

WSP WATER SAFETY PLANS IN DRINKING WATER SUPPLIES



THE WATER SAFETY PLAN (WSP) approach came to prominence in 2004 with the publication of the third edition of the World Health Organization's Guidelines for Drinking-water Quality¹.

Essentially, all risks to the safety of the final water and the health of consumers from hazardous events likely to affect each drinking water supply system are assessed and, where necessary, controlled and monitored. Emphasis is placed on an inclusive and enduring systematic approach backed by thorough management and supporting procedures. For water suppliers the WSP approach builds on good practice already prevalent in the mature European water industry but it is applicable to any

size of water supply, however small. It is the ideal practical approach for raising awareness of the risks that can affect small supplies and how they can be controlled.

The aim of a WSP is to ensure that a drinking water supply consistently produces safe drinking water that is acceptable to consumers. However, the scope and application of the WSP approach is often misunderstood for it should go much further than just hazard identification and risk assessment and control through catchment, treatment and distribution.



David Drury
Former Deputy Chief Inspector,
Drinking Water Inspectorate

It should envelop all operations linked to water supply including management and management procedures, training, internal and external communications, monitoring, laboratories, reporting and incident and emergency procedures. Obviously, the complexity and scope of the WSP approach will reflect that of the water supply system and will be much simpler for small supplies.

Welcome to the Autumn Issue of the FWR Newsletter

The focus of this issue is drinking water quality. We are delighted that David Drury, former Deputy Chief Inspector at the DWI, has agreed to write the key article dealing with the development and significance of the recently introduced Water Safety Plans. In addition, on page 4, Tony Lloyd reports on a recent, FWR sponsored, conference on private water supplies.

In the news from our Wastewater section on page 5 Tim Evans reports on research into a revolutionary activated sludge treatment utilising the environmentally damaging nitrous oxide gas. The WFDIC section, on pages 6 and 7, outlines current developments in marine and coastal management. On the last page, Caryll Stephen, FWR Chief Executive, reports on our current activities and The Library section informs about new publications available from the FWR bookshop.

For more information we invite you to have a look at our FWR website, where each of the four sections, i.e. Water Supply, WFDIC, Wastewater and FWR Library, has its own News page, in addition to the more general FWR News page (<http://www.euwfd.com>) or (<http://www.fwr.org>). You can also contact us by email or telephone (see details on the last page).

The Editor

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BENEFITS OF THE WATER SAFETY PLAN APPROACH

Traditionally the demonstration of the quality of water supplied to consumers has relied upon testing the water for a wide range of parameters after it leaves treatment or at the consumers tap. The drawback of this approach is that the water is likely to have been consumed before the results of analysis are known. Although developments in rapid and on-line analysis have gone some way to overcome this problem, relying solely on analysis to demonstrate the safety of water may allow insufficient time for remedial action to be taken to protect consumers. The WSP approach of comprehensive hazard identification, risk assessment and risk management puts emphasis on controlling risks where they arise putting less reliance on water treatment processes which can mean more sustainable solutions with reduced carbon footprints. Monitoring becomes more targeted towards demonstrating that the controls are working and WSP procedures should enable early identification of new or increased risks. Incidents and events should become more predictable and preventable. The inclusive WSP approach will enable stakeholders to better realise their responsibilities towards the safety of water supplies and enable consumers to have more confidence in the quality of their drinking water.

DEVELOPING A WATER SAFETY PLAN

There is no one way to develop a WSP. Generally, for ease of acceptance within water suppliers, it should fit in with existing ways of working unless these are shown to be insufficient or to have the potential to introduce or fail to identify hazards to the safety of the water supply. A WSP should be developed for each water supply system. The simplest form of water supply system consists of four elements, catchment including the source water, treatment, distribution and consumers but other formats can be used. Development of a water safety plan by a water supplier will require the support of senior management both because there will be cost and time requirements and because without such support the approach will not get widespread staff acceptance. Below is an outline of the main points of a WSP. Much more detailed explanation and advice is available in, for example, the WHO Water Safety Plan Manual² and, particularly for small supplies, a Scottish Government website³.

- Recognise that developing a WSP will require financial, management and human resource support.
- Set up a team to decide on WSP methodology and oversee implementation with a leader able to drive the project and motivate people. For water suppliers the team should consist of experienced individuals representing all aspects of drinking water production, each with a specific role and responsibility. Stakeholders with an interest in the water supply should be involved. The size of the team will reflect the complexity of the supply system. For smaller supplies the team will probably need some external expertise.
- Describe and document the water supply system and identify through existing records, local knowledge and site visits all the hazards that can affect the safety of a water supply from the catchment, through treatment and distribution to the consumer. Potential hazards must be considered in the widest possible sense including such things as flooding, power supplies, availability of alternative supplies, availability of trained staff, laboratory facilities and reporting and communications and not just restricted to chemical and microbiological parameters.
- Where there are ineffective or no existing controls for significant risks draw up and implement an improvement programme giving priority to the most serious hazards.
- Demonstrate that the water supplied to consumers is consistently safe through operational and compliance monitoring and that any deviations are detected and remedied quickly and keep accurate records of all results and actions.
- Ensure that there are management plans for actions to be taken during normal operation and incident conditions and documentation of the system assessment, monitoring and communication plans and supporting programmes.



- Assess the risk presented by each hazard by considering the likelihood of its happening and the consequences for the safety of the water if it does occur.
- For any risks assessed as significant consider if controls or barriers are in place and demonstrate that these are effective and will ensure that water quality standards are met.
- Make sure that there are adequate and effective programmes for training, maintenance, research and development and consumer information and that the WSP is subject to audit.
- Regularly review the hazards, risks, controls and functioning of the WSP, particularly after something has gone wrong.

WATER SAFETY PLANS FOR SMALL SUPPLIES

The above outline of WSP implementation may seem daunting for owners and users of small water supplies particularly where funding, expertise and human resources are limited but the main elements that they should apply will be the same albeit in a more simplified form. The best approach is to concentrate on the main points of identifying hazards and then to mitigate risks in the most sustainable and cost effective method possible. For example, if cattle or sheep have access to a spring or stream used as a water supply, the hazard of faecal contamination would be immediately obvious from a site visit and would represent a significant risk to the safety of the water supply. The most effective sustainable control would not be occasional monitoring of the water for faecal bacteria; it would be prevention of animal access to the water by erection of a sturdy fence and the monitoring would be regular checking that the fence was intact and effective. Obviously not all hazards are so straightforward and external expertise and analysis will be required for help with those less easily detectable.

WATER SAFETY PLANS IN REGULATIONS

A number of countries' regulations for drinking water quality now specify a requirement for water suppliers to implement a risk assessment and risk management approach to the production and distribution of drinking water. These vary from a vague requirement for water safety plans to be implemented to very specific requirements as to how the approach should be carried out and reported. For regulations requiring WSP implementation to be effective it is essential that water suppliers understand the approach fully. This may mean that terms such as water safety plan, water supply system, risk assessment, operational monitoring, validation and verification need to be carefully defined or that the whole WSP approach needs to be described. Flexibility of approach is a key to WSP regulatory success and it is important that regulations do not become so prescriptive as to prevent water suppliers from developing approaches that work well for them. It is easier to draw up separate regulations for small supplies because, as was explained above, a simpler WSP approach is likely to be the most effective.



The water safety plan approach has both attractions and drawbacks for regulators. Seeing a water supplier's hazard identifications and risk assessments will give the regulator insight into how well the supplier understands and protects its systems. However with greater emphasis on targeted operational monitoring, compliance monitoring would be reduced making it more difficult for straightforward reports on percentage compliance and comparisons between suppliers. Where there is a regulatory requirement the regulator can become the external WSP auditor. This is not so easy when the best WSP approaches should be influencing every aspect of water abstraction, treatment and distribution but can work well if used selectively, for example, by assessing how well the approach was applied to an individual water treatment works, in dealing with consumer complaints or was followed during an incident.

REFERENCES AND FURTHER READING

1. **Guidelines for Drinking-water Quality.** Third Edition. Volume 1 Recommendations. World Health Organization, Geneva 2004. **ISBN 9241546387** (freely available at (http://www.who.int/water_sanitation_health/dwq/gdwq3rev/en/index.html))
2. **Water Safety Plan Manual:** step-by step risk management for drinking-water suppliers. World Health Organization, Geneva, 2009. **ISBN 9789241562638** freely available at (http://www.who.int/water_sanitation_health/publication_9789241562638/en/)
3. (<http://www.privatewatersupplies.gov.uk>)

Since the Drinking Water Seminar organised by the European Commission (EC) in October 2003, the EC has stated on several occasions that the water safety plan approach will be an important element to be considered in the forthcoming revision of the Council Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive; DWD). Whilst still favouring the approach, the EC is struggling with some of the regulatory issues outlined above. How can it lay down in a directive a water safety plan approach that is acceptable and understandable to 27 member states? In principle it could be done quite easily with some definitions and perhaps one new article but some form of guidance document would be required to explain the WSP approach in more detail. Such guidance would be welcomed by many member states but as it is unlikely that it would have legal status it would make DWD implementation more difficult. Another question is how could member states demonstrate DWD WSP implementation to the EC? A further problem for the EC is that any changes to the existing DWD have to be justified through cost and environmental appraisal. Whilst it is easy to see how the WSP approach will benefit both in theory, collecting actual evidence around Europe where there are different approaches and timescales is difficult because the WSP approach requires time to deliver benefits. Small supplies may be the key here as across the EC they have the worst water quality and, if resources are available, are the easiest to improve through risk management.

David Drury

PRIVATE WATER SUPPLIES The New Regulations, Six Months On

London, 1 July 2010

THIS ROYAL SOCIETY FOR PUBLIC HEALTH'S CONFERENCE was supported by the FWR. Some 80 representatives from local authorities, the water industry, water treatment equipment suppliers and health professionals attended the sell-out event.

Presentations by Peter Jiggins (Defra) and Teresa Isaacs (DWI) introduced the background to the making of the Regulations, the development of guidance and the risk assessment process. The presentation by Geoff Nemeč, representing UK Water Treatment Association, UKWTA, concentrated on the need for clarification of the approval requirements for equipment used in PWS improvement schemes.

Deanna Fernance, National Trust Water Manager, spoke about the National Trust's inheritance of some 900 PWS and outlined the outcome of an in-house risk assessment process and the strategy for addressing the challenges of the PWS regulations. Liam Cooper, Leeds City Council, provided a practical overview of the risk assessment process and called for clearer wording in the risk assessment proformas on the Government's PWS website.

A number of speakers criticised the practicability of certain regulations. Others commented on the inadequacies of the current Defra Guidance. Questions included why there were no transitional arrangements in Regulation 5 to ease the burden of obtaining costly Secretary of State approval for treatment equipment. Highlighted also was the inconsistency with public water supply approval arrangements, where equipment identical to that used in PWS, was subject to the less onerous and less costly Water Regulations Advisory Scheme test requirements.

In his chairman's introduction David Clapham took Defra to task over the inadequacies of certain regulations. He mentioned in particular: the ineffectiveness of the 5-yearly monitoring requirement for single properties; the impracticability of the requirement for householders to monitor disinfection by-products; and the confusion surrounding the definition of Private Distribution Systems.

Sarah Johns (Pembrokeshire County Council) spoke about how the Water Health Partnership for Wales, which brings together relevant agencies to collaborate in protection of public health, is addressing the challenges posed by PWS. Jackie Hyland (NHS Fife) described the positive effects of offering PWS improvement grants in Scotland. The conference closed with a presentation by Steve Tuckwell (WRAS) who drew attention to relevance of the Water Fittings Regulations to design and installation of PWS distribution systems.

Tony Lloyd



Conference speakers, from left: Teresa Isaacs (DWI), Deanna Fernance, NT, Geoff Nemeč, UKWTA, Tony Lloyd, FWR, Dr Steve Tuckwell, WRAS Ltd, David Clapham, Bradford Council, Peter Jiggins, Defra, Dr Jackie Hyland, NHS Fife, Liam Cooper, City of Leeds, Sarah Johns, Pembrokeshire CC and Chris Moss, Shropshire LA.



Teresa Isaacs, Drinking Water Inspectorate (DWI)



David Clapham chaired the afternoon session



Dr Jackie Hyland, Consultant in Public Health Medicine, NHS Fife explaining her work



Conference was a sell-out



Tony Lloyd chaired the morning session

NITROUS OXIDE and wastewater treatment

NITROUS OXIDE (N₂O, laughing gas) is a 'leakage product' of the bacterial processes of nitrification (ammonia to nitrate) and of denitrification (nitrate to nitrogen gas) irrespective of whether this happens in wastewater treatment or in soil. There's not a lot produced but it has a global warming potential (GWP) 298 times that of CO₂ so the effect is large and so are the consequences of errors in estimating its emission factors.

The activated sludge process (ASP) was developed by Arden and Lockett at Davyhulme WwTW in Manchester. They presented it to a meeting of the Society of Chemical Industry on 3rd April 1914 at the Grand Hotel in Manchester; we are coming up to the centenary of ASP. The ASP and its adaptations for denitrification and biological phosphate removal have had major benefits for the quality of receiving water but the ASP is also a major contributor to the GWP of wastewater treatment. The more stringent the treatment requirement, the greater the GWP [as well as the cost]. Aeration uses electricity (UK average GWP 0.541 kgCO₂e/kWhe) and releases biogenic CO₂ (GWP=0) and N₂O (GWP=298).

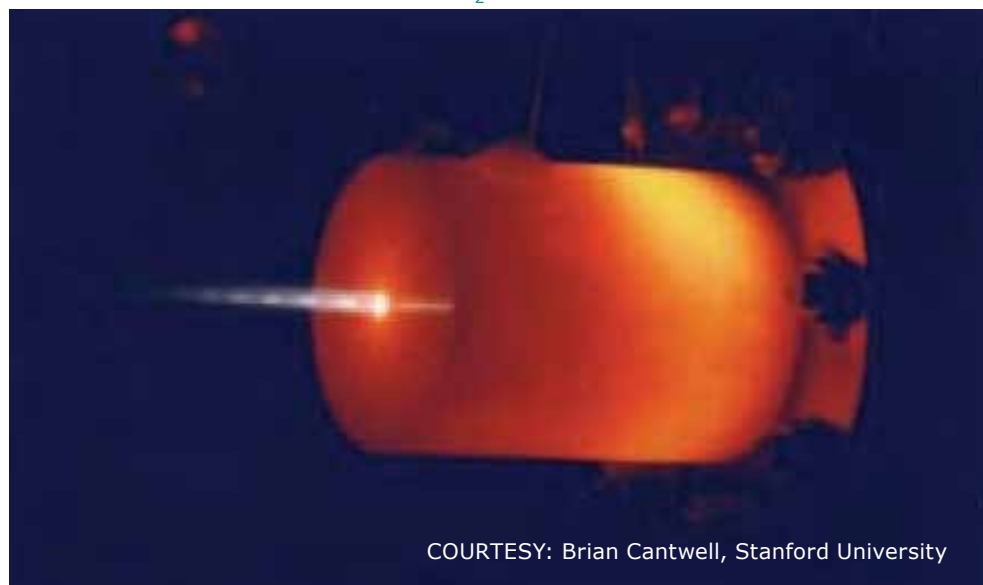
Keeping primary clarifiers aerobic to prevent rising sludge combined with efficient desludging minimises the carryover of load to the ASP and thus the aeration demand. Counter-intuitively Kampschreur and colleagues have found that operating ASP at lean dissolved oxygen (DO) to minimise electricity demand actually increases the GWP because the N₂O emission increases at low DO.

Research just released from Stanford University (USA) contributes to the idea that we might invert the paradigm (www.physorg.com/news199366527.html). Scherson, Criddle and Cantwell have suggested maximising CH₄ and N₂O by operating the primary stage anaerobically, capturing the gasses and using them as energy sources.

Brian Cantwell is Professor of Aeronautics and Astronautics. He has spent the last five years designing rocket thrusters that run on nitrous oxide. They are compact and burn at more than 1650 °C producing pure, clean nitrogen and oxygen gasses. His PhD student, Yaniv Scherson, discussed wastewater as a source of N₂O with Craig Criddle, Professor of Civil and Environmental Engineering. Rocket science met wastewater engineering! Optimising N₂O removes ammonium from the wastewater and uses less of the organic matter than would be the case with nitrification-denitrification so there is more substrate for CH₄ production from the organic load. Then use the extra methane to power the plant and a small rocket thruster to break down the nitrous oxide into clean, hot air.

Tim Evans

Figure: Rocket thruster burning N₂O



COURTESY: Brian Cantwell, Stanford University

WASTEWATER RESEARCH AND INDUSTRY SUPPORT FORUM

The last meeting of the Wastewater Forum, on 15th July 2010, was an opportunity for exchange of information about urban drainage. There were also three technical presentations:

- Brian Hickland from Uhrig Kanaltechnik GmbH described the retrofitting of Therm-Liner into sewers so that the wastewater can be used as a renewing source of heat or dump for cooling.
- Dr Tim Evans, Technical Secretary to the Forum, described the FWR/WaPUG workshop "Retrofitting green infrastructure for rainwater - what's stopping us?" that was held on 19th April in London.
- Prof. Stephen Smith, Imperial College, presented a review of 'emerging' organic contaminants in biosolids and assessment of international research priorities for the agricultural use of biosolids.
- An extensive Note on the Meeting and the presentations are available on our website www.fwr.org, Wastewater section/Meeting Notes. The next meeting of the Forum will be on 24 November 2010. For further information contact Dr Tim Evans (tim@timevansenvironment.com)

WaPUG AUTUMN CONFERENCE The Wastewater and Urban Drainage Conference

WaPUG, now CIWEM's Urban Drainage Group, organises technical conferences and specialist workshops for the urban drainage community. The Autumn Conference is taking place in Blackpool on 10 to 11 November 2010. FWR is sponsoring the event and we would welcome you at our exhibition stand. For further information and to register visit the CIWEM website: (<http://www.ciwem.org/events/events-calendar/wapug-autumn-conference---the-wastewater-and-urban-drainage-conference.aspx>).

WHAT'S NEW IN MARINE AND COASTAL MANAGEMENT

Now, when the River Basin Management Plans have been signed by Ministers, the attention of the European Commission and Governments in Member States (MS) has moved to legislation concerning our marine and coastal areas.

THE EUROPEAN COMMISSION'S MARINE STRATEGY FRAMEWORK DIRECTIVE (MSFD; 2008/56/EC)

The MSFD follows the pioneering approach adopted by the WFD and aims to achieve Good Environmental Status (GES) in Europe's seas by 2020. The key requirements of the Directive, which came into force on 15 July 2008, are:

- An assessment of the current environmental status by MS in waters of their marine region by July 2012
- Determination of what GES means for those waters, and associated targets and indicators by July 2012
- Establishment of a monitoring programme to measure progress by July 2014
- Establishment of a programme of measures for achieving GES by 2016

The MSFD makes specific reference to the overlap of MSFD and WFD in coastal waters and includes provisions aiming to ensure that the two directives are complimentary and unnecessary overlaps are avoided.

After a consultation last year a Statutory Instrument transposing the MSFD into UK law came into force on 15 July 2010 and puts in place a legal framework to enable the MSFD to be implemented in the UK.

Marine Coastal Access Act 2009 and Marine (Scotland) Act 2010

The new Acts provide the tools to take an integrated approach to protecting and improving the state of our marine habitats and species, whilst using marine resources sustainably. (The Scottish Marine Act legislates for all activities in the marine environment out to 12nm except those reserved to the UK Government. Reserved activities include oil, gas, telecoms and shipping.)

In April 2009, the Scottish Government established Marine Scotland (<http://www.scotland.gov.uk/About/Directorates/Wealthier-and-Fairer/marine-scotland>) and in April 2010 the UK Government set up the Marine Management Organisation (MMO) for England (<http://www.marinemangement.org.uk/>) to deliver integrated marine management. Teams in the Welsh Assembly Government are responsible for marine management.

THE MARINE POLICY STATEMENT (UK) (MPS)

The UK Government is currently developing a system of marine planning as provided for in the Marine and Coastal Access Act (2009). There are two stages to the marine planning system, the MPS and marine planning. The MPS will be the first part of new systems of marine planning being introduced around the UK.

It will provide the high level policy context within which marine plans will be developed, and set the direction for marine licensing and other relevant authorisation systems. Following a pre-consultation process earlier this year, a consultation exercise was launched on 21 July 2010 and will run until 13 October 2010 (<http://www.defra.gov.uk/corporate/consult/marine-policy/index.htm>).



The second level will consist of a series of marine plans that will interpret and present the national policies within the Marine Policy Statement and apply area specific policy where appropriate within marine plan areas. Marine plans must be consistent with the MPS, ensuring a strong link between national policy and local application.

DELIVERING MARINE CONSERVATION ZONES AND EUROPEAN MARINE SITES

Following a consultation in 2009, Defra has published its strategy for marine protected areas. The strategy sets out proposed vision and framework for marine protected areas (MPA) in territorial waters adjacent to England and UK offshore waters over the next ten years. The strategy sets out how existing obligations for marine protected areas under European Directives together with Marine Conservation Zones under the Marine and Coastal Access Act and other designated sites will deliver an ecologically coherent network by 2012.

CHARTING PROGRESS 2

This latest comprehensive study of UK seas, was published on 21 July 2010. It has been published by the UK Marine Monitoring and

Assessment community which has over 40 member organisations. This is the result of a five-year study into how human use and other pressures, such as climate change, are affecting our seas. It draws on evidence gathered by scientists from marine agencies, research institutes, universities, environmental organisations and industries around the UK. The UK Government and Devolved Administrations have published a Government Commentary on Charting Progress 2 in which they highlight the important messages coming from the report and outline their approach to them. (<http://chartingprogress.defra.gov.uk/>).

INTEGRATED EUROPEAN MARITIME POLICY FOR THE EUROPEAN UNION (IMP)

The European Commission is continuing with the implementation of the Action Plan of the ambitious Integrated Maritime Policy, which was launched in October 2007.

From 16 August 2010 to 15 October 2010 runs a public consultation on a proposal for a Commission communication on Integrated Maritime Policy for the Atlantic Ocean sea basin (http://ec.europa.eu/fisheries/partners/consultations/atlantic_ocean/index_en.htm).

Ivana Wilson



Useful links:

- **European Commission, Maritime affairs:** IMP
(http://ec.europa.eu/maritimeaffairs/index_en.html)
- **European Commission, DG Environment:** MSFD
(http://ec.europa.eu/environment/water/marine/index_en.htm)
- **Defra, Environment, Marine Environment:** Marine Coastal Access Act 2009, MPS, MPA
(<http://www.defra.gov.uk/environment/marine/index.htm>)
- **The Scottish Government, Marine:** Marine planning and legislation in Scotland,
(<http://www.scotland.gov.uk/Topics/marine>)
- **Environment Agency, Marine Environment:** Background information
(<http://www.environment-agency.gov.uk/research/planning/33104.aspx>)
- **Wildlife and Countryside Link, Marine Legislation:** Marine Legislation Working Group
(<http://www.wcl.org.uk/marine.asp>)





An update on the activities of the FWR



Caryl Stephen

Chief Executive of the Foundation for Water Research

As you will see from the previous pages of this newsletter, FWR has been busy during the Summer months. Our new Drinking Water Section has been growing steadily and we are sorry that Tony Lloyd, who has been so instrumental in setting up this section, will be leaving us in October. We thank him for all his hard work and wish him well in the future.

Our other Sections (Wastewater, Water Framework Directive Information Centre (WFDIC) and our Library) have also continued to grow and new Reviews of Current Knowledge (ROCKs) and Guides are planned for the Winter months. In September we shall also be exhibiting at the 4th European Water & Wastewater Management Conference in Leeds and at the EUROPE-INBO 2010, 8th International Conference for the implementation of the European Water Framework Directive.

We are already working on our next Newsletter due to be published at the end of the year and will feature an article on urban flooding and work of our Wastewater Section.

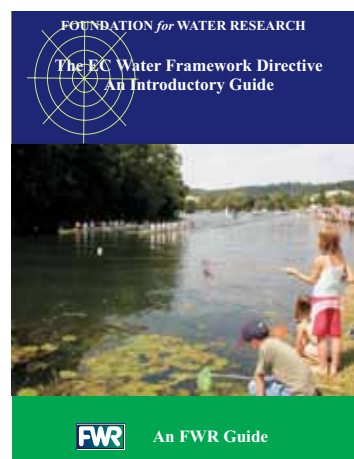


Library

the information centre for water, wastewater and related environmental issues



New publications from the FWR



New FWR ROCKs and Guides:

- **Updated FWR Guide FR/G0001:** The EC Water Framework Directive - An Introductory Guide (available September 2010)
- **Updated FWR ROCK FR/R0007:** Causes of Copper Corrosion in Plumbing Systems (available October 2010)
- **A new FWR Guide FR/G0008:** Urban Wastewater Management (available October 2010)

SNIFFER Reports:

SNIFFER, the Scotland and Northern Ireland Forum for Environmental Research, manages and publishes research addressing knowledge gaps relating to environmental issues. The reports are available in pdf format on the SNIFFER website (<http://www.sniffer.org.uk>). Printed copies or CDs (£20+VAT) can be ordered from our FWR website (<http://www.fwr.org>) or by e-mail: office@fwr.org.uk. The following new reports are now available from FWR:

- **ER05** - Impact of Biomass and Bioenergy Crops on Landscape, Land Use and the Wider Environment in Northern Ireland and Scotland (£35)
- **ER07** - Development of a Methodology to Summarise and Track Air Pollution Effects on Ecosystems at Regional Scales (£25)
- **ER09** - Levels of Pharmaceuticals and Drugs of Abuse in the Scottish Environment (£25)
- **ER11** - Code of Practice on the Use of Sludge, Composts and Other Organic Materials for Land Restoration (£11)
- **UKCC14** - The Use of Environmental Limits in Regulating Environmental Systems - How Could the Concept Be Applied in Environmental Agencies? (£25)

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