

LEAKAGE

Managing leakage 2011 - the research goes on

October saw the release of *Managing Leakage 2011* that is a comprehensive update of the groundbreaking *Managing Leakage* series of reports issued by the water industry in 1994.

The original publication became the manual of best practice in the UK and internationally and was instrumental in helping water companies to reduce their leakage.

Managing Leakage 2011, managed for UKWIR by **Nick Humphrey**, has drawn on results from UKWIR's leakage programme which began in 1994 and comprises some thirty projects. These had a particular aim of filling in the knowledge gaps.

It incorporates other important research as well as evidence from papers issued at major UK and international leakage conferences.

All the information is up-to-date and in one place saving a good deal of time and effort for practitioners involved in leakage control.

The release comes in the form of a short printed summary accompanied by a CD holding the text of seven individual reports. The CD is fully linked to help guide users, interested in a particular leakage issue, through the reports with the ability to check all the referenced documents.

Busy times

Even though *Managing Leakage 2011* is now published (see page 4 for the issue details), the research goes on, as demonstrated by the leakage dissemination workshop held this October in Coventry.

'*These are busy times*' admitted UKWIR Client Manager, Northumbrian Water's **Dennis Dellow**, adding that '*Managing Leakage 2011 is the most important project of the last fifteen years*'.

Developments in leakage knowledge continue and the workshop facilitated discussion on the progress of four new projects, each building on earlier UKWIR projects.

The 2010 project *Leakage from PE Pipe Systems* alerted the industry to the fact that plastic pipes are not leak free. This is compounded by the fact that such leaks are hard to find, especially by conventional acoustic sounding methods.

Mark Loveday from the contractor, Hydrosave, updated delegates on the progress of *Leakage Detection on Plastic Pipes* that began with a literature review.

There followed thirty detailed interviews with UK manufacturers and leak detection specialists, widened to include evidence from the USA, Australia, Middle East and Canada. The information gleaned helped to establish four trial sites to see how successfully a wide range of equipment (for example, see figure 1) located leaks at varying distances and with different leak flows.

A clear conclusion is that direct acoustic sounding is not recommended as such equipment was only successful when poised over or very close to the leak.

It was found that there was merit in transient pressure techniques but this has the potential drawback that sudden induced pressure change could itself cause leaks.

The project will provide evidence to the water industry how different equipment, such as hydrophones, can help reduce leakage under different sets of circumstances.

The project identified the need to obtain accurate measurements of flow velocity to give a more accurate measure of the distance of the leak.

Low flows

Dene Marshallsay of Artesia Consulting set out how the project *Low Flow Components of Night Use and the Water Balance* has investigated the impact of unregistered and under-registered low flows at customer meters on estimates of per-capita consumption and household night use.

UKWIR 2012/13 programme

UKWIR Client Managers and Research Managers met for the year's second Advisory Group meeting held in Warwick in September and spent the day presenting, debating and prioritising the research proposals for UKWIR's 2012/13 programme.

UKWIR Board Member, Southern Water's **John Spence**, introduced the day and welcome special guests, **Rick Karlin** and **Glenn Reinhardt**, who gave an American view on water research themes from the perspective of WRF and WERF respectively.

UKWIR Chief Executive, **Hans Jensen**, set the scene by emphasising the need to think about the longer term challenges facing the industry and the opportunity provided to help shape the industry's strategic research agenda.

The prioritisation process has been systematically developed over recent years and the Advisory Group events were facilitated by **Chris Overton**.

The projects selected are now advertised on the UKWIR website for potential contractors to express their interest.

Over the period January 2012 to March 2012 tenders will be invited and contracts awarded from April 2012.

Customer night use is a significant parameter in a water company's estimate of overall leakage.

At very low flows, a domestic consumption monitor meter may under-register or not register any flow but, at average flows, may well slightly overestimate water use.

The flow profile through such a meter when a water using appliance is being used is influenced by whether the plumbing is direct, indirect or mixed supply.

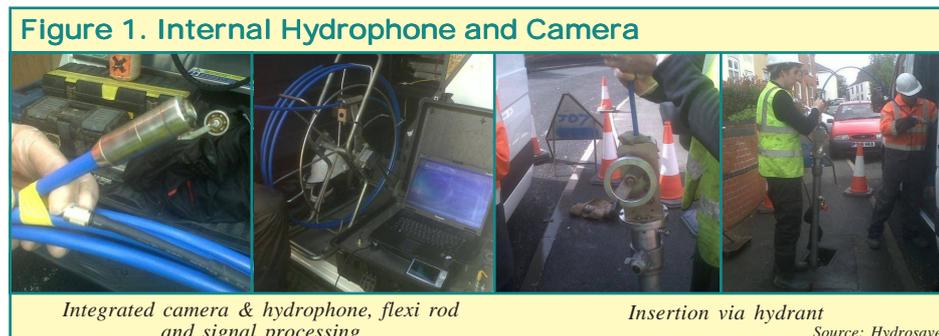
Dene Marshallsay illustrated how different appliances might generate such low flows.

When flushing a modern WC at night in a house with an indirect supply a valve then shuts and the flow at the meter tails off because of the ball valve in the loft tank until readings are below the level of detection. With an older WC cistern, which has a ballcock control, there can be a double attenuation.

With a direct supply the tail is not significant (see figure 4, on page 3). With an indirect supply slow dripping taps also often fail to register a reading. White goods on the other hand are now mostly attached to the direct supply.

Information has been collected to model meter errors and the effect on night use and per capita consumption estimates.

(continued on page 3)



Assessing the effects of climate change

UKWIR's climate change research is now focusing on how water and wastewater treatment will be affected and what adaptation strategies might be applied, both in the catchment and at the treatment works.

In July the focus was on water treatment, with a technology transfer workshop on the project *Climate Change Implications for Water Treatment*, managed by **David Holt** with Scottish Water's **Mark Williams** as Client Manager.

Entec's **Peter Daldorph** took delegates onto the next stage, appraising catchment adaptation measures, by using the 2050 climate scenarios before and after adaptations. Adaptation included reducing diffuse phosphorus, nitrogen and sediment run-off from catchments.

Dan Fawcett returned to identify the treatment adaptation measures required in the short, medium and long-term, as shown in figure 3.

twenty five years on the performance of water company assets.

This encompasses short-life assets, such as mechanical and electrical facilities and long-term assets such as pipelines and civil structures.

The study is examining changes in asset deterioration and looking at the capital and operational expenditure required to meet customer levels of service.

The project was concentrating on operational assets and described how climate change could have 'direct' impacts, such as increased corrosion and 'indirect' effects such as pumps required to work harder and longer.

Varying impacts

Phil Dyke described how structured interviews with water companies confirm that climate change impacts differ across the UK and that the impacts can vary depending on the specific circumstances of a water company.

Raw water quality, flood risk and freeze/thaw events are the most frequently mentioned parameters.

Alan Erskine took the audience through the principles of when to alter the asset replacement frequency, when to replace to offset operational inefficiencies and when to replace because better and more efficient designs were available.

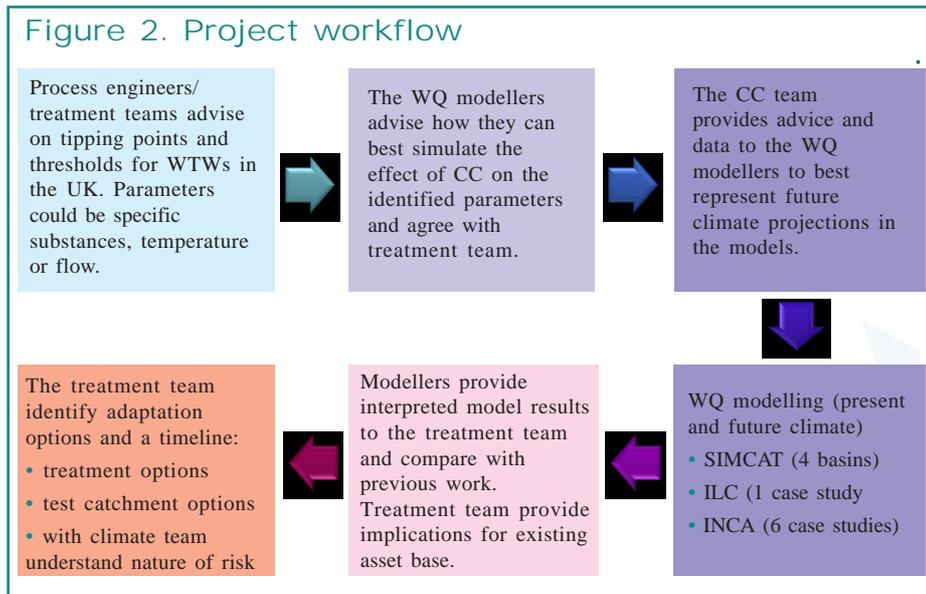
He said 'it was important to have all these three in your head'.

Bruce Horton, from Environmental Policy Consulting, introduced an open session in the afternoon to devise examples to support the project and illustrate the range of issues involved.

He also concluded the workshop by saying that water companies had not looked at climate change through the 'asset lens' until now, concentrating on the customer service aspect.

The project is to provide a way ahead for water companies to quantify the effects of climate change in time for PR14 submissions.

Figure 2. Project workflow



Brian Cox from the contractor, Atkins, set the scene with the 'project workflow', as shown in figure 2.

Dan Fawcett then described the results of an industry-wide consultation confirming the key parameters of concern to be colour, turbidity, organic carbon, manganese, iron and nitrates.

There were likely to be algal blooms impacting on coagulation and filtration facilities as well as increased trihalomethene formation following post summer heavy rains.

This means that the most vulnerable technologies to climate change are likely to be coagulation, flocculation, sedimentation, rapid gravity filtration and chlorine disinfection.

Climatic range

Geoff Darch updated delegates on the latest climate change scenarios whilst University of Oxford's **Paul Whitehead** described how these applied to three regularly used water quality models, SIMCAT, ILC and INCA.

Six catchments were selected to give a representative range of climatic, geographical and physical aspects across the UK.

He concluded that rapid gravity filters, sludge blanket clarifiers, chlorine dosing, chemical conditioning and groundwater treatment present the greatest risks from climate change.

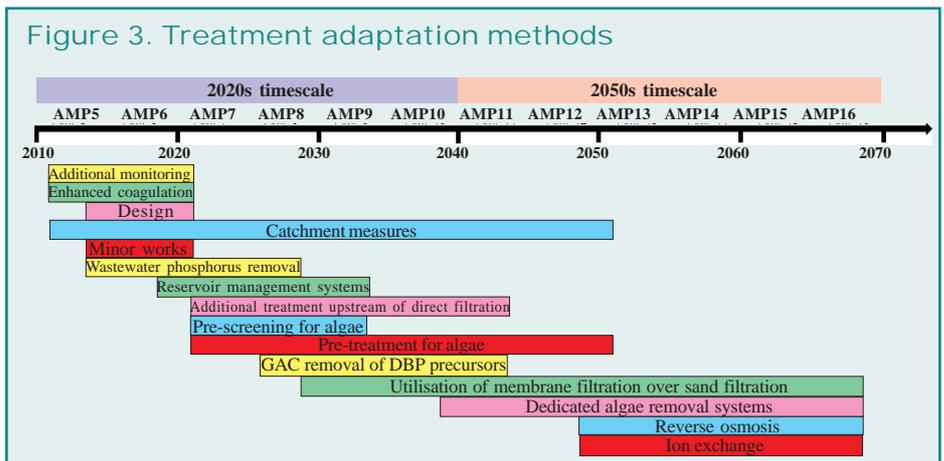
Impact on assets

The UKWIR climate change programme is being taken a stage further with projects on the climatic impact on water treatment and wastewater treatment providing evidence for *Impact of Climate Change on Asset Management Planning*.

The project is being managed by **Brian Wilkinson** with Scottish Water's **Mark Williams** as Client Manager.

Delegates at an UKWIR workshop in September heard how the study, being carried out by MWH, is examining the effect that changes in rainfall, temperature or soil moisture deficits will have over the next

Figure 3. Treatment adaptation methods



Lead - the alternatives to phosphorus dosing?

As the lead limit for drinking water is tightened to 10µg/litre for the first litre drawn at the tap, phosphorus (P) dosing is, up to now, a satisfactory process to reduce lead levels to meet this standard.

These were the opening remarks by **Sean Comber**, from the contractor Atkins, at an UKWIR workshop to discuss the findings of the project *Alternatives to Phosphate for Plumbosolvency Control*, managed for by **David Holt**, with Yorkshire Water's **John Haley** as Client manager.

Sean then went on to say that the 'future is less certain'.

The disadvantages of phosphate dosing are the strong pressures to use 'source control' methods to reduce P in the environment, as it can induce eutrofication in rivers and lakes.

Indeed, water companies have been lobbying for the reduction of P in washing machine and dishwasher detergents.

Rising prices

The price of phosphorus for treating drinking water to control plumbosolvency has been rising over the years and there are only two major sources of supply in the world, Morocco and China.

Ironically, the dosed phosphorous has to be removed from wastewater using iron, whose cost is also increasing.

Survey

Looking to the longer term, a survey of water companies was undertaken to assess the current scale of the issues and what might happen in future.

David Blackwood, from the University of Abertay, Dundee, set out results and was pleased to report that replies were received from water companies, covering some 90 per cent of the UK population.

It was found that P dosing ranges from 0.7 to 1.9 mg/litre of water and that about 5,000 tonnes of P were used each year.

About 90% of the population receive P dosed drinking water and this contributes about 20% of the P load at wastewater treatment works. Current strategies are working well as the reported lead levels in drinking water are 1.2µg/litre with compliance achieved in 99% of cases on average.

Wider view

Sean Comber returned to examine the business case for future alternative approaches to meet the lead standards.

To facilitate this, a model, in Excel spreadsheet form, has been developed to help companies examine alternatives and assess their costs against the baseline of P dosing. He said there is a need to take a wider view when considering alternative approaches such

as mains replacement or mains relining.

The model encompasses the consequences downstream of wastewater treatment works, the carbon costs as well as the social costs, such as health. There is also the issue of sustainability, particularly in the case of P supplies.

Sean confirmed that the environmental costs are the most difficult to model as the levels of eutrofication of rivers are uncertain.

Health costs present a considerable challenge as the benefits are based on cognitive research into the IQ and earning potential of the population. Other factors taken into consideration are:

- about a quarter of houses have lead supply pipes and replacing these will reduce lead levels at the tap. However, there is the complexity that consumers are often reluctant to replace their internal lead pipes
- alternatively lead pipe rehabilitation can be applied through relining. Companies could also apply a more targeted approach would be to identify lead 'hot spots' within water supply zones.
- in each case there is the potential bonus of reducing leakage levels, hence offsetting lead replacement and relining costs.

In the afternoon delegates tried out the spreadsheet model that facilitates assessment of a variety of scenarios from company level down to a zonal basis.

Weather effects

A further leakage project, just starting, is the *Effect of Weather on Leakage and Bursts*, managed for UKWIR by **Vic Lee**.

At least six climatic events have significantly affected leakage in the past decade, most recently the extremely cold December of 2010.

Leakage can be affected by various weather parameters such as air temperature, ground temperature, subsoil temperature, water temperature, rainfall and prolonged periods without rainfall and soil moisture deficit.

So far, little work has been done to define and quantify these effects. This is all compounded by the increasingly likelihood of climate change impact that could lead to a requirement for a different approach to design, installation and maintenance of mains and services.

The project will develop a series of relationships to quantify the effect of various weather parameters on leakage.

This will help utilities to mitigate, the effects on leakage of events such as cold winters and dry summers and to use weather forecasts to make short and medium term forecasts of leakage and burst levels.

LEAKAGE (continued from page 1)

Leakage workshop

Two other current projects featured at the Coventry workshop.

Background leakage, the lowest level of detectable leakage using current technology, is a vital component in leakage economic models.

Mike Butler of RPS introduced *Factors Affecting Background Leakage* which is looking at the influence of various physical factors, such as pipe material, pipe age, soil types, pressures, network density and joint types on background leakage levels.

He described how they have carried out non-linear regression analysis of data collected from 2,940 DMAs in four water companies.

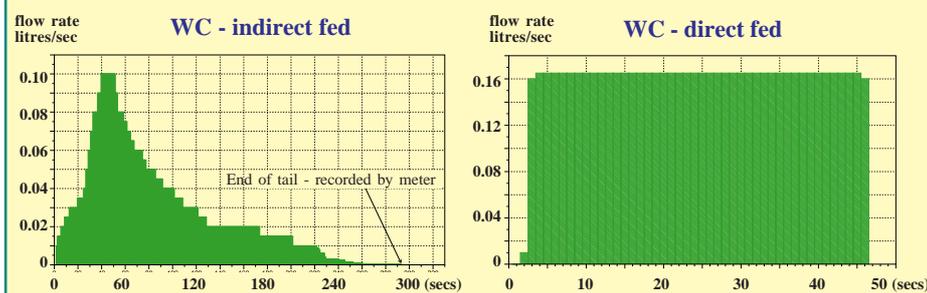
Robert Warren and **Alan Cunningham** then informed the forty delegates on progress on the project *Best Practice for Derivation of Leakage Cost Curves in ELL Modelling*.

There are a number of different approaches to estimating the leakage cost curve and it is not clear what is the best approach. Most companies have limited experience in recent years of the costs of reducing leakage, as leakage has generally been stable.

The project aims to determine the advantages and disadvantages of alternative methods of estimating the relationship between active leakage control costs and the level of leakage.

Figure 4. Examples of device profiles

Source: Artesia Consulting



Roadmap for sustainable regulation

The publication of the government's Water White Paper will set the scene for future water management across much of the UK.

In anticipation UKWIR commissioned a project *A Roadmap for Sustainable Regulation*, managed by **Bruce Horton** with **Mark Williams** as Client Manager.

A workshop in October was designed to interactively engage the water sector in further developing this road map, in particular to get feedback on the key issues identified by the project, and the barriers and opportunities to a more sustainable regulatory regime. The workshop also considered priority actions and how these could be refined into a more complete programme.

Bruce Horton introduced the session by saying that, whilst the project was originally conceived from an environmental perspective, it also encompasses social and financial aspects of sustainable water management.

For example, where traditionally a one-time capital solution may have been adopted, the project is identifying actions that would enable more step-wise solutions to be found, which may be cheaper and enable companies to adapt to change over the longer term.

Figure 5. Over-arching themes

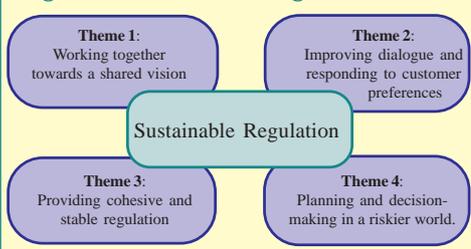


Figure 5 shows the over-arching themes identified by the project that underpin sustainable regulation for the UK water industry.

For each theme there are a number of issues which were debated by delegates during the workshop. There were representatives from the UK water utilities, regulators, consumer groups and environmental organisations.

They all worked in a series of groups to tease out the important issues, the links between them with a special focus on specific actions required.

Correction

In the last issue on page 1, the text should have designated **Matthew Smyth** as of Aqua Enviro and **John Sutherland** representing Atkins and not the other way round. Apologies to those concerned.

This edition features a listing of UKWIR publications issued since the last newsletter.

DRINKING WATER QUALITY & HEALTH

11/DW/14/4 Treatment for New and Emerging Pesticides (1 84057 605 7) £750

REGULATION

11/RG/07/21 Barriers to 100% Compliance, or is it Achievable? (1 84057 602 2) £100

11/RG/07/22 Carrying Out Willingness to Pay Surveys (1 84057 607 3) £500

11/RG/07/23 A Review of the Scientific Basis for Proposed EU Limit Values for Organic Chemicals in Sludge (1 84057 606 5) £100

11/RG/08/3 The New Industrial Emissions Directive (IED) - What are the Implications for the Water Industry? (1 84057 603 0) £50

SLUDGE TREATMENT & DISPOSAL

11/SL/06/8 Enteric Pathogen Survival in Sewage Sludge Amended Agricultural Soil (1 84057 604 9) £50

WATER MAINS AND SEWERS

10/WM/08/42 Managing Leakage 2011 (1 84057 563 8) £ 550

11/WM/13/1 Deterioration Rates of Log-Life, Low Probability of Failure Assets: A Literature Review (1 84057 608 1) £ 50

11/WM/13/2 Deterioration Rates of Log-Life, Low Probability of Failure Assets: Project Report (1 84057 609 X) £ 250

UKWIR research reports are available for non-members to purchase via www.ukwir.org



Delegates concentrate on one of the issues at the workshop

David Corbelli, from the consultants Cascade, said that the project was designed to review current approaches to regulation to ensure we have a system that is 'fit for purpose' for addressing the key challenges of the 21st century.

These challenges are significant. For example a changing climate and a growing population (from 61m in 2008 to 71m in 2031) will place considerable strain on water infrastructure in the future.

Cascade's **Kieran Conlan** said this will require fresh and innovative solutions from the water industry in order to build resilience and address these long-term challenges to deliver optimum customer service in the most cost-beneficial

manner. Eleven issues were discussed in detail and examples were:

- achieving greater customer focus
- providing regulatory incentivisation
- balancing competition and collaboration
- focusing on longer-term planning
- finding holistic and innovative solutions
- investment decisions based on integrated assessment
- forecasting change in water requirement.

Following the workshop, the output is due to be checked in early 2012, using a gap analysis, against the *Water White Paper* and Ofwat price limits review, prior to finalisation.

UKWIR PEOPLE

Bruce Horton is managing the *Sustainable Regulation* project for UKWIR, described in detail on this page.

Bruce is Director at Environmental Policy Consulting, which he founded after leaving his post of Environmental Policy Adviser at Water UK. There he gained particular experience in climate change, water resources and sustainability.

Bruce gained a PhD in Environmental Economics and Risk at the University of East Anglia following a MA from the same institution and a BA in Economics at the University of Hull.

