The benefits of drinking water quality regulation – England and Wales

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Abstract This paper aims to demonstrate that the regulation of drinking water quality in England and Wales has been successful in securing the improvements to drinking water quality resulting in better performance against EU and national standards. The water industry in England and Wales went through a major change in 1989 when suppliers were privatised and the government set up a robust regulatory regime. The regime was necessary as the industry was, as a result of privatisation, a monopoly with customers having no choice of supplier, unlike what was later available with other utilities such as gas or electricity. The regime would protect the interests of the consumer, the environment and public health through the quality of the product. The Drinking Water Inspectorate (DWI), as established in 1990, had to ensure the implementation of the European Drinking Water Directive (DWD) that had been transposed into national legislation. The aim of the DWD is to ensure that all EU Member States provide drinking water of a prescribed quality. In England and Wales, a body was required to oversee the performance of the industry against those standards, reporting to the Government and the European Commission.

Through acts and legislation, the set up of the industry, the duties of the suppliers and regulators and the powers available to the regulators were established. The improvements to drinking water quality since privatisation were achieved by massive investment of the privatised water industry overseen by an independent regulator with clear duties and the powers to inspect, enforce and prosecute. The DWI's achievements show that to improve quality performance with the ability to report in detail how the improvements were made with extensive data evidence, a special regulator is required. The DWI advises policy departments and Ministers and when there are serious concerns regarding a threat to human health through drinking water, the highest level of regulatory power is the creation of new legislation, for example, the *Cryptosporidium* regulations that are unique to the UK. The DWI is more than what is traditionally thought of as a regulator because it has a single remit – drinking water quality – and its style of regulation has been key to improved drinking water quality in England and Wales.

Keywords Drinking water quality; inspectorate; regulation; regulator

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Introduction and background

For the water industry in England and Wales, a major turning point in its development came in 1989 when the then Conservative Government privatised the ten large Regional Water Authorities that dealt with all sewage and most drinking water. At that time, there were also 29 small water only companies already in the private sector but these were controlled statutory companies and were now allowed more financial freedom. The Government's reasoning for privatisation was mainly influenced by the fact that the industry had been severely under-funded for decades, resulting in limited improvements to service and poor drinking water quality. One of the solutions for addressing the lack of funding was privatising the industry to allow private investment in the 39 water suppliers instead of the less flexible and more limited public borrowing. The privatisation process included the government writing off £5.2 bn of debt and the cash injection of £1.6 bn known as the 'green dowry'. The Department of the Environment (DoE) produced a white paper in 1986 proposing privatisation of the industry (Ofwat, 2005) stating that 'profit was a more effective incentive than Government control'. During consultation, it was clear that one

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of the major concerns for a privatised utility was the need for regulation. The Water Act 1989 established the industry and regulatory framework. The ten Water Authorities were privatised, for the non-privatised element of their environmental responsibilities, the National Rivers Authority (subsequently merged into the Environment Agency (EA)), was charged with the regulation of quality of rivers, lakes and bathing waters, the Office for Water Services (Ofwat) was set up as the economic regulator and the Drinking Water Inspectorate (DWI) was responsible for regulating drinking water quality.

Another of the incentives for privatisation was that the water industry was failing to achieve the requirements of the European Community Directive for Drinking Water (Council Directive 80/778/EEC relating to the quality of water intended for human consumption). The Drinking Water Directive (DWD) that was compliance mandatory by 18 July 1985, applied to all members of the European Community (EC). Initially, for England and Wales, the DWD implementation was through administrative means. By 1985, the European Commission was threatening to take the British Government before the European Court for the unsatisfactory implementation of the Directive and this was therefore an important incentive for the Government to assess the framework of the industry with the intention of meeting the requirements of the DWD. The lack of structured regulation of the water industry caused difficulty regarding the gathering of the information necessary to prove the DWD had been fully implemented and that the standards for the parameters listed were being met. The solution was to transpose the requirements of the Directive into national legislation, namely, the Drinking Water Supply (Water Quality) Regulations 1989 (the Regulations), and set up the industry and regulatory framework in the Water Act 1989 (both subsequently superseded).

Therefore, a combination of the need for investment in the industry and the necessity for compliance with the DWD were the incentives that resulted in the privatisation of the water industry in England and Wales and the establishment of the regulatory framework that exists today.

The regulators

Before privatisation, the funding of the water industry was under the control of the Treasury. It was the responsibility of the DoE Water Directorate and its technical advisors to work with the funding arrangements provided by the Treasury and keep the delivery of the service. Once all of the suppliers were in the private sector, a new dynamic was introduced: profit. The suppliers now had to demonstrate that the water industry was profitable, to secure the private investment. In order to protect the rights of the consumers who were now paying their bills to private monopolies, Ofwat reviews all the work carried out by the suppliers as far as capital maintenance, asset maintenance, improvement programmes, etc. are concerned. This is carried out in cooperation with the DWI to ensure that work is necessary to meet certain targets such as, for example, the quality standards in legislation. There is also cooperation between Ofwat and the EA to ensure that environmental targets are met cost-efficiently.

Performance of the regulatory regime

The performance of the financial and economic side of the industry is well documented and is still a topic covered frequently in city seminars and conferences. Equally well reported is the subject of the environment for the water industry including all other water related Directives, e.g. for Bathing Water and Urban Waste Water. The performance of the third regulator, the drinking water quality regulator, has been somewhat overlooked since its creation at privatisation. The improvements to drinking water quality have been achieved by various methods utilised by the DWI in cooperation with the tasks that have to be fulfilled by the other water industry regulators.

Achieving the standards

At privatisation, the quality of the drinking water being supplied to consumers was not at a level that could be considered as performing well against the standards. Although this was known within the industry, it was not a fact that could be reproduced in hard data until the enhanced monitoring brought in by the DWD was being carried out. It is noted that monitoring was taking place before the implementation of the Directive in England and Wales; however, it was not substantial or structured enough for an accurate picture of the drinking water quality situation. The suppliers' water quality personnel understood their water supplies and where the water quality problems were, they could therefore quite accurately suggest where the water quality problems were, based on their knowledge and experience. Once the water quality data was being produced through the new monitoring schemes, the suspicions of the suppliers were sometimes confirmed, and most importantly, there were now the facts to prove exactly where the problems were and to their severity. The new, more robust data was the most rigorous way to demonstrate to Ofwat that funds were required to facilitate remedial action. Where problems specifically concerned the quality of drinking water, the Inspectorate would play a very important role.

The national legislation included the requirements for sampling methods, the performance of analytical methods and analytical quality control. These requirements were necessary as the industry was based on 'self-regulation' whereby the suppliers would take all samples and carry out analyses. The results of the analyses would then be submitted to the DWI and action taken upon assessment. As regulatory action was based on the supplier's analyses, it was imperative that they be robust, with the DWI confident in their accuracy and that they were representative of quality of the water supplies. This is the most efficient form of independent verification as prescribed in the World Health Organisation (WHO) Guidelines (third edition), as it does not involve any duplication of monitoring.

Methods

Water quality data

The first year of privatisation was the start of the Asset Management Programme (AMP) for Ofwat and regulation of drinking water quality by the DWI. The submission of the quality data was a legal requirement and originally provided to the Inspectorate in the form of quarterly returns plus annual summaries by each supplier. This was not the only information submitted; the full requirements being detailed in the Information Direction as referred to in the Regulations.

In order to analyse the water quality data available from 1990 to 2003 (the duration of the first Water Quality Regulations) it was necessary to produce a new database from the various data formats. The new database holds the summary data from all companies that includes: the parameters tested; the number of samples taken; and the number of the samples that failed the standard in the legislation. The data can be analysed to produce trends per company or particular parameter. It can also produce a 'snap-shot' sample of data to demonstrate levels of compliance.

DWI operations

In order to understand how improvements in quality were achieved it is necessary to assess how the DWI fulfils its role as a drinking water quality regulator. Its methods have developed since 1990, being influenced by new challenges to the production and supply of drinking water which could be considered internal influences and the external influences such as the Better Regulation agenda from government and the need for regulators in general to work effectively and efficiently, not being an unjustified burden to the businesses they regulate.

Technical audit process. The technical audit process is one of the main tools used by the DWI to regulate the industry. The most recent development to the system used as of 2005 is a rolling, risk-based programme. The suppliers' assets including laboratories are ranked according to the results of previous inspections, whether there are improvement programmes in place, water quality events, consumer complaints and other factors. The resulting list shows those sites that are of immediate priority for inspection, with the last sites on the list being the lowest priority. The list is 'live' as any water quality event or inspection result is entered into the system by inspectors, thus recalculating the priority list.

Enforcement and prosecution. The overall improvement in drinking water quality has been achieved mainly through massive investment by the water industry (funded by borrowing and increased charges to consumers) coupled with the regulatory enforcement mechanism that has been used over 3000 times since 1990. Consideration of enforcement normally results in the water company carrying out a mutually agreed action or undertaking a legally binding programme of work to set timetables to achieve the necessary improvements. The DWI monitors progress with improvement programmes to ensure that the work is carried out appropriately and that the required improvements in quality are secured. Additionally, the technical audit process can lead to recommendations of improvements identified as necessary to prevent potential non-compliance or risk to health. These recommendations are also enacted through the enforcement system.

Investigation of incidents affecting drinking water quality is an important aspect of the regulatory framework in England and Wales. The DWI will form a view as to the cause of the incident, whether it could have been avoided or prevented and its potential impact on drinking water quality and the health of consumers. These aspects are covered by the enforcement mechanism but the regulatory framework also gives the DWI the power to bring a criminal prosecution against a water company for supplying water unfit for human health. Unfit water is not defined in legislation; it is a matter for the Courts to decide. Penalties are normally financial but the fines are not representative of profits made through non-compliance as with other industries.

Results and discussion

Results

Figure 1 illustrates the water suppliers (anonomised) failing to meet the standard for trihalomethanes (THM; a group of compounds formed during the chlorine disinfection process, the result of a reaction with the naturally occurring organic substances present in the water) and the percentage of those non-compliant determinations for the year 1990.

Figure 2 shows the same selection of suppliers and their performance against the THM standard for the year 2003. The THM standard set down in the Regulations remained the same from 1990 until 2004. It is clear by using the same scale, that the degree of improvement over the 14 years of privatisation was great. The numbers of samples taken by the companies in each year is approximately the same.

Another important illustration is the general improvement in compliance with all standards. Figure 3 shows the number of determinations failing the standards from the year 1992 to 2004.

The improvements were achieved by the identification of the most important quality issues that needed remedial action, those that required recommendations and finally those that the DWI made suggestions of action to the supplier. Those events that were considered most important would have resulted in a legally binding agreed programme of work that is taken into consideration by Ofwat when the prices charged by the company are reviewed. The programme is closely monitored by the DWI to ensure that the

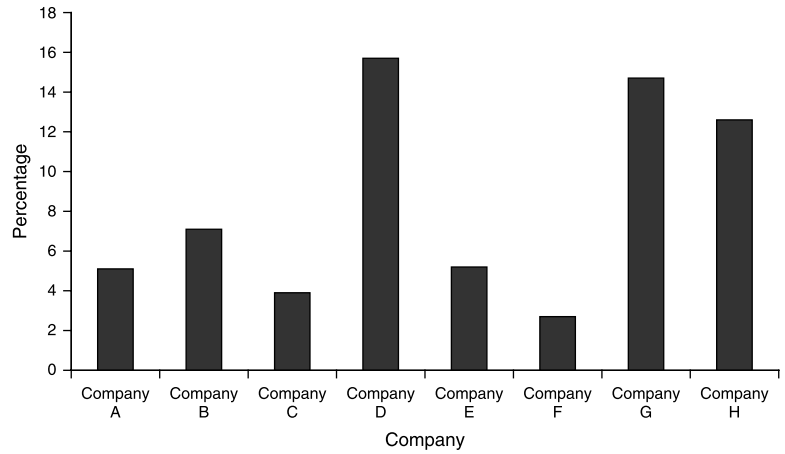

Figure 1 The percentage of determinations failing the THM standard in 1990

work carried out will achieve the improvement necessary to further compliance with the standards or to prevent events that may result in water unfit for human consumption being supplied to the consumer. The significant improvement in compliance with the THM standard was not achieved 'overnight' but over time as the commissioning of capital works is a long process from the point of identifying the problem and the possible solution to the time a new treatment process, for example, is running at optimum.

The enforcement system is an effective balance of the levels of powers available to the DWI. Table 1 shows the decreasing number of enforcement action taken by the DWI in the first four years of the regulatory regime (1990–1993).

Discussion

The regulatory regime began in 1990 when improvements were initialised by monitoring results identifying where they were required. Compliance with the standards improved from 99.00% in 1990 to 99.88% in 2003 and improvements for certain individual parameters were significant.

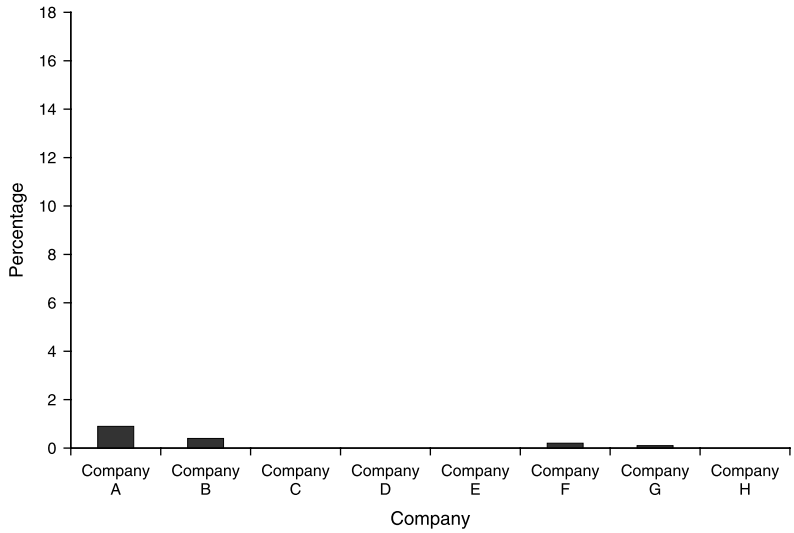

Figure 2 The percentage of determinations failing the THM standard in 2003

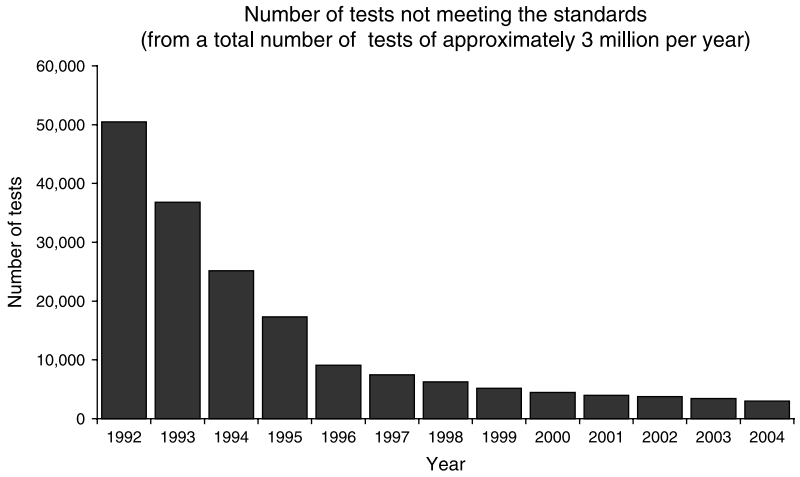

Figure 3 Number of tests not meeting the standards from 1992 to 2004

The DWI has refined its methods for regulating the industry over time and now compliance is at such a high level this development has become more important.

Statistical analysis of the sample data produces the compliance figure. This compliance figure has been used to demonstrate the improvement in drinking water quality for many years. More recently, it has been accepted that this figure does not provide enough information about where the quality problems are so that some action could be taken. New statistical analyses were introduced in 2005 with a regional approach to reporting to suit the water industry stakeholders such as the local authorities. Instead of summaries of the data being submitted to the DWI; as of 2004 all data results were submitted, approximately 3 million results. This allows the DWI to more easily interrogate and manipulate the data, therefore better demonstrating the important issues. The risk based technical audit process concentrates the limited resources of the DWI on where it is most needed. These are all efforts by the inspectorate to achieve the finer and therefore more difficult improvements to quality. With new GIS methods, it will be possible to locate problem areas and more accurately assess the effectiveness of remedial action.

Over the 15 years since the DWI's creation, the role of monitoring has significantly changed. To start with, as previously mentioned, the robust monitoring was the main tool for the identification of the quality problems and was the proof needed to secure the investment to make improvements. The monitoring then became the best way to check that the solutions that were being implemented were actually achieving the levels of compliance that were originally estimated. This process has worked well over the four AMP periods, however, one aspect of monitoring has never quite fitted with the responsibility of the DWI to protecting public health. Monitoring only confirms the quality of the water that has already been supplied and consumed by customers. This point is important because to protect public health, allowing the consumption of water that may be contaminated is unacceptable.

Table 1 Enforcement action in respect of breaches of Regulation 3(3) relating to water quality in water supply zones (DWI, 1993)

Year	1993	1992	1991	1990
Total items	213	220	223	410

The Water Safety Plan (WSP) concept as introduced in the WHO Guidelines is being implemented in England and Wales as it is the best approach to treating the water supply system as a whole, from catchment to tap, considering all of the hazards affecting the supply chain. The main body of the work for producing a WSP is the hazards assessment. Thanks to the *Cryptosporidium* Regulations in England and Wales, suppliers are well practised at assessing their many supply chains, looking for the hazards that may have a negative effect. To comply with the *Cryptosporidium* Regulations, the suppliers had to risk-assess all of their supplies against criteria relating to the risk of *Cryptosporidium* oocyst presence in the raw water. Many of the sources that as a result were considered high risk were abandoned, with other sources taking their place. Where this was not possible, there were strict requirements for specific treatment and monitoring; the monitoring being particularly secure in order to produce a chain of evidence.

The hazard assessment and risk analysis of supplies for the WSP will be very much more involved, but the principles are well practiced by suppliers in England and Wales. The DWI welcomes this approach as it takes the emphasis away from the end-point monitoring and puts a focus on the real risks to health and consumer acceptance. Improvements will now not only be initiated by the results of monitoring, but the results of the assessments for the WSPs, which will be based on continuous assessment of supplies. This is the way forward to achieve the improvements to quality, delivery and service that may have eluded some suppliers up to now.

Conclusions

Privatisation has achieved significant benefits in drinking water quality but only with strong regulation and a regulator specifically dedicated to drinking water quality. The challenge now for the Regulator (DWI) is to maintain what has been achieved so far with more emphasis on maintenance of new assets with ever-increasing pressures on prices and less regulation. There are also the quality problems that still plague the industry, for example, many customers still receiving 'dirty' water (usually colouration due to sediments). The WHO WSP approach is seen as the best framework for this move forward as the identification of the hazards which would cause a risk to public health will replace the monitoring results that was used to prove the need for funding. It will present a challenge for Regulators across Europe, as it has yet to be made a legal requirement by the EC. Many Member States do not have the same type of water quality regulator that exists in England and Wales and these regulators often lack the powers and official position of the DWI. This can make it very difficult for them to action changes and issue new requirements, without those requirements coming from a strong legal basis like the European Commission. The inclusion of WSPs in the DWD will take some time and therefore some countries may not benefit from the approach until such time as the DWD is reviewed. The new focus that the WSP will bring, plus the new methods of regulation that the DWI will practice in order to complement this concept, will be welcomed by the industry and the consumers in England and Wales. There are still some areas of drinking water quality in England and Wales that lie in a 'no-man's-land' of regulation such as the water systems in buildings and homes; bringing these problems to light will truly bring the water supply system's relationship to public health to the fore.

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