

THE SOIL AND GROUNDWATER TECHNOLOGY ASSOCIATION

SAGTA REPORT 30 – WATER ISSUES AND CONTAMINATION: LEGISLATION AND MANAGEMENT

Introduction

SAGTA's June 2006 workshop considered the issues associated with water and the management of land contamination. The focus for the day was to develop an understanding of where we are now with these issues and where we are going in the future.

The workshop drew upon experience from industry members of directly addressing regulatory matters relating to water and experiences in integrating with catchment management planning. Cost benefit issues were also addressed, including a regulatory perspective from the Environment Agency (the Agency). Finally the workshop considered what tools were available to land owners for assessing the impact of contamination on controlled waters and asked whether these tools were fit for purpose.

Key Issues Drawn from Workshop Presentations and Discussion Sessions

European Legislation

One of the main conclusions of the day was that significant regulatory progress is being made in this area and SAGTA needs to work hard to keep plugged into it. Issues with the Water Framework Directive (WFD) and Groundwater Daughter Directive (GWDD) highlighted the need to keep on top of developments in European legislation. There is a need to track proposals coming to the Commission, as this is the time to get involved. Links exist already via NICOLE as certain SAGTA members, including Nexia and National Grid, are also members. One particular piece of legislation for which there is cause for concern is the proposed Soil Framework Directive, which is not joined up with the WFD or GWDD.

Another possible opportunity for involvement is via DEFRA's Stakeholder Groups (e.g. Groundwater), who are consulted on Regulatory Impact Assessments from Europe. National Grid has attended the Groundwater Stakeholder Group in the past. It was also suggested that SAGTA could contact Development Policy Heads in the Agency to keep in touch with upcoming issues. The possibility of setting up six monthly meetings with the relevant Environment Agency policy heads was raised, together with involvement of the Scottish Environmental Protection Agency (SEPA). SAGTA networking was also identified as a way of keeping up to date with developments.

Views were expressed that EC legislation has a tendency to be risk averse rather than risk-based. As such, Member organisations need to campaign, via trade bodies, at a European level for a risk based approach. One particular issue that was highlighted during the workshop was the potential for the proposed GWDD to impact on the way that contaminated land is managed. If adopted as it stands, it will introduce concentration based thresholds in groundwater as compliance criteria, as opposed to risk based levels. One consequence of this may be to prohibit the use of MNA as a remediation technique.

Guidance

The requirement for a number of pieces of guidance was raised during the day. This included guidance on 'significant pollution of controlled waters', cost benefit analysis and the setting of compliance points in the assessment of water pollution. The issue of whether SAGTA could aid consistency through contributing to the consultation on such guidance was raised. The question of whether there were gaps in the guidance available was also raised and whether guidance to the guidance was required.

The change in definition under Part 2A to 'significant pollution of controlled waters' was discussed. Statutory guidance has been issued by SEPA, which refers to the exceedance of a relevant EQS as being

‘significant’. Guidance is yet to be issued by the Agency. Both the Agency and SEPA believe that the requirement for ‘significant’ pollution has always been implicit within the Part 2A regime, as pollution is defined as harm, so by definition is always significant.

Cost Benefit

Cost Benefit Analysis (CBA) is enshrined in the Water Framework Directive. The Agency are undertaking research on tools for the appraisal of disproportionate costs under the Water Framework Directive and are updating their guiding on CBA in relation to groundwater. It was felt that CBA is not used enough in decision making and the possibility of SAGTA raising the profile of CBA through a workshop was raised.

Modelling

The Agency’s P20 guidance is currently being redrafted and SAGTA should provide support to this process. Information on the behaviour of plumes could also be made available through CL:AIRE/SIREN etc. These projects should be used as an information source.

One of the key issues to discuss at the upcoming joint SAGTA/CL:AIRE workshop is the issue of ‘fit for purpose’ tools for groundwater modelling. Having confidence in remediation starts with having confidence in the modelling tools used.

SAGTA Contributions

SAGTA should be able to contribute in the following ways:

1. By capturing concerns of SAGTA members and communicating this to government agencies (through various trade bodies). More should be done on a European level – SAGTA should review their representation at a European level;
2. Arrange 6 monthly meetings with EA/SEPA policy heads;
3. Offer representation at DEFRA Stakeholder Groups;
4. Possible input to EA/Regulator collaborative research on tools for the appraisal of disproportionate costs under Water Framework Directive;
5. Indication of SAGTA members’ experience of CBA for land/water contamination and lessons learned;
6. Providing input to the revision of CBA guidance;
7. Holding a workshop on CBA;
8. Request input to compliance point guidance;
9. Feedback into P20 guidance;
10. Ensure P20 is used by SAGTA’s suppliers if appropriate.

Summary of Workshop Presentations

Setting the Scene

Water Issues and Land Contamination – Where are we going?

This presentation looked at the legal perspectives relating to water and in particular looked at current legal developments in the following four areas:

- Water Framework Directive
- Proposed Groundwater Directive
- Changes to the Contaminated Land Regime – the ‘significance test’
- Environmental Liability Directive

The **Water Framework Directive (WFD)** is the largest and most ambiguous piece of water legislation to date. The aim of it is to rationalise and update existing water legislation and to introduce a coordinated management approach, based on a six yearly cycle of River Basin Management Plans.

The Directive will cover all surface waters (inland, transitional and coastal) and groundwater and the objectives are to:

- Enhance status and prevent deterioration of aquatic ecosystems;
- Achieve 'Good Status' for most water bodies by 2015;
- Reduce pollution, especially by priority and priority hazardous substances;
- Combat the effect of floods and droughts.

The definition of 'Good Status' differs for surface water and groundwaters. For surface water it refers to achieving good ecological and chemical status. For groundwater the aim is to achieve good quantitative (i.e. balancing abstraction rates with recharge) and chemical status. Chemical status will be further defined in the Groundwater Daughter Directive. An alternative objective of achieving 'Good ecological potential' is also provided for where water bodies are artificial or heavily modified.

In the UK, the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 came into force in January 2004, establishing the roles of the Agency and DEFRA. Nine River Basin Districts have been identified in England and Wales, plus 2 cross border River Basin Districts with Scotland. The UK's progress on implementing the Directive was outlined, as was the next steps for the Directive, including the date by which the Programme of Measures should be operation (22nd December 2012).

The programme of measures is a package of legislation and policy tools intended to achieve the WFD objectives in each River Basin District. This will include legislative powers, such as the Contaminated Land Regime and the Water Resources Act, but can also include economic instruments, codes of practice and education programmes. The Programme of Measures will need to be agreed between the Agency and other regulators and implementers and should reflect the Governments Better Regulation Agenda.

Groundwater Daughter Directive (GWDD). The proposed new Groundwater Daughter Directive (GWDD) was originally proposed in September 2003 under Article 17 of the WFD. The intention is to clarify some of the WFD Objectives, such as the criteria for assessing good chemical status in groundwater. Key provisions include the requirement for Member States to establish groundwater quality standards in accordance with specific standards for nitrates and pesticides, as well as guidelines for other pollutants and a requirement to carry out additional trend assessment in relation to point sources and contaminated sites which threaten WFD objectives. A second reading of the Directive was planned for June 2006. An interim Direction has been issued to the Agency by the Secretary of State under section 40 of the Environment Act. This requires the Agency to set threshold values for pollutants (submit for approval by 22nd June 2008); establish methodologies for deriving threshold values (by 22nd December 2006); identify any significant and sustained upward trend in pollutant concentration and apply the approach set out in the common position draft Directive (by 22nd December 2008).

Contaminated Land Regime. Changes to the Contaminated Land Regime are due to be made in relation to the new definition of contaminated land with relation to the pollution of controlled waters. This definition is not yet in force, although the legislation requiring the change has been enacted. The definition of Contaminated Land currently includes land that is in such a condition that 'pollution of controlled waters is being, or is likely to be, caused'. The new definition will require land to be causing 'significant pollution' or 'significant possibility of pollution'. The question of whether pollution of controlled waters is significant will be determined in accordance with guidance issued by the Secretary of State. This guidance has not yet been consulted on. The definition of groundwater under the Regime has also been amended, such that it does not include waters in underground strata above the saturation zone.

Environmental Liability Directive (ELD). The Environmental Liability Directive (ELD) must be implemented into UK law by 30th April 2007 and applies only to damage that occurs after this date. The Directive covers damage to land and habitats and species protected by EU law as well as to water. For water it applies to damage which adversely affects the ecological, chemical or quantitative status and/or ecological potential of water. Operators of specific business activities listed in the Directive are strictly liable for any environmental damage caused, and must take measures to remedy or prevent such damage. Operators of

other activities are liable for damage to protected species and habitats if at fault or negligent. Two consultations are planned on the ELD:

- An initial consultation in summer 2006 on options for implementing the ELD into UK law; and
- A second consultation on draft legislation in winter 2006/2007.

Water Framework Directive and its Implementation: Groundwater/surface water issues.

The Agency gave an update on the progress being made with implementing the WFD and the GWDD. The initial characterisation of water bodies was completed by December 2004. It involved data gathering; risk assessment and the division of water bodies into those at risk of failing WFD objectives and those not at risk.

No further action was necessary where water bodies were not at risk, but those identified as being at risk were taken to the next stage of characterisation. This involved a more detailed risk assessment and further development of conceptual models and was completed by December 2005. Monitoring networks have been established, which will help groundwater bodies to be classified as being of good or poor groundwater status. Monitoring is due to start in December 2006.

Article 17 of the WFD provides for the development of the GWDD for the purpose of establishing:

- Criteria for assessing “good groundwater chemical status”
- Measures to prevent inputs of hazardous substances to groundwater and to limit inputs of all other pollutants; and criteria for identifying significant and sustained upward trends and the starting points for trend reversal.

Unlike the existing Groundwater Directive, which deals with activities, the proposed GWDD will deal with ‘inputs’ arising from activities and from other sources, such as diffuse pollution.

The European Council adopted a Common Position in January 2006 which will be the subject of a second reading by the European Parliament in June 2006, with the aim of adopting the Directive by the end of the year. Member States will have two years from the date of its adoption to transpose the GWDD into national law.

Good groundwater chemical status would require common groundwater quality standards to be met for nitrates (50 mg/l) and individual pesticides (0.1 µg/l). Upward trends in pollutant concentrations in groundwater would be regarded as significant and sustained when they exceeded 75% of the relevant threshold value. This is also the point at which there would need to be a reversal.

The Common Position would also require inputs of hazardous substances to be prevented and for inputs of all other pollutants to be limited. There are potential problems with the transposition of this requirement to ‘prevent’ inputs in the UK. The term ‘prevent’ has a different meaning in other European languages than in UK law, where it means to stop absolutely. This will be impossible in certain situations. A number of exemptions to the prevention and limitation of inputs to groundwater exist in the Common Position, including exemptions of de minimis inputs and inputs resulting from accidents or natural causes that could not be reasonably foreseen.

The European Parliament will consider a large number of possible amendments to the Common Position during its second reading. There are a number of potentially problematic proposals for amendments e.g. additive threshold setting system for those water bodies with naturally occurring levels of substances above threshold values (i.e. background + standard). Another proposed amendment is to define the baseline concentration as the average concentration measured during 2007/8. No deterioration in quality would be allowed from this point.

However, should the GWDD not be adopted by the end of the year, Member States will be required to act unilaterally to implement the groundwater requirements of the WFD. To this end the UK Government has

issued the Groundwater (Water Framework Directive) Direction 2006 to the Agency. This Direction requires the Agency to proceed with establishing threshold values and criteria for identifying significant and sustained upward trends and determining a starting point for the reversal of trends on the basis of the available draft Common Position (i.e. at 75% of the threshold value).

Guidance will be produced at various levels to fill out the framework provided by the GWDD and the WFD. Within the UK the UK TAG has provided guidance on surface water classification, monitoring and classification of groundwater. The Agency is producing a subsequent tier of internal process guidance based upon these. Furthermore the Agency will be consulting on a revised groundwater protection policy (GP3) and will be revising P20. In the longer term the UK will need to transpose the GWDD into UK law. Even if a GWDD is not adopted, changes will need to be made to existing UK groundwater legislation to implement the groundwater related requirements of the WFD. This will include preventing and limiting impacts of all pollutants, not just List I and II substances; preventing and limiting all inputs, and not just those from activities (e.g. diffuse pollution from farming etc..) and the inclusion of radioactive substances.

The GWDD is not expected to have immediate effects on landowners, but changes to legislation will be picked up in reviews of existing consents and authorisations. The requirement to prevent or limit inputs of pollutants to groundwater may have the greatest impact.

Dealing with diffuse pollution is also likely to present a significant problem, because this area is traditionally unregulated (e.g. farming). Codes of practice (with considerable awareness raising) are likely to be the best way forward.

The question of what is meant by 'significant pollution of controlled water' is currently being looked at by DEFRA. Guidance will be issued on this subject once the requirements of the GWDD are understood. As a UK regime, Part 2A does not necessarily fit in with the WFD or GWDD requirements. There could also be an interaction between planning and the WFD and GWDD, for example planning decisions will need to fit in with River Basin Management Plans.

Related Considerations – Cost Benefit

Cost benefit issues – assessing net environmental issues

Remedial decision making requires a consideration of a number of issues such as deciding the appropriate level of remediation, which risks to address and to what degree, what is a reasonable cost and what the benefits to stakeholders are. Risk assessment is a decision making tool widely used and advocated by regulators, which qualifies and compares risk. The economic argument, however, considers all perspectives and looks at problems in terms of financial value, which is a universally understood concept. It also allows landowners to focus limited resources on action that will provide the greatest benefits. Financial analysis differs from CBA as it involves looking at costs only and does not take into consideration society as a whole.

UK guidance precludes the monetisation of human health impacts as all remedial options considered must be protective of human health and mitigate identified human health risks.

The benefits are expressed as damage avoided. This approach allows the benefits and the risks managed by different remedial approaches to be compared, by monetizing the risk and damage averted. The economic optimum can be found by comparing various options (e.g. do nothing vs containment vs hotspot removal vs full source removal).

A case study example was given for contaminated land at a former gas works. CBA was used to look at the least costly option for breaking the significant pollutant linkages. Benefit Cost Ratios (BCRs) were compared for different options.

Cost benefit – Environment Agency perspectives

The WFD recognizes the need to accommodate social and economic considerations in its implementation and is a key driver for needing information on groundwater ‘benefits’. Obtaining information on costs associated with groundwater management is easier than monetizing the benefits.

A key question for the WFD is what evidence do you use to demonstrate that your measures are effective? Other issues include the response time of aquifers – will they allow us to achieve good status within the required timeframes?

The Agency is undertaking research on tools for the appraisal of disproportionate costs under the WFD. They are also currently revising their existing guidance on CBA and groundwater, which will contain more guidance on how to determine ‘benefits’.

Members Activities and Issues

CONCAWE Groundwater/Surface Water Sensitivity Study

CONCAWE is an acronym for Conservation of Clean Air and Water in Europe. Its membership includes most oil companies operating in Europe and it operates as a Health Safety and Environmental technical forum which establishes guidance for the oil industry.

The CONCAWE environmental sensitivity study at downstream oil industry facilities was undertaken for a number of reasons including: to promote a site specific, risk based approach to the management of groundwater and surface water contamination; to input to the debate on implementation of the WFD and GWDD and to enable CONCAWE member companies to identify high risk countries or regions of countries in which they operate to facilitate the development of risk management plans. The technical objectives of the work were to assess the risk of the downstream oil industry (e.g. petrol stations, supermarkets etc.) to the environment (surface waters, groundwater and ecological receptors) arising from leaks and spills to land. A phased approach was taken to look the various countries involved and a number of countries could not be included in the study due to the lack of easily accessible data.

In order to assess potential risk, 5 sensitivity categories were identified for each receptor type which ranged from a high potential risk (e.g. within a source protection zone) to low potential risk (e.g. a non aquifer and not within a source protection zone). The Czech Republic provided a good data set and was presented as an example. The study concluded that oil industry facilities do not pose a widespread threat to water resources as the number of high sensitivity sites is limited. Inter country comparisons proved difficult and the study also found that the availability and cost of environmental data was highly variable from country to country and was a significant limiting factor in some countries.

Experiences in implementation of the Groundwater Directive – waste management sites

A specific example of on-going issues associated with the implementation of the Groundwater Directive at Pulverized Fuel Ash (PFA) disposal sites was discussed. This type of ash is an inevitable result of burning coal. The major components of the waste are Si/Al/Fe oxides (up to 80%) and it also contains some trace elements (B, Mo, As, Se) and unburned carbon. There are no measurable traces of organic compounds due to the high combustion temperatures. The primary aim is to recycle this waste (largely in the construction industry), although this is currently hampered by the definition of waste. The remainder (around 50%) needs to be disposed of.

There is an historical assumption of limited potential for impacts on groundwater from this waste. It has a low hydraulic conductivity and is classed as non-hazardous in the European Waste Catalogue. The most significant potential contaminants are: Cd, Hg (List I) and Mo, As, Se, Al (List II). Compliance is assessed against Environmentally Acceptable Limits (EALs), which are based on Minimum Reportable Values (MRVs) and are very low (Cd - 0.0001 mg/l). The logic behind using MRVs to assess “deterioration in the quality of receiving groundwater” was questioned. MRVs cannot reliably be attained even by the Agency’s lab. A simple risk assessment at a particular site demonstrated that the UK & EU Drinking Water Standards and the EQS for Cd, which are both considerably higher than the MRV, would not be breached, yet this

situation was considered unacceptable based on a breach of the MRV. This raises the question of whether this should really be considered as “pollution” i.e. danger to human health, aquatic systems, use of water, etc.?

It was felt that this represented a tendency in the UK to over-implement EC environmental legislation compared with other states. EC legislation is inherently ambiguous and there is a tendency for UK enforcement and practical implementation to be risk averse rather than risk-based and legalistic rather than pragmatic. Guidance by UK environmental regulators tends to be heavily precautionary. These issues are common to many other pieces of European legislation. This approach fails to prioritise real environmental risks and results in resources being targeted at insignificant issues and away from more significant problems.

Tools and modelling – activity and experience

Current Agency work – Updating the P20 publication

P20 is the Agency’s “Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources” and was published in 1999 to deal with historic contamination. The purpose of the document is to allow the user to derive ‘reasonable and achievable’ remedial targets for soil and groundwater, which are protective of groundwater and surface water receptors. It can be used against a background of planning controls and the Agency’s responsibilities to protect the water environment (e.g. Part 2A). The document now requires updating to reflect the experience gained over the last 7 years, to incorporate changes in legislation and to bring it in line with Part 2A and the Model Procedures.

The document will maintain 4 assessment levels (currently called ‘tiers’ in 1999 methodology) through which the assessor moves (with increasing complexity) until the assessment process is complete. The compliance point changes as the assessment progress through the tiers. The compliance point moves away from the source to allow attenuation to be taken into account, but a balance needs to be struck between attenuation and the expansion of the plume. Factors to be taken into account when setting the compliance point include the sensitivity of down gradient receptors, the future use of the water resource and the implications of cost versus environmental benefit. The Agency will be issuing a separate document on setting compliance points.

Natural Attenuation is key in limiting the expansion of plumes and degradation can have a significant influence on calculated remedial targets. However, the rate of degradation is site specific and can vary greatly for individual contaminants. How contaminants behave in groundwater will determine the type of plume associated with the contamination (i.e. expanding, steady state or shrinking). Limited information is available in the UK but some generalisations can be made. Travel time can also be taken into account and for some contaminants retardation can be significant.

In order to follow the P20 methodology, a certain amount of data needs to be available to the assessor. This includes a good definition of soil and groundwater contamination and site specific data relating to permeability of the strata, the geochemical environment and evidence of degradation. Monitoring boreholes are also essential and access to off site boreholes, where these are required, can be a problem. A spreadsheet tool is provided for use with the methodology, however a large number of other tools are available.

Difficulty can arise where, for example, there is a poor understanding of the conceptual model and by blinkered use of mathematical models. Choosing the location of the compliance point can also cause problems. Advances have been made, however, in the science that supports such assessment of groundwater pollution, as has the quality of investigations.

Tools to match UK regulatory requirements. Fit for purpose?

For risk models to be fit for purpose they need to allow sound decisions to be made. A large number of tools for the risk assessment of water pollution and decision making are available. The assessor must ensure that these tools are relevant to the problem at hand. This includes making sure that the tool addresses all of the key processes described by the conceptual model and with an appropriate level of conservatism. Because it is not possible to achieve a 100% accurate representation of reality, the assessor must retain conservative

approximations. These conservative assumptions need to be balanced against cost, but it is important that the implications of these assumptions is understood.

Two case study examples were given which highlighted typical processes and the implications of the risk assessment approach. In conclusion, the following points were made:

- Tier 1-3 tools can be fit for purpose as screening tools. Standard tiered methodologies have a strong role, but must be recognised as screening tools.
- It is important that the risk model is chosen appropriate to the site and not based on the availability of a software package or the training of users or reviewers.
- It is also important to question whether the risk assessment presented is 'fit for purpose'.
- If remediation is indicated:
 - Critically review the conceptual model
 - Test understanding of the field evidence
 - Review levels of simplification in the risk model. If the assessment stopped as a tier 3, look at the benefits of progressing to tier 4 (tier 3 is not a sufficient basis for remediation unless supported by lines of evidence).
- Get a second opinion?
- It is important to understand what the risk assessment is telling you. For example, if a tier 3 shows that a remedial target will be exceeded, does this mean: 'If we don't remediate then unacceptable impact will occur' or 'If we don't remediate then we will need to invest time and effort in understanding what risk of unacceptable impact there is'.

The way forward for risk modelling is to provide more feedback from real field evidence to increase confidence in risk models and to gain a better understanding of whether processes can be relied on to protect the receptor. The toolkit should also be expanded to provide tools to deal with key processes and better training needs to be provided for practitioners and regulators. Practitioners also need to be required to provide appropriate assessments.