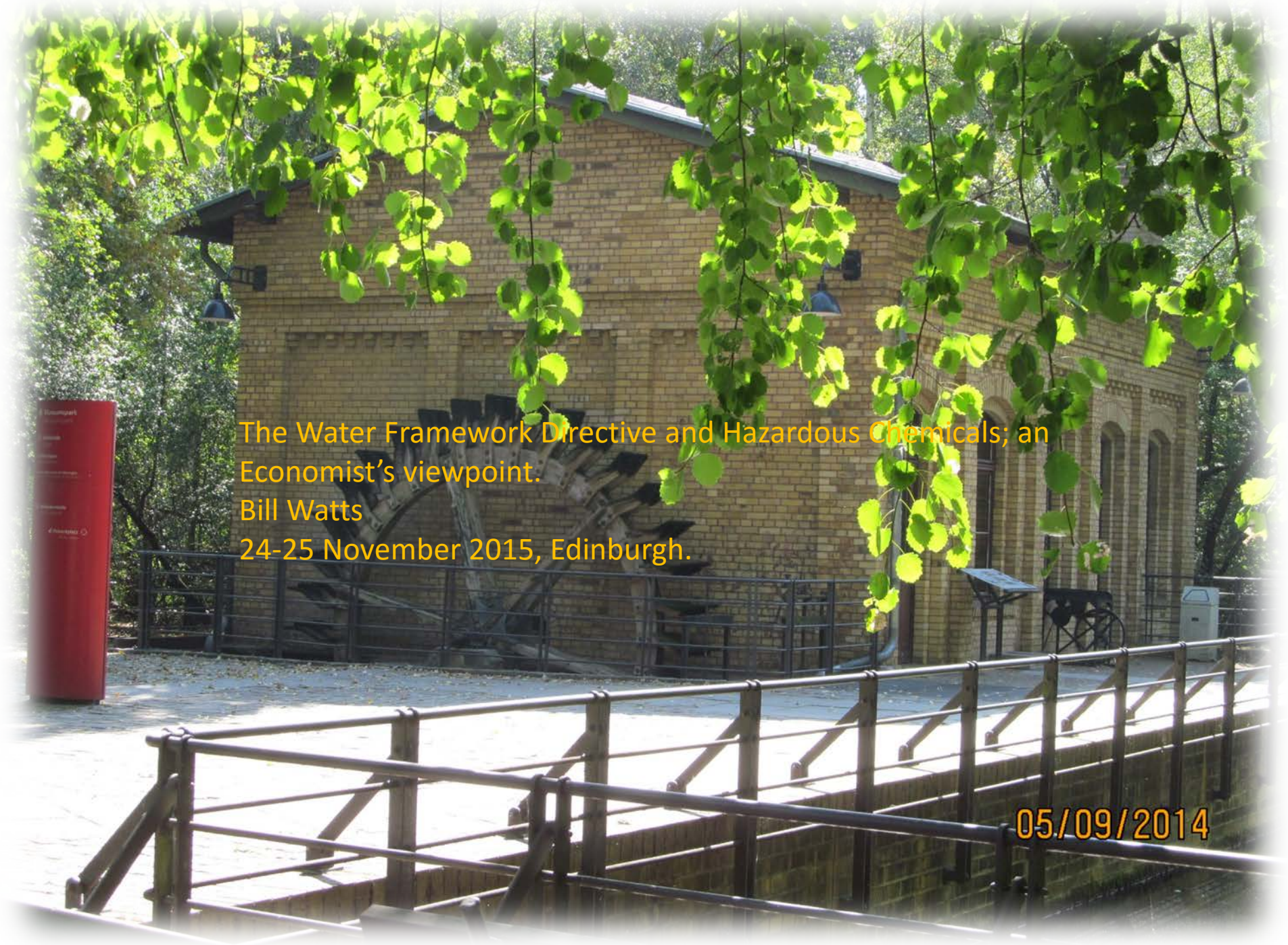
The Water Framework Directive and Hazardous Chemicals; an Economist's viewpoint.
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24-25 November 2015, Edinburgh.
05/09/2014

The Directive says…….probably

David Taylor elsewhere shows that the Directive is a patchwork of various influences. The purpose is to drive up the standard of water bodies with regard to 3 rather important things (Article 4, para 1.a.iii):

- That benefits should be proportionate to costs of the measure (Artic 16 para 6) (Prologue para 31) (Article 4, para 5 a)
- The polluters pays both the costs of their treatment and there is an implication given the acceptance of the economic instruments that the damage caused by pollution should be internalised back on to the polluter (may be) in the form of a (ecosystem) damage related tax. (Prologue para 38) (prologue, para 11)
- Control at or close to source regulation is to be preferred. (prologue, para 11)

Implementation

- No UK primary legislation; existing powers and responsibilities were adapted to comply.
- The economics seem lost sight of and the precautionary principle, also referred to in the Directive given prominence in a series of inconsistently applied limit standards, related to some concept of ecological damage (prologue, para 11).
- The Polluter Pays Principle has often been ignored even in the limited sense of covering own treatment costs, notably in Agriculture.

“The significance of hazardous chemicals in wastewater treatment works effluents Michael Gardner , Mark Scrimshaw et al.” (Science of the Total Environment 437 (2012) 363–372)

- The Chemicals Investigation Programme (CIP) is coordinated by the UK Water Industry Research (UKWIR). CIP operates in three components:
- C1 — Final effluents from 162 WwTWs in England, Scotland and Wales were collected, the concentrations of chemicals discharged to receiving waters measured and compared with regulatory compliant levels.
- C2 — Investigations to assess WwTWs performance; 28WwTWs were examined in an evaluation of treatment efficacy at primary, secondary and tertiary treatment levels.
- C3 — Nine urban catchments across the UK were studied to assess catchment sources of the CIP specified chemicals discharged to sewer.

Some of the conclusions from the Chemicals Investigation Programme

- “trace contaminant concentrations in wastewater treatment works‘ effluents can exceed existing or proposed EQS values. In over 50% of the WwTWs monitored, effluent concentrations of the following substances exceed the relevant EQS: Zn, PAHs — fluoranthene, benzo(a) pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i) perylene and indeno(1,2,3-cd)pyrene, BDEs—47 and 99, TBT, triclosan, erythromycin, oxytetracycline, ibuprofen, propranolol, fluoxetine, diclofenac and EE2 and E2.
- A nominal tenfold dilution in the receiving water will ensure compliance with EQSs for the majority hazardous chemicals, apart from the BDEs and to a lesser extent the steroids and (when/ if regulated) some pharmaceuticals.
- In some cases there will be insufficient dilution to guarantee compliance with downstream EQSs. Here additional management options will have to be considered, taking account of the need for proportionality between costs and benefits. Measures to be considered will include: source control, substance substitution, tertiary treatment, and optimisation of existing processes.”

Well so what?

- Sewage Waste Water Works take a lot of Hazardous substances out of waste water and also put some stuff in too. There is also the knotty problem of sewage sludge, which may contain residual contamination.
- There are some Priority substances, including pharmaceuticals where there is no realistic likelihood of meeting required standards using existing plant
- The majority of these chemicals come from the domestic not the industrial sector. (In a real example drawn from CIP, nonylphenol: the domestic sector accounted for 75% of the chemical emitted to the sewage system with Light Industry contributing 6%, “Traders” 13% and “Town centre and runoff” 6%.)
- Note the conclusion taking account of the need for proportionality between costs and benefits. “Measures to be considered will include: source control, substance substitution, tertiary treatment, and optimisation of existing processes.”

And what are the implications?

- The reference to Costs and Benefits is an oblique reference to the (high) cost of meeting some of these standards by traditional Water Industry treatment measures. It is notable that much of existing WFD standard setting is made by recourse to the “precautionary principle” and not a Cost Benefit calculation.
- In the case of a chemical such as Triclosan for instance it would almost certainly be cheaper to control at source; say through REACH rather than the WFD through an end of pipe measure.
- Thus stricter controls at source in the use of Hazardous Chemicals and indeed out right bans could well be the most Cost Effective way of meeting WFD standards; but would they be Cost Beneficial?

The precautionary principle lies at the heart of much EU environmental regulation, but:

- Precautionary regulation affects companies (loss of market, consequent changes to production processes and the costs of abatement technologies) and
- Wider society (passed-on costs, loss of useful substances and substitution by substances which may be equally harmful)
- There is often no apparent countervailing and quantified measure of benefit from the proscription.
- The question of the best point of regulatory intervention remains; should we eliminate through REACH, the Industrial Emission Directive or take a chemical out of sewage waste water or indeed through some other product quality or process control?

Some further observations.

- If improperly handled information about chemical risks can yield destructive results; over-regulation and economic damage.
- We have already seen there is a problem with BDEs which are useful substances with the ability to stop fires and save lives and property.
- There are the risk of false positives (unnecessary bans) and false negatives (chemicals which should be banned and are not)
- Moreover there is the question of the best point of regulatory intervention.

Cost Benefit and the Management of Hazardous Chemicals – **Decabromodiphenyl ether** (also known as deca-BDE)

The ecosystem effects of this chemical are affected by the pathway into the environment, sewage waste water, sludge, air, misconnections, solid waste, but has the potential to affect:

- Provisioning, notably food and water
- Regulatory, mainly air quality though will affect natural pest predators and pollinators
- Cultural, mainly affects fishing though contamination of landscape and water courses could affect recreation and aesthetic value
- Supporting, will degrade habitat and suppress natural productivity
- Could affect Resilience and System Integrity (“ecosystem glue”)

Commentary on these welfare end points.

With deca-BDE and possibly other PBT type compounds the scale and nature of these impacts are very unpredictable, long lived, with far field effects difficult to value with confidence

- may include secondary poisoning as an important component of damage. If true the valuation issue is tractable. (There is an extensive literature on the Value of Premature Fatalities and various impaired human health states.)
- Toxicity is a variable and often subtle concept and the hypothesis needs to be tested. Could we establish a usable taxonomy of effect, which can be used to simplify valuation?
- The effect of the chemical depends on the many pathways from the human to the wider environment through which is it is dispersed.
- Given that the direct effect of the dispersion of this chemical is so poorly understood, the wider system resilience effect can only be labelled as wild conjecture.

And of course deca-BDE is a useful chemical

- It is a flame retardant with valuable properties. We might note Deheuvels (2004) conclusion that a ‘year-on-year’ reduction in fire deaths in the UK since the 1988 Furniture Fire Safety regulations, after the influence of smoking or of smoke detectors has been removed was 180 lives per year saved by 2000. This improvement is a consequence of using flame retardants such as deca-BDE and is an example of benefit.
- Substitution entails costs in terms of reformulation, loss of efficacy and potential harmful effects from the material used as a substitute.

So where does this leave us?

- The deconstruction implicit in Cost Benefit Analysis shows that Hazardous Chemical management decisions are complicated.
- The issues are mainly scientific and technical; valuation, once you know what you are valuing is quite straight forward
- The scientific knowledge required for a Cost Benefit analysis is also needed for a proper science based judgement on the use of these chemicals whether that is labelled Risk Assessment or Precautionary Principle.
- We have limited understand of the effect of these chemicals and should be honest and seek guidance from our most important stakeholder the General Public. It is not honest to hide in a regulatory black box.

Can we get useful results from the public, if the effect we are seeking to value is poorly understood but may have adverse consequences ?

- In every day life, the public make judgements and spend money in respect of goods and services of which they have only limited understanding
- Note the following proof of concept study the “Economic benefits of controlling PBT/vPvB substances: Two case studies” by Susana Mourato, at London School of Economics and Stavros Georgiou the Health and Safety Executive”.
- This showed that the public (or at least the sample) had a total Willingness To Pay value ranging from £129 to £145 to avoid the known adverse consequences of deca-BDE; though whether this specific to the chemical or Persistent Bio-Accumulative and Toxic chemicals as generality is a moot point.

In conclusion

- As distinct from the original legislation, the implementation of the WFD has been a (good rather than bad) economics free zone.
- The haphazard application of the precautionary principle as expressed in EQS, mean that we are almost certainly trying to regulate some chemicals too much and some too little
- Once these hazardous chemicals are in effluent, the only option is either to let them go or introduce (often) expensive end of pipe treatment. Economically the best option might be to control closer to source, if at all.

What can be done?

- Hazardous Chemical management should be subject to Cost Benefit Analysis, both in terms of the (1) extent of regulation and (2) where that regulation takes place, that is whether close to source or end of pipe.
- A full Cost Benefit Analysis of the control of a Hazardous chemical is a complicated thing, noting the various pathways, lags, varied ecosystem headings affected and not least properly accounting for Ecosystem Resilience effects. (Not forgetting the need for cost as well as benefit data.)
- However, proper Cost Benefit Analysis just makes explicit the data and analysis which should have been there is setting current standards.

Furthermore and the good news.

- It may be analytically appropriate to appraise Hazardous chemical control strategies at group, rather than individual chemical level; thus needing fewer analyses and reducing the aggregate burden of analysis
- There are short cuts in Cost Benefit analysis, such as Value Transfer for benefits numbers which reduce cost and effort. (Could this approach also be used for cost data and possibly effects data?)
- If we cannot deconstruct the benefits of Hazardous chemical control, we can elicit people's preferences and associated "willingness to pay" to avoid the potential risk these chemicals represent and use that within a Cost Benefit Analysis. This would allow us calibrate the precautionary approach, so that it is applied consistently to all similar chemicals and yield an optimal pattern of control.
- Improved analysis would also reduce implementation costs by pushing regulation closer to source where that was appropriate as well as gaining the most benefit from that regulation.

The End, thanks for you attention.