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Sewage effluent assurance: a new future?

With sewage discharges and their monitoring the focus of political, media and campaigner attention there is considerable change to come. The monitoring approach should be strengthened, but also provide a more accurate description of effluent quality assurance. Peter Matthews and Alastair Chisholm set out a way forward which builds on the recommendations by the Worshipful Company of Water Conservators.

Demand for more stringent sewage effluent monitoring and enforcement has been growing for some time. The Environment Agency (EA) recently [consulted](#) on changes to its permit charges to enable “tougher action on pollution.” Environment Secretary Steve Barclay last month [announced](#) a fourfold increase in inspections by the end of 2025 and tenfold from April 2026, supported by recruitment and upskilling of EA inspectors.

The concerns over the monitoring and reporting of adventitious discharges, such as storm overflows or treatment works major failure has become conflated with concerns over that of continuous effluent discharge. This article focuses on the latter as any changes to that could have very serious consequences as is described below.

Operator self-monitoring (OSM) by water companies has for some time been referred to by campaigners as “marking their own homework”. Under the approach, water and sewerage companies are required to sample their treated effluent discharges, reporting results and flag any breaches of the monitoring and analytical requirements.

The EA audits this process and told the House of Commons Environmental Audit Committee’s 2021 inquiry into [Water Quality in Rivers](#) that it was “confident in the effectiveness of our regulation and our ability to hold the water companies to account.”

The pressure has come from [evidence](#) and testimonies in television media that companies frequently circumvented proper process and the EA’s auditing was infrequent and inadequate. This prompted calls for an end to an over-reliance on OSM (after inspections progressively decreased in frequency following OSM introduction) and an increase in inspections (and where appropriate, enforcement).

This doesn’t mean that OSM *per se* should end, however. It should provide valuable data but must be supported by sufficient regulator monitoring – which is on the way back. And this whole discussion requires clarification and confirmation of what is understood by ‘compliance’.

The current monitoring and compliance system is founded on sound statistical principles, but clearly the quality assurance framework in which it is embedded needs urgent attention.

What is compliance?

The core principles of dealing with the sanitary content of used water was established at the turn of the 19th and 20th centuries by the reports of the Royal Commission on Sewage

Disposal which established standards of 30 mg/l suspended solids (SS) and 20 mg/l biological oxygen demand (BOD). These were incorporated later into discharge consents. In some cases, tighter standards were needed to protect receiving waters and additional treatment was provided.

For many decades these were treated as norms and were the basis of wastewater treatment plant design. Persistent exceedance was used as a basis for investment and planning embargoes by government departments, local authorities and, after 1974 by Regional Water Authorities (RWAs).

Fundamentally the approach was an appreciation that however well-managed, the sewage treatment processes being biological would exhibit performance variations reflecting such factors as fluctuations in flow and temperature. In the late 1970s and early 1980s however, there was an increasing demand for more precision and accuracy on what was meant by non-compliance. This arose from concerns by the Regional Water Authorities (RWAs) on government restrictions on investment, the increasing threat of private prosecutions and the need for better data to serve the increasing use of computer models of river water quality management. The current situation has echoes of those times.

It was agreed that the concept of compliance for 95% of the time for a prescribed standard in a consent was right for the challenges being faced. Adherence to this performance ensured that a receiving river was protected but that it would be necessary to put a cap on the 5% exceedance. Further it was agreed that the bigger the works the greater would be the need for confidence in the assessment of percentile compliance, the asymptotic value being 95%.

These were principles from quality assurance in production management and toxicology for example. They were later further established by UKTAG (UK Technical Advisory Group on the Water Framework Directive 2000). A 95th percentile is routinely used in compliance assessment in UKTAG guidance, even though the standard is referred to as an 'Absolute Limit'. This is because the use of 95th percentile allows confidence of failure to be calculated. The principles were defined in [guidance](#) by government in 2019.

These standards for compliance were formalised in the mid-1980s in the form of the look up table (LUT); a simple way of expressing these concepts in consents. These were based on 24-hour composite samples for SS and BOD, which were chosen in preference to spot samples as it was recognised that there could be very short-term variations during a 24 hour period, in themselves of no consequence, and it was the overall daily variation which needed to be controlled.

An upper tier value was also set to avoid extraordinary events within the LUT envelope. Assessments were made for each determinand separately, then applied universally to all consents for treatment works serving populations more than 250 people. Most works had the Royal Commission limits, but some were more stringent and some less stringent (e.g. in coastal areas). Ammonia limits which were becoming more important and subject to the same process variability as BOD and SS, so these were included too.

There was a more flexible attitude towards other determinands, as these were perceived as less critical terms of investment and prosecution and set as absolute limits with assessments on a sample-by-sample basis. This approach was formalised with the implementation of Part Two of the Control of Pollution Act 1974.

Monitoring under the microscope

At that time the RWAs were self-regulating and monitoring. It made sense that the monitoring data should also be available for external bodies to take action and the monitoring data was made available on registers. These are the deep roots of what we do now.

There was understandable pressure to separate environmental regulation and this was one of the elements behind privatisation and establishment of the National Rivers Authority (NRA) in 1989.

The Urban Waste Water Treatment Directive 1991 (UWWTD) adopted the direction of travel of the UK with some tweaks including introducing nitrogen (N) and phosphate (P) limits in nutrient sensitive areas though these were not covered by the LUT. The biggest change was of course the extension of the need for full treatment for larger populations in coastal areas, and the consequent demise of long sea outfalls and sedimentation only treatment. So, operator monitoring was assumed, but not specified within the Directive. The [EA guidance](#) in 2018 describes it as self-monitoring.

The Directive was enacted in 1994 with the LUT and flow proportional sampling. So, the existing UK approach was more demanding than the 1994 Regulations apart from the addition of total N and P limits in nutrient sensitive areas (and the extension of treatment to coastal works). Even though the removal of N and P was to be effected by biological processes, the LUT was not applied. These regulations are extant.

The emergence of the formal concept of Operator Self-Monitoring (OSM)

Quite rightly, there were demands that the system was made more rigorous and to apply the principles of quality assurance management more robustly. So, in 2009 the formal concept of OSM emerged. In 2023 following challenges to these concepts, Defra set out a [defence](#) of OSM and stated that:

“In 2019 the EA increased, not decreased, its regulatory scrutiny of sewage treatment works to include auditing, data analysis and other interventions as well as inspections. This removed the outdated inspection guidance and replaced it with action to use a wider range of regulatory tools. This increases the level of scrutiny, rather than reduces it.”

Arguably, a key issue is how effective the application of the quality assurance processes have been through this approach.

The 2009 guidance underpinning OSM set out various requirements, including on numeric compliance:

- LUT compliance limits
- maximum and minimum compliance limits, such as upper tier, lower tier and absolute limits
- mean compliance limits
- percentile compliance limits
- comparative compliance limits
- Urban Waste Water Treatment Regulations (UWWTR) numeric compliance limits.

The guidance stated that the EA normally only use the percentile limit for routine sampling of water company treated sewage discharges, on the following sanitary parameters:

- Biochemical oxygen demand
- suspended solids
- ammoniacal nitrogen
- colour
- chemical oxygen demand.

Other guidance provided for samples to be flow, composite or spot samples. The EA would be inspecting and sampling where necessary. LUT requirements for sanitary determinands would operate in accordance with the consent requiring composite samples, but it also provided for spot sampling for other kinds of discharge.

The results collected by the operator were to be submitted regularly to the EA and exceedances against LUT were to be reported immediately, particularly for category 1 and 2 pollution incidents and are recorded as 'self-reported'. Clearly there was scope for site visits by EA staff, although there does not appear to be a specific document on inspections process.

The guidance aligned with the monitoring certification scheme of the environment agencies of England and Wales (known as MCERTS) and it referred to Operator Monitoring Assessment (OMA). This assesses the management and performance of an operator's monitoring arrangements to identify any improvements needed.

There was further elaboration of self-reporting as an obligation to report any breach of consent conditions potentially causing pollution for any other kind of discharge. This has been the topic of intense media interest, particularly in the process for the categorisation of the impact of discharges. Self-reporting is a different matter to self-monitoring but both are key elements of OSM.

Quality assurance: a new future?

There is a complexity in the systems around the monitoring of sewage effluents. Focusing on the decision around OSM in 2009 misses nuance, as from a historical perspective it was an important – but just one – step in a long journey. The current focus should be on the guidance since 2018.

It may well be that the complexity of the guidance is an impediment to understanding. So, there is an urgent need to pull all the documents together and review how effective the guidance has been and how it can be strengthened and implemented fully, couched in terms of smarter regulation.

There are very legitimate reasons why inspections should be increased. There are extensive questions over how effective self-reporting has been which need to be addressed. This needs to be aligned to a reconfirmation of the approach and full training of inspectors and works operators on the process. And any failure of cooperation by dischargers must not be tolerated.

Any future quality assurance of effluent quality must be based on the 95-percentile concept with confidence limits, and on a time series of flow proportional sampling i.e., the LUT. Any

move from this premise would have significant consequences in terms of compliance assessment. For example, a shift in the basis of LUT to spot samples to suit compliance assessment by the EA would cause a statistical shift of assessment of a perfectly acceptable effluent from compliant to non-compliant.

There are two options to retain the integrity: the first is that the monitoring – in accordance with the terms of the LUT – is conducted by the EA. This would have huge resource demands and would parallel the necessary monitoring – by water companies – as part of responsible process management. The second is to leave the focus with water companies with a much more rigorously controlled quality assurance system, including more inspections by the EA. The latter is more practical and offers the best opportunity to maximise the richness of the performance picture.

In responding to the focus of the current debate, but retaining the fundamental principles of quality assurance management, the strengthened system should be framed more accurately to give the more accurate and informative description of Effluent Quality Assurance (EQA). The additional resourcing within the EA for inspections arising from the revision of the charging scheme could contribute to the costs of the new EQA system.

There will be a need for upskilled operators to deliver against an EQA system. Whilst Directors would retain overall legal liability, a suitably qualified senior manager (we suggest a Chartered Water and Environmental Manager) should be appointed to oversee EQA. The current model of the Health and Safety Manager in a water company might be a starting point for this approach.

This whole topic of monitoring has significant implications, because the judgments of performance which emerge are crucial not only for conservation of the environment, but also determine where and what investment is needed. It forms the basis of any legal action, and plays a major role in trust through presentation in the media. Greater legal rigour will need greater information rigour.

Summary:

The way forward for Effluent Quality Assurance starts with:

- Consolidated guidance that everyone can understand
- A clear articulation of how the new inspection regime will work
- Benchmarking with other quality assurance schemes, including the success of the Drinking Water Inspectorate's schemes, and learning from ISO14001
- The appointment of an appropriately qualified (e.g. CIWEM) EQA Manager in each water company, overseeing the excellence of the scheme.

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