lead to savings in water consumption, but also in other areas, like energy.**

#### Flow Restrictors

Reduce the volume of rinse water to optimum levels by installing flow restrictors, in the form of simple valves or orifice plates, in the supply pipes. Good Practice Case Study (GC22), *Simple Measures Restrict Water Costs*, details the benefits of installing flow restrictors and of adopting good housekeeping measures for reducing water use. This publication is available free of charge through the Environmental Helpline.

#### Multi-stage Rinsing

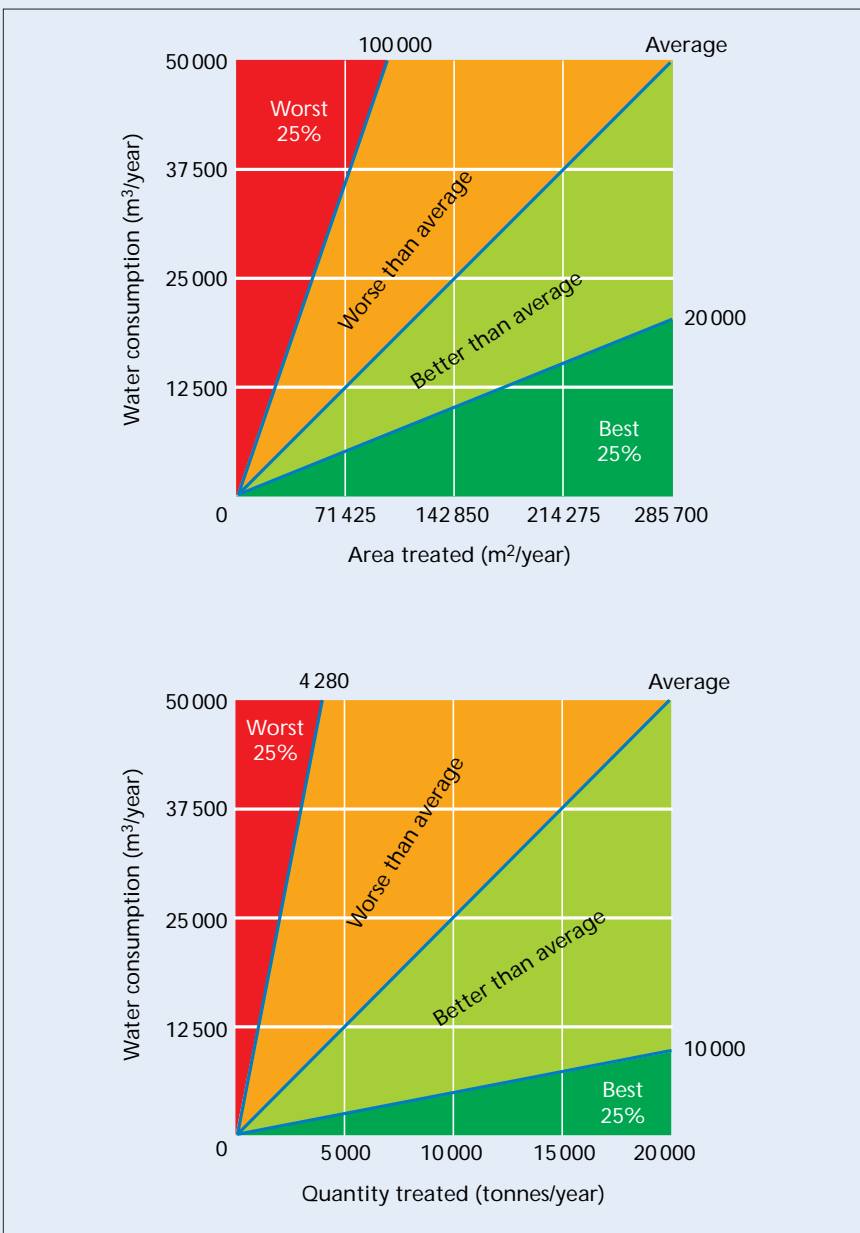
If you are using single-stage dip tank rinsing, consider adding one or more further stages. Not only will this improve your water economy, but it will also have a beneficial effect on product quality. If space is limited, there are tank designs that allow a single rinse stage to operate like a multi-stage system.

Table 1 Water consumption table - the first step in reviewing your water performance

Water used in a suitable time period, say one month (or one year)	..... m <sup>3</sup>	A
Metal processed in the same time period*	..... m <sup>2</sup>	B
	..... tonnes	C
Current specific water consumption	..... m <sup>3</sup> /m <sup>2</sup>	$\frac{A}{B}$
	..... m <sup>3</sup> /tonne	$\frac{A}{C}$

\*If you currently measure production in batches, estimate the equivalent surface area or weight processed.

Fig 4 Water economy diagrams



Countercurrent Wash Systems

Use countercurrent wash systems to rinse product. By having a series of wash tanks, cascading water from tank to tank in the reverse direction to the product re-uses rinse water and yet ensures that the cleanest water is used as the final rinse. Re-using rinse water in this way has been shown to cut the volume of clean water required by 70%. New Practice Case Study (NC11), *Rinsing and Chemical Recovery System Achieves Large Savings*, outlines the benefits of countercurrent rinsing, and is available through the Environmental Helpline.

Activity-based Control

Install devices which shut off the rinse water supply when it is not needed. Manual devices, such as foot switches, can be used, but it is often more efficient to install automatic devices, like timers and photo-electric cells or other sensors.

Conductivity Meters

Control the amount of make-up water added to a wash bath by installing conductivity meters, either as part of an automatic system to control the quality of rinse water or to enable manual control of water into the rinse circuit.

Recycling (after treatment)

Treat contaminated rinse water to remove impurities and re-use it for rinsing or divert it for other on-site uses, if demand exists.

Re-use

Dilute process chemicals with used rinse water, or use the water directly for other purposes. You need to make sure that the quality of the untreated rinse water is suitable, for example any impurities should not react with the process solution (see NC11 mentioned earlier).

Reactive Rinsing

If you are using both caustic and acid cleaning systems, use the discharge from the acid stream to feed the alkaline rinse circuit. This system can cut clean water requirements by up to 50%.

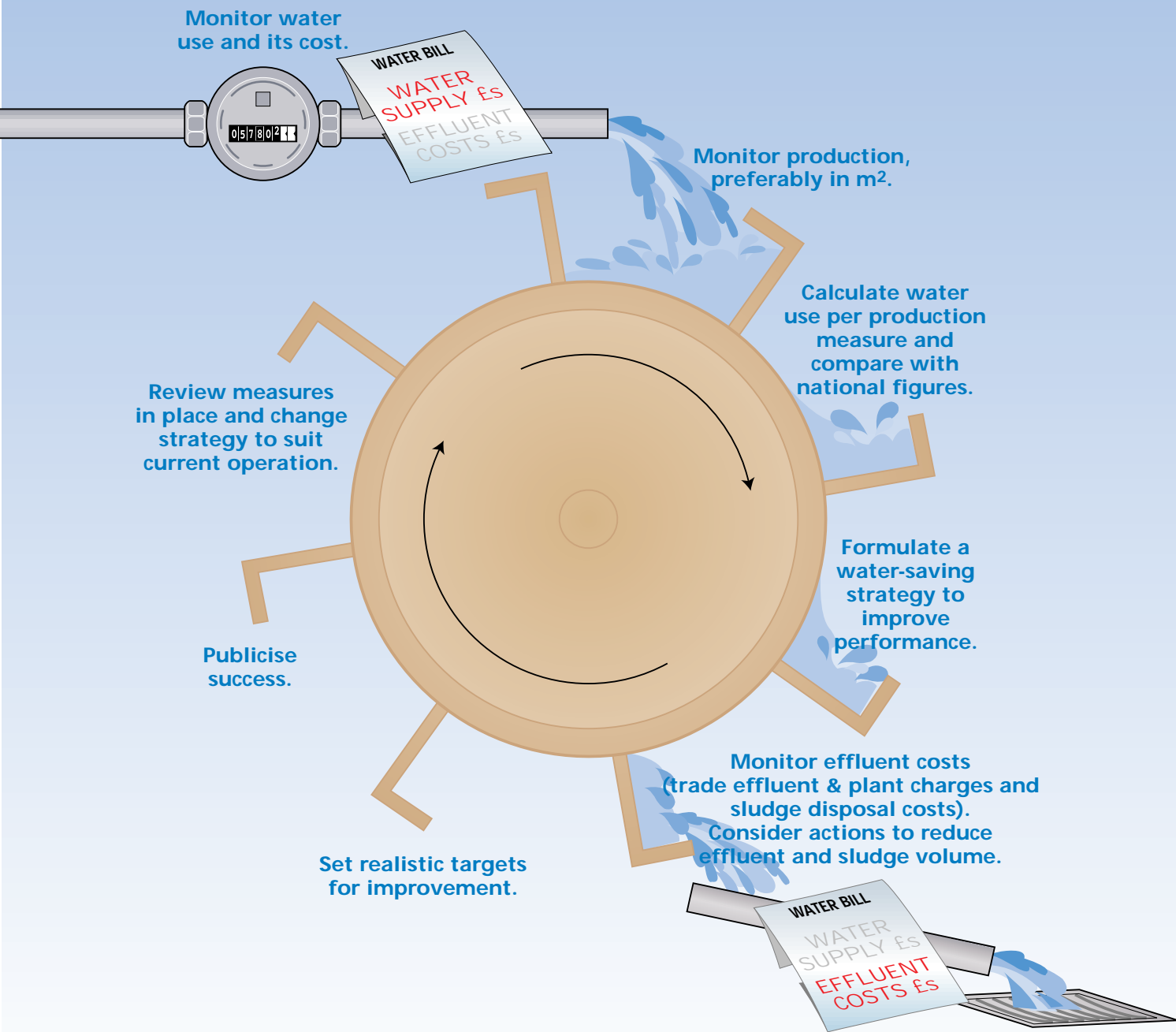
Filter Press

Use a filter press or similar de-watering system to reduce the water content of sludge, and thereby reduce the quantity of sludge sent to landfill.

It is important to review your water-saving strategy at regular intervals, to ensure that the options selected are still the best for your operation. Previously discarded ideas may become more attractive with changes in production, water use and its associated costs and legislation.



# Action Plan Water Wheel



This Guide was produced by the Environmental Technology Best Practice Programme.

Prepared with assistance from McLellan and Partners Ltd.

For more information about the Environmental Technology Best Practice Programme and how its free services can help you, please phone the  
**ENVIRONMENTAL HELPLINE 0800 585794**

<http://www.etsu.com/ETBPP/>

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