CIWEM Chartered Institution of Water and Environmental Management

Policy Position Statement

Sustainable Water Permitting

Purpose

More flexible and dynamic permitting offers opportunities for energy efficiencies to be achieved in treatment processes. This PPS sets out CIWEM's position on how sustainable permitting can offset energy consumption associated with increasing requirements for treatment, particularly relating to emerging contaminants.

CIWEM considers

1. Increasing regulatory requirements are likely to continue to drive energy intensive and high carbon treatment.
2. The emergence of a range of chemical contaminants is likely to require increased levels of water and wastewater treatment.
3. Increasing permit conditions are likely to require the construction and operation of a treatment plant.
4. Alternative, low-carbon treatments may be perceived as less certain of guaranteeing consent conditions, so hard engineering approaches have often been favoured.
5. Greater emphasis should be placed on the control of pollutants at source, wherever this is practicable.
6. Dynamic and catchment based permitting offer potential for more flexibility to reduce energy, chemicals and carbon.

CIWEM calls for

7. Collaboration and innovation between the water industry and its regulators to develop innovative and appropriate permitting solutions to meet the challenges posed by legislation, emerging contaminants and climate change.
8. A review of EU and UK regulatory frameworks to ensure they are fit for purpose and drive the appropriate quality outcomes, whilst meeting the needs of public health and the local environment.
9. Permits to, wherever practicable and appropriate, include increased flexibility and seasonal variability.
10. The importance and benefits of source control and catchment measures to be emphasised within regulation over end of pipe solutions, resulting in a more holistic approach to the reduction of water pollution.

11. An evidence base to be built from more dynamic permitting based on environmental conditions at existing treatment works.
12. A move towards composite compliance and away from spot compliance, where appropriate, for consenting.

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Context

In recent decades there has been considerable progress on reversing the damaging impact on the water environment of industrial discharges and intensive agricultural practice, which occurred since the industrial revolution. This has been a result of declines in heavy industry, improved land management practice, stronger legislation and implementation of its requirements by regulators, and significant investment by the water industry to improve the management and levels of treatment of wastewater discharges.

Greenhouse gas emissions from water treatment are approximately 2.1 million tonnes CO2 equivalent (MtCO2e) per annum for wastewater and 0.6 MtCO2e for drinking wateri in England. Approximately two thirds of emissions from the water industry may be derived from operational activities and the remainder from carbon embodied in the construction and maintenance of assets.

Point source discharges to the water environment are controlled by environmental permits issued by the Environment Agency (in England), Natural Resources Wales in Wales), Scottish Environment Protection Agency (SEPA, Scotland) and Northern Ireland Environment Agency (NIEA, Northern Ireland). Requirements and standards for drinking water quality are regulated by the Drinking Water Inspectorate in England and Wales, the Drinking Water Quality Regulator in Scotland and NIEA in Northern Ireland.

Permits for wastewater discharges typically include conditions relating to both effluent quality and quantity. These are designed to protect the quality of the receiving watercourse or water-body by meeting the Environmental Quality Standard (EQS) and the requirements of environmental legislation. The water industry is governed by a number of regulations, the most important of which include the Urban Wastewater Treatment Directive (UWWTD), the Bathing Water Directive (BWD), the Habitats Directive (HD), the Water Industry Act (WIA) and the Water Framework Directive (WFD)ii.

Environment Agencies, other regulators (e.g. Ofwat) and increasingly water companies (e.g. Scottish water and NIWater) have a statutory duty to contribute to sustainable development and consider the carbon impacts of their activities. Scottish Water also has a statutory duty under the Climate Change Act 2008 to contribute to the achievement of Government targets to reduce carbon dioxide emissions and in England and Wales, companies are required to follow Defra's Statement of Obligations which requires them to contribute to overall Climate Change Act targets.

There is increasing interest in more flexible permitting systems. The intention is that these would allow the growing concerns of energy consumption, carbon emissions, cost and other sustainability requirements to be balanced, whilst meeting the requirements of regulations. There is also a range of new contaminants which are very challenging to remove at source (e.g. pharmaceuticals) and which have a long term risk to public health or the environment which may be poorly understood. Sustainable permitting also recognises the benefits of managing water in a more holistic manner, often at the catchment scale with the collaboration of a wide range of stakeholders.

The Environment Agency has identified a range of strengths and weaknesses of the current permitting system for Englandiii:

STRENGTHS	WEAKNESSES
Well established and compliant with current legislation Delivered quantified improvements in water quality Based on environmental need Principles are simple and understandable Enforceable	Point discharge focused Limits innovation No ability to recognise or reward outperformance Outperformance can lead to tighter standards Does not encourage multiple benefits Procedures and processes for regulation and compliance assessment are complex and bureaucratic
OPPORTUNITIES	THREATS
Although deemed to be inflexible, there are opportunities to use the process more flexibly Opportunity to link intermittent and continuous discharges in a single permit Opportunity to link abstraction licences and water quality permits Better catchment planning could lead to better or more efficient carbon and energy savings Provide multiple wider benefits	Current system may not be sufficient to drive improvements needed to achieve good status in all water bodies by 2027 Current system may not be resilient to climate change

Table 1. Strengths and weaknesses of the current permitting system for England, Environment Agency

Key Issues

Regulatory requirements are likely to continue to drive high energy and carbon treatment

Legislation and regulation have driven a marked improvement in the quality of the water environment. However, many of the regulatory drivers to which wastewater treatment is required to operate were written before carbon was a concern.

Older Directives, such as the Urban Wastewater Treatment Directive, did not take into account carbon and carbon equivalent emissions resulting from consent conditions and could have

unintended consequences on greenhouse gas emissions. More modern directives such as the WFD do relate to environmental objectives and are starting to consider the wider carbon impacts, (e.g. the cost-benefit analysis for the WFD and Priority Substances Daughter Directive including the cost of carbon in decision making). The Environment Agency continually reviews guidance on how permitting under the WFD is regulated, to allow the water industry to achieve efficiencies without the risk of failing permit conditions. When considering disproportionate cost and technical infeasibility, carbon impact is now a consideration.

CIWEM considers that there is a need to ensure that EU and UK regulatory frameworks are fit for purpose and drive the appropriate quality outcomes, including carbon. A review should consider EU directives, how they have been transposed, and how they are implemented. The Environment Agency will need to take a holistic approach to regulation in order to address the weaknesses it has identified in table 1. This will require the cooperation and collaboration of the water industry and the economic regulator. Such collaboration is increasingly observed, which is to be welcomed. It is likely that the development of a permitting system which is able to appropriately address the wide range of pressures now observed, will be a major challenge for the water industry and its regulators over coming years and decades.

Emerging contaminants are likely to require increased levels of water treatment

The emergence of a range of chemical contaminants in both drinking and wastewaters, as a result of improvements in analytic chemistry and its appliance to the environment, has led to the need for increasing levels of water treatment. Many such compounds are anthropogenic in origin, arising from commercial products, which enter the water cycle and are understood by scientists to pose potential long-term human and environmental health risks even at the low concentrations at which they are commonly found.

Whilst more conventional pollutants, such as ammonia, have clear thresholds above which the risk to the environment is evident (e.g. fish die due to lack of dissolved oxygen), these emerging contaminants often occur at low levels and their effects may only become evident over the long term. Examples such as the impact of oestrogenic compounds on aquatic ecology are now quite well researched and understood, however an understanding of their associated risks and the evidence base for the impacts of a large number of compounds is limited. A better understanding of these risks would be able to inform appropriate management actions.

Increasing permit conditions are likely to require the construction and operation of a treatment plant

Permit limits are calculated using the full range of river flows, represented in a complete flow duration curve, with the calculations providing to the permit holder the benefit of the dilution provided by the complete mix of high, low and moderate river flows.

Typically to achieve permit conditions will require the construction and operation of a treatment plant (source control may be possible in a small number of cases). The construction of plants requires the use of materials and energy with their associated embodied carbon emissions. This means that the benefits of such actions to improve one or more environmental parameters can often have associated negative impacts on another. Additional emissions will

typically be associated with manufacture of any chemicals used as part of a treatment process and biological processes often produce direct emissions of CO2 or methane. Additionally, there are also likely to be emissions associated with treatment and disposal or recycling of residual waste materials.

Alternative, low-carbon treatments may be perceived as less capable of guaranteeing consent conditions

Sustainable treatment systems which use less energy and produce less residual waste have been developed. Unfortunately such 'soft systems' may be perceived to be less capable of guaranteeing consent conditions than 'hard' engineering systems. They may also have a much larger land take and be more expensive, hence are less likely to be supported by financial regulators. Hard engineering processes are therefore preferred. Ofwat's recent efforts to remove capital expenditure bias in water company planning is welcome in that it may provide a greater incentive to companies to reduce headroom in treatment plants and focus on greater efficiency across a range of assets to deliver the same outcomes.

Whilst demand management is not a treatment option, it can play a key role in reducing the carbon footprint of water treatment, simply by requiring less water to be treated. Energy is expended putting treated water into supply, pumping it long distances and then treating the associated effluent. The average per capita consumption is 150 l/h/d in the UK and Defra has set a target of an average of 130 l/h/d by 2030. Other European countries such as Germany and Belgium have average consumption levels already significantly below this target level.

It is important that the wider impacts of housing and infrastructure development which impact on demand for additional permitting and water treatment and consequently the environment are fully understood. The concerns of the regulator must be appropriately recognised in relation to planning applications and in strategic level plans such as Local Plans.

Greater emphasis should be placed on the control of pollutants at source, wherever this is practicable.

Historically much regulation relating to wastewater treatment has focused on end of pipe solutions. It is now widely recognised that diffuse pollution can seriously undermine the value of investment for point source discharges and this is now a far greater subject for attention.

Source control must be an integral part of the application of new regulatory regimes for quality, particularly the Priority Substances Daughter Directive. This has the potential to be very costly and energy-intensive if applied 'end of pipe' rather than in controlling the original sources. Broadly speaking, source control or more upstream solutions often represent the most environmentally beneficial solution and are better suited to addressing challenges associated with diffuse pollution. Efforts by Defra to roll out the catchment based approach with a strong focus on tackling diffuse pollution, as well as growing recognition of the benefits of such approaches by Ofwat, are welcomed.

Dynamic and catchment based permitting allow for more flexibility to reduce energy, chemicals and carbon

Water companies are often risk averse when it comes to avoiding failure against their permit conditions. Water companies may take the approach whereby they set themselves a limit approximately 10% lower than the compliance level set for a parameter in order to allow themselves a safety margin. It is common, depending on the substance being treated, for companies to treat to as low as a tenth to a half of the discharge consent value in order to ensure compliance. This is often due to variance in influent quality or process efficiency. Whilst this approach may lessen risk, it results in significant extra energy use and carbon emissions to treat effluent so intensively. These risks become more pronounced when very small quantities of a substance require advanced treatment, the technologies for which may be new and there may not be extensive records of data to understand the exact levels of treatment required.

'Level playing field' directives such as the Urban Waste Water Treatment Directive can often result in treatment which may not be necessary, as the self purification capacity of the environment may still allow environmental objectives to be met.

There is some scope for seasonally varying permits (e.g. in some locations it may be possible to discharge higher loads of ammonia in winter when river flows and dilution rates are higher). Although from a practical perspective there are limits to how much treatment can actually be saved using such an approach. Some permits already include seasonal parameters such as UV treatment for bathing waters. However, this can be controversial where there may be year-round recreational users such as surfers.

There is a need to build evidence from more dynamic permitting, based on environmental conditions, at existing treatment works. This is starting to happen. The Environment Agencyiv and Severn Trent Water are undertaking trials on this approach and modeling them using catchment models with the aim of a more dynamic approach to consenting. Yorkshire Water are undertaking similar work with the ultimate aspiration a situation whereby all abstraction and discharge consents are dynamically controlled and variable, balanced and centrally controlled, to deliver a significant reduction in energy, chemicals and carbon.

There are opportunities for increased use of advanced process control (APC), allowing increasing or decreasing levels of treatment according to the status of influent and receiving water. Such telemetry may assist in reducing the need for such large margins for error in guaranteeing compliance with permits, as described above. UKWIR researchv found that the response under APC offers scope for reducing the headroom between normal operation levels and the permit conditions limit. At the same time, it must be recognised that the number of treatment plants which can be controlled dynamically is quite limited and this approach is most likely to be successful at larger treatment works.

UKWIR also found that whilst there may be energy savings to be found with APC (up to 20% but varying on a case by case basis), more widespread future use, allowing treatment plant to operate closer to permit limits, could impact upon compliance with WFD objectives for the receiving water. In this case, it is likely that permit limits would be tightened accordingly by environmental regulators to ensure compliance. There would therefore need to be a balance struck between the energy savings which may be derived from APC and the potential for it resulting in tighter permit limits.

The Environment Agency has facilitated discussion around a number of possible levels on the potential for a more flexible permitting approach and sought views on how this might workvi. These indicated that broadly it might consider an appropriate outcome (such as operational performance for a sewerage network or an environmental objective for a water body or catchment), linking up individual consents under one overall permit. Then, the optimum combination of consent conditions would be employed to meet the objective in the most carbon and/or cost effective manner. This arrangement may be quite straightforward, e.g. in the case of direct discharge permits for a single water company sewerage catchment.

More complex scenarios, for example a whole catchment with a range of discharges and dischargers, might be brought under one permit issued to a single legal entity. This could allow the principal discharger to work in collaboration with others to establish the most effective combination of discharges. There could be an option of investing in actions to limit discharges other than its own, if this represented a more efficient way of meeting the objective of the overall permit. This approach has not been employed in England and Wales as yet, due to practical and regulatory barriers, but it represents a possible direction of future travel, particularly in the context of the Catchment Based Approach (CaBA). The Environment Agency considers that there will be lessons to be learned from the Abstraction Reform process, which will take place between now and 2030, and which could assist in the delivery of a more dynamic, catchment-based permitting approach.

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Note: CIWEM Policy Position Statements (PPS) represents the Institution's views on issues at a particular point in time. It is accepted that situations change as research provides new evidence. It should be understood, therefore, that CIWEM PPS's are under constant review, that previously held views may alter and lead to revised PPS's. PPSs are produced as a consensus report and do not represent the view of individual members of CIWEM.

References

i Defra. 2008. Future water – the Government's water strategy for England.
ii Environment Agency. 2009. Transforming wastewater treatment to reduce carbon emissions.
iii Environment Agency. 2011. Developing and assessing options for catchment permitting.
iv Severn Trent Water – balancing carbon and ecology.
v UKWIR. 2013. Role of wastewater process control in delivering operating efficiencies.
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