A strategic approach to tackle risks from harmful chemicals in UK waters (UK Administration level document).

Introduction

The purpose of setting out this UK-level strategic approach is to describe a framework to prioritise harmful chemicals based on their risk in the water environment and to detail common approaches on management options as far as is possible. This will help ensure a consistent approach as the most effective way to manage chemicals of widespread concern from sources and pathways that are common across the UK. It gives the individual UK nations the autonomy to set the levels at which a concern is triggered within the framework, and to prioritise chemicals used or released in ways that are particular to their situation (e.g. chemicals used in specific industries, agriculture, aquaculture).

The approach aims to focus efforts on sustainable solutions to tackle and reduce chemical pollution in a way that is both cost beneficial and will bring optimum benefits to people and wildlife. It is designed to help provide consistency in the next update of River Basin Management Plans (RBMP), ensuring that options for improvement action to address chemical pressures are also appropriate and proportionate to meet RBMP objectives and help address land-based sources of pollution to the marine environment.

We link chemical prioritisation to monitoring as an iterative process, allowing UK nations the freedom to improve the evidence of known and higher risk chemicals. The approach identifies chemicals and associated issues of potential emerging concern, and responds accordingly. In this way it is designed to be dynamic, responsive to changes in scientific developments and the environment.

Following the decision to leave the European Union, we now have a fresh opportunity to consider a long-term vision for our environment. The approach set out here will ensure a continuing high level of environmental protection into the future. It will continue to evolve to ensure it remains relevant to deliver the longer term environmental ambitions of the UK Government and the Devolved Administrations (such as the 25 year environment plan being developed by Defra).
The principles underpinning the strategic approach are documented in Annex A (I).

Protection Goals

Many chemicals have some hazardous properties, but it is the extent of exposure to them that determines the risk. The strategic approach set out here identifies and focuses action on chemicals of widespread risk, for instance ones that need action to reduce elevated concentrations in the environment arising from common “sources”. These include metal pollutants from abandoned mines, persistent organic pollutants (POPs) from waste streams and domestic sources discharged through sewage treatment works and widespread diffuse, low level inputs of pollutants like mercury and combustion by-products from aerial deposition. Chemicals of local concern – those with relatively few, isolated issues – are best dealt with at a water body or catchment level and we do not specifically seek to address all of these within this approach.

This approach aims to protect the following:

- Aquatic life (fish, plants and invertebrates) from exposure to chemicals in UK waters;
- Human health and higher wildlife predators from chemicals that may accumulate via the aquatic food chain; and

- Surface and groundwater sources where chemical contamination may compromise their on-going use to supply water for domestic or food production purposes.

Emerging evidence from monitoring of aquatic organisms such as fish or mussels suggests wider concerns from a few chemicals. These substances do not break down easily and can accumulate through the food chain, potentially affecting people and top wildlife predators (the so-called Persistent, Bioaccumulative and Toxic (PBT) chemicals).

Chemical Prioritisation Framework

Chemical prioritisation under the approach currently uses existing environmental data held by the UK Administrations for harmful substances recognised to be of potential concern at the EU or UK level, but also recognises the potential threat posed by what are termed "chemicals of emerging concern". Individual UK Administrations have carried out their own data collection and prioritisation exercises, sometimes supplemented by data from other stakeholders, such as that from the water industry's Chemicals Investigation Programmes.

Environmental Quality Standards (EQSs) as set in the Water Framework Directive (WFD) legislation for chemicals recognised to be of potential concern at the EU or UK Administration level form a benchmark against which the potential for adverse effects in wildlife and humans can be judged. Other benchmarks may include status assessments of the marine environment and measurements against maximum limits for environmental contaminants in food e.g. as currently stipulated in EU regulations (see *underlying principles 1* at Annex A (I) below.

Any chemical is considered to be 'of concern' if monitoring in the water environment shows impacts that may affect the protection goals, as follows:

- If levels exceed EQSs (set to protect aquatic life, or top predators/people) including where this is causing, or at risk of causing, water bodies to fail "good status" under WFD and MSFD legislation;
- There is a risk that water quality is deteriorating (e.g. significant deterioration within a water body or risks of failing "good status", or objectives to protect groundwater and drinking water sources, or significant increases in chemical concentrations in sediment or organisms such as mussels or fish); or
- That for chemicals classed as a 'Priority Hazardous Substances' in WFD, levels are not expected to decline with existing controls in place.

This strategic approach only considers chemicals that are intrinsically hazardous and so excludes nutrients such as phosphorus and nitrate. Chemicals of widespread concern are those for which there is sufficient evidence showing widely distributed risks that meet any one (or more) of the above three criteria, suggesting a common problem that is best addressed through a national or for chemicals subject to international initiatives, a UK-wide approach. To help prioritise action, the approach ranks chemicals into high and medium priority. The criteria used to do this are up to each individual Nation. Criteria being used are set out in Annex A (III).

The approach also identifies "chemicals of emerging concern" to flag chemicals that do not currently have statutory EQSs or groundwater quality threshold values. These may be emerging at the UK-level as priorities based on widespread exposure or international concern and warrant a national overview so we can respond appropriately if risks are confirmed. This will be a dynamic list and a snapshot of substances and the current criteria being used are set out in Annex A (III).

Environmental monitoring is critical to help identify emerging issues, confirm chemicals representing the greatest risks in the water environment, and track the success of control measures to get the maximum value from available financial investment (see *underlying principles 6* at Annex A (I)).

Options for Improvement Interventions

Management actions to improve water quality are divided into three types:

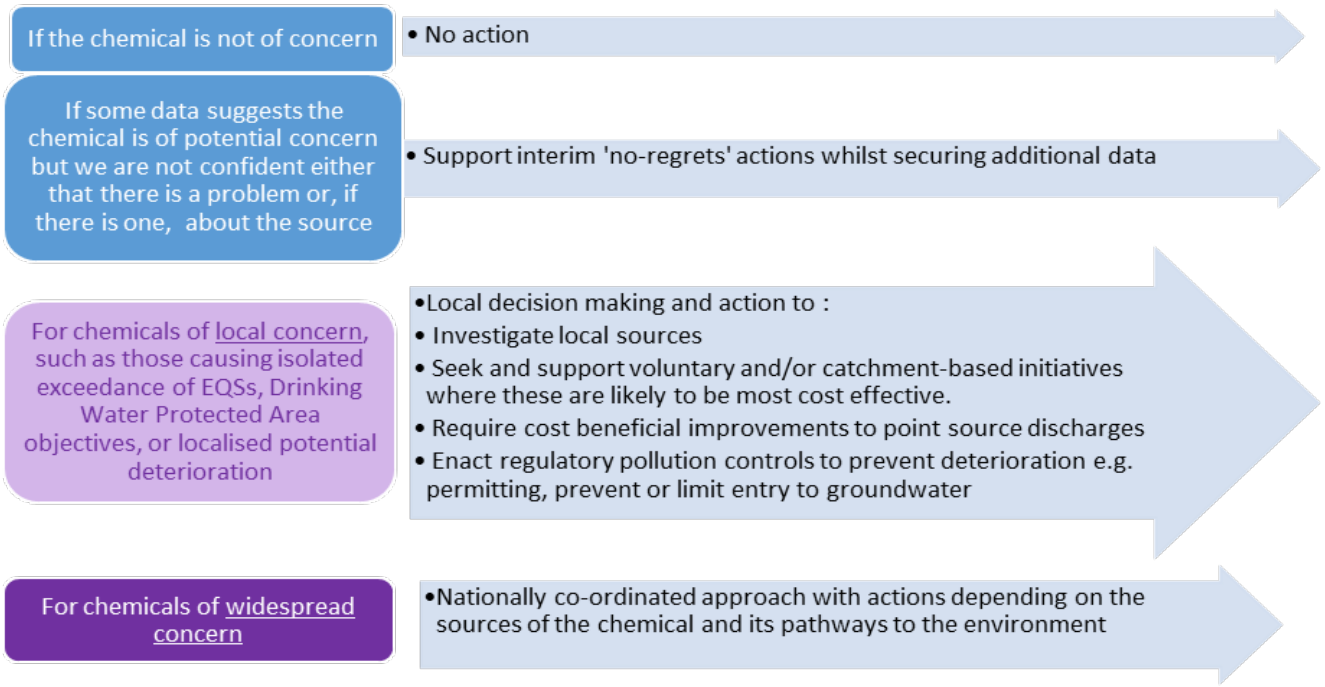
- **Supply-side source controls**: the use of chemicals is restricted or banned through regulation or voluntary initiatives;
- **Pathway interventions**: chemicals are prevented from reaching the receiving environment by blocking their 'pathway' to the environment such as removing pollutants from road run-off through sustainable urban drainage, agricultural good practice schemes or preventing entry of hazardous substances to groundwater through appropriate site engineering; and
- **End-of-pipe treatment**: chemicals in wastewater are reduced or removed before discharging the treated effluent to receiving streams, rivers, ground / groundwater, or the sea.

Annex A (II) gives more detail for these three groups of potential actions and lists their pros and cons.

There is no single best management action. Each substance, or group of substances, requires a tailored approach, often using a combination of actions. Voluntary initiatives can be very effective in mitigating problems at any point in the lifecycle of the chemical. Stakeholders and partner organisations have significant roles to play, often at a catchment level. Catchment-based management approaches can cost less and result in wider environmental, social and economic benefits. Examples include initiatives between water suppliers and the agricultural sector to protect drinking water sources from pesticides and other agri-chemicals and these may also benefit wildlife. Voluntary initiatives are not always enough, in which case statutory source control measures may need to be pursued. These often need to be taken at the UK, EU or international level because of implications for UK businesses.

We must seek to prevent deterioration of our waters, for example by preventing entry of hazardous substances to groundwater because once polluted this is very difficult to reverse. The weight of evidence should be sufficient to justify the actions proposed. When seeking to improve environmental quality, we should be satisfied that the benefits of actions outweigh the costs incurred. We need to recognise that it is often not possible to fully quantify benefits and qualitative assessment may play a role. If costs are disproportionate to the anticipated benefits then a slower pace of progress to achieve good status may be appropriate. Proposed actions should have regard to well established principles of 'precaution' and 'polluter pays'. Where we lack sufficient evidence to support a decision, steps must be taken to address this so robust evidence-based decisions can be made. In such cases, interim 'no-regrets actions' – generally low cost, low risk actions, can be pursued.

The following figure summarises the approach and includes options for chemicals of local concern (those with few or isolated issues).



For chemicals of widespread concern, management options should focus on significant emissions and their pathways to the environment. Intervention as close to the source of the problem as possible is often the most cost-effective solution and should be pursued first when possible. In addition to supply-side controls, this might include pollution control measures implemented by farmers, traders and the general public to minimise discharges to sewer or the environment. However, such measures only work when there is sufficient take-up by the relevant stakeholders and this approach requires concerted and active engagement between all involved. Improvements in domestic wastewater treatment is unlikely to be the most cost-beneficial solution to achieve widespread environmental improvements of specific chemicals except in cases where complementary treatment solutions can be found to reduce inputs of a range of substances and multiple benefits justify the costs incurred. However, good maintenance of the sewer network, appropriate trade effluent controls and engagement with customers on best practice or behavioural change can all contribute to reduce the need to rely on removal through treatment and can have the additional benefit of reducing pollutants in sewage sludge going to land. Where interventions are being made to actively reduce inputs to sewer, we should seek to give these approaches time to demonstrate they can be effective. We should then consider end-of-pipe treatment if other control mechanisms are not available or do not deliver the necessary improvement within an agreed timescale.

Grouping Chemicals by Source for Action

Across the UK, the chemicals prioritised under this approach can be grouped into four categories by source.

Chemicals arising from current sector use/activity: As well as discharges from industry direct to the environment and via sewer this might include plant protection products (PPPs) used in the agricultural or amenity sectors or sea-lice treatments used in aquaculture. However, in the case of PPPs used in agriculture certain catchments are more vulnerable to surface or groundwater pollution from approved ‘pesticides’ because of their intense use in certain localities at particular times of the year. So use of these can be retained,

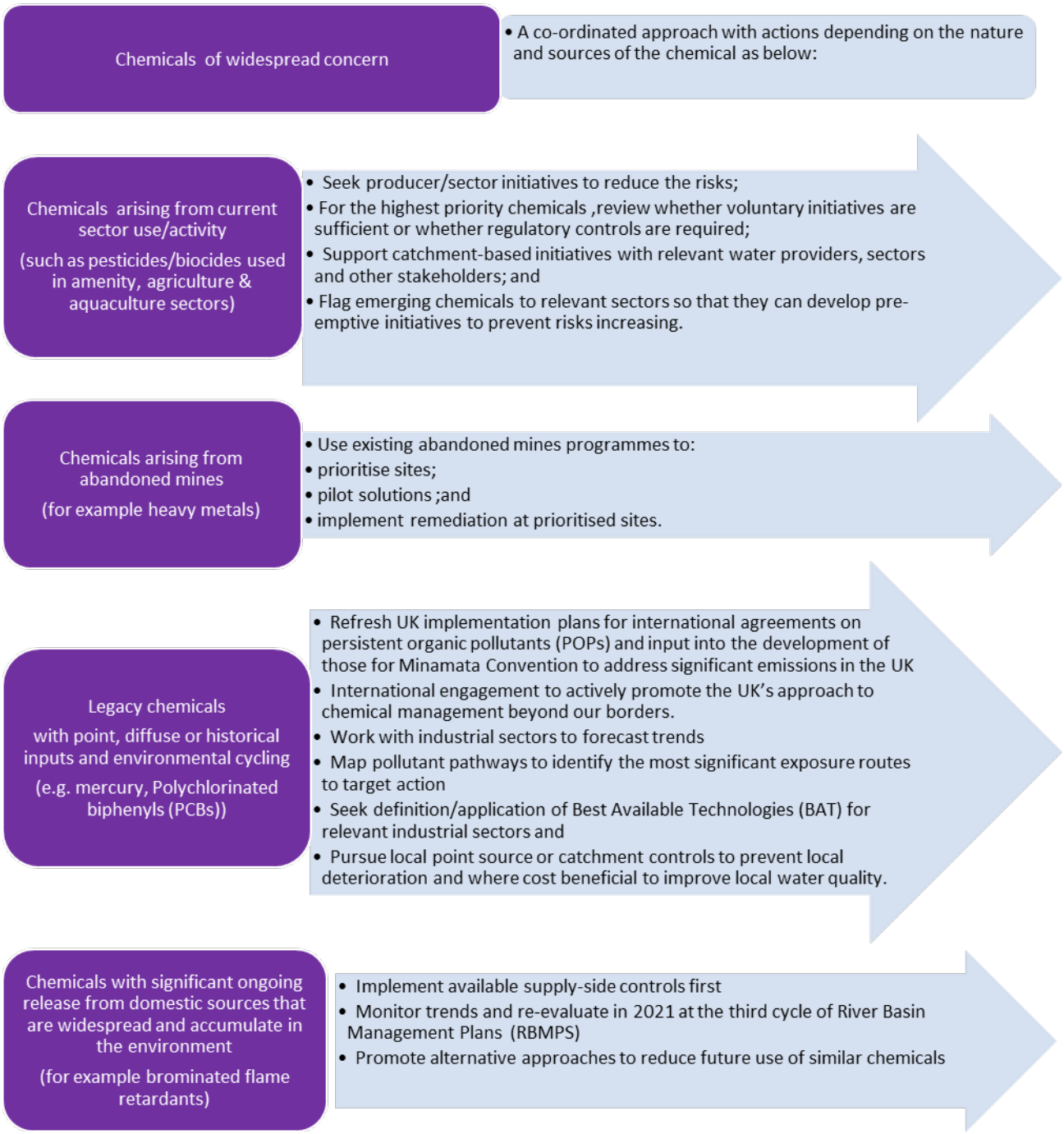
manufacturers and the agri- sector need to adopt integrated pest management practices, promote and adopt codes of good practice (e.g. the Sheep Dip groundwater protection Code) and develop voluntary and catchment-based initiatives with water companies and others to protect drinking water sources and the environment. This requires partnership at both a UK- and local level to deliver improvements where they are most needed. Where problems persist despite such initiatives, then regulatory options will be explored and, if justified, put in place.

Discharges from abandoned metal mines are still responsible for large scale heavy metal loadings in surface waters and groundwater in the UK. Cleaning up this pollution protects aquatic organisms and delivers economic and environmental benefits for local communities. No one is liable for pollution caused from mines abandoned before the year 2000 and here the best approach to solving this issue is to prioritise the most cost beneficial improvements and deliver these through partnership working at the local level.

Domestic chemicals continuing to be discharged through wastewater treatments works (WWTWs). Many chemicals arise in UK waters after they have passed through WWTWs or from storm overflow. A number of persistent and bioaccumulative chemicals of high concern are present in our surface waters as a result of domestic use. These chemicals are now largely banned, although they may still be present in household goods until the end of their life and their presence will diminish over time. Water companies should monitor the anticipated decline in emissions to surface waters and to groundwater, work to reduce locally elevated inputs to sewer and optimise treatment where needed. There might be the need to address local hotspots of specific concern but they should not, at this point in time, put in place advanced treatment technologies to specifically tackle them at a UK level.

Legacy chemicals. These are substances that accumulate in the environment that have been tightly controlled for many years but are subject to ongoing diffuse inputs and environmental cycling. Such substances are often subject to a more complex range of measures, often agreed internationally, to reduce a wide range of sources and inputs over time. Our approach is to continue to work through international agreements to monitor the effectiveness of current measures, revising these if necessary, and tackle remaining sources whilst addressing local hotspots through cost beneficial measures that are identified.

The figure below summarises these four categories, describes the types of chemicals that each category currently captures, and lists available improvement actions.



The last two categories, in particular, contain chemicals that persist in the environment and become widely dispersed throughout freshwater and marine systems. A broad understanding of current environmental quality and a focus on efforts to understand trends in emissions, and the environmental response to reductions, will enable the effectiveness of already identified measures to be evaluated and reviewed. In many cases, measures are included in national implementation plans to deliver international agreements and include the proper disposal of waste materials to minimise releases of identified chemicals back into the environment. Environmental improvement from such measures may be subject to considerable time-lag because of the nature of environmental response mechanisms. This is particularly true for marine systems and groundwater.

Ensuring the strategic approach remains current

This strategic approach is intended to be dynamic and needs to be periodically refreshed to ensure it remains relevant to the UK nations' long-term environmental plans so it can continue to minimise the risks from chemical contaminants in our waters.

The approach needs to keep pace with new developments in technology (such as nanomaterials) and in science to ensure we have appropriate tools to assess the risks of chemicals used in society in the future and to ensure that we have early warning of emerging issues and can respond appropriately to gather information and make timely decisions. Changes in prevailing environmental conditions (e.g. increased environmental fluxes as a result of climate change) are likely to alter our priorities and intervention options over time and this needs to be factored in to the way we respond to those changes in our monitoring, assessment of risk and improvement actions. In England, and to allow early intervention, we will develop a systematic approach to intelligence gathering that is periodically reviewed, sifted and prioritised to direct further work to assess potential risks to the UK environment, wildlife and people. This will include the development of an extended intelligence network with the academic community, international and national policy and regulatory contacts and initiatives to identify and share information on emerging concerns and new approaches to risk assessments. The water environment is a key indicator of wider environmental health and we will utilise intelligence to inform priorities for time-limited targeted monitoring and specific investigations to confirm whether the UK has an emerging issue for water or more broadly.

The UK nations should aim to review and refresh the criteria used to identify chemicals of national concern when their River Basin Management Plans (RBMPs) are updated in 2021. It will be necessary to revisit the prioritisation process to ensure focus is on the highest priorities over the subsequent six year RBMP period. Periodically, the nations will review data for UK specific pollutants through the UK Technical advisory Group to check that EQSs and other measures continue to be appropriate and, if not, consider updating these. They will also consider whether new specific pollutants and accompanying environmental standards should be adopted.

We will undertake periodic surveys of biota that might be relevant to assess chemical impacts e.g. imposex surveys and a survey to confirm the levels and severity of feminisation in selected lowland English rivers that might be caused by endocrine disrupting chemicals. We are keeping a watching brief on the European Commission's strategy on pharmaceuticals and we will clarify the approach we intend to adopt when it is appropriate.

We have currently prioritised two emerging issues for particular attention because of their potential connection to chemical contamination. These are anti-microbial resistance (AMR) and the sources and consequences of micro plastics in the environment. In particular, the Environment Agency is working with the water industry to plan a programme of work to understand the contribution domestic wastewater treatment works effluent may make to the release of antibiotic resistant genes to the environment and the quantity and types of micro-plastics entering domestic wastewater treatment works and subsequently entering the environment in sewage effluent or in sewage sludge.

We also need to continue to evolve our approaches to detect environmental risks in cost effective ways. We will continue to develop a strategic approach to monitoring the environment to make the most of new technologies, approaches to the assessment of environmental impacts (including evaluating new approaches that may emerge to assess risks of environmental mixtures) and, working in partnership with others, to source and

share good quality data and information. This includes continuing to improve information exchange and consistency between freshwater and marine regimes. The Natural Environment Research Council (NERC) has recently launched an initiative to develop radically new approaches to assess chemical risks in the future. Defra and national regulators will work with this initiative as well as maintaining an awareness of other initiatives to identify how any promising new approaches might be taken forward to inform the our approach in the future.

Since many actions to deal with harmful chemicals are determined internationally and have implications for trade as well as environmental protection, the UK needs to continue to engage at the international level on chemicals with widespread risks. Agreeing standards for mutually acceptable data, exchanging knowledge and expertise will help ensure that priorities and approaches agreed to deliver international solutions also reflect what is important in the UK. However, the withdrawal of the UK from the EU will also provide us with the opportunity to tailor our approach to priorities in the UK.

ANNEX A (I): Principles Underlying the Strategic Approach to Managing Risks from Harmful Substances in Our Water Bodies.

1. **Environmental standards will continue to be used to provide a benchmark of environmental quality**. Environmental Quality Standards (EQSs) are set in legislation for chemicals recognised to be of potential concern at the EU or Member State level based on a combination of their toxicity, use and environmental exposure. Standards which are protective of aquatic life address the direct effects of chemicals; those protective of wildlife and human health address indirect toxicity through the food chain. Thus, EQSs fulfil the protection goals of this strategic approach.

   At the present time, meeting EQSs for individual substances is the best guide available to ensure we continue to deliver a high level of protection to people and wildlife from potentially harmful substances in water. Exceeding EQSs will not necessarily result in immediate environmental damage but equally, EQSs do not address the combined risk of mixtures of substances which are found locally in the environment. Approaches to develop supplementary and improved indicators of environmental health continue to be developed internationally.

2. **Widespread concerns are best dealt with by a UK co-ordinated approach.** Chemicals can usefully be separated into those of local or widespread concern. Chemicals showing widespread distributions can be addressed through source control (regulatory) measures or through local measures (e.g. use of pathway interventions like sustainable urban drainage systems or permits on discharges). It is the coordination at the UK-level of local efforts to best address the latter that differentiates them from sporadic or isolated chemical issues.

3. **Decisions will reflect the confidence in the evidence.** We want to strive to continue to improve decision making on the environment. In all decisions, we will take account of the confidence we have in the information available and respond proportionately. Thus, where costly investment would be needed to improve environmental quality, we will need a higher level of certainty that there is a problem to be solved and that the solution will deliver benefits which outweigh the costs of investment.

4. **Available supply-side controls will generally be pursued first.** Waste water treatment works (WWTWs) discharge a wide range of potentially harmful chemicals which are not entirely removed during treatment. For those chemicals that cause widespread risks, supply-side controls (e.g. marketing and use restrictions or source controls) are likely to be the most cost-beneficial solution to reducing these emissions to the water environment. If these measures are not available or inadequate within a defined timeframe, end-of-pipe treatment will be considered. This will mean that progress towards complying with some EQSs will be slower.

5. **A more pro-active and shared response to emerging issues will be encouraged and applied.** We want to help people understand the true value of the environment and make it easy to become responsible stewards for it. The use of voluntary initiatives and stakeholder action will be pursued at an early stage as an active part of solutions to emerging issues. Ownership of emerging issues will be sought to address key information gaps and identify ‘no-regrets’ actions that can be taken to help address emerging concerns.

6. **Strategic monitoring will help identify emerging issues, confirm chemicals representing the greatest risks in the water environment, and track the success of control measures to get the maximum value from available financial investment.** The UK Devolved administrations will continue to develop approaches to monitoring the environment, responding to developments in technology and science, to inform the approach we set out here. Monitoring undertaken by operators and other third parties has an important role and a collaborative approach will be encouraged to share data and information and develop approaches that give ever greater insight into the relationship between chemicals and ecological quality in UK waters and status of our groundwaters.

7. **We will continue to seek to prevent the entry of hazardous substances into groundwater and reverse any confirmed upward trends.** All necessary and reasonable measures need to be taken to ensure drinking water sources are protected as a vital resource for the future.

ANNEX A (II): Summary of Management Options.

Type of Control	Examples	Pros/Advantages	Cons/Limitations
Supply-side controls Seek to eliminate or restrict uses that drive environmental exposure and risks	• International and national implementation plans for Persistent Organic Pollutants (POPs) • EU use restrictions under REACH regulation • Withdraw authorisation for pesticides or active ingredients used in other sectors, e.g. bans on atrazine and simazine • Voluntary initiatives to reduce use of e.g. pharmaceuticals or use alternative substances.	• Good for multiple sources as can be applied at the UK level or internationally to all or some uses to minimise new contamination. • Level playing field for business (same rules apply everywhere).	• High evidence requirement to link environmental levels to specific sources e.g. use of certain products. • Slow process as often needs to be negotiated at EU level due to trade implications (up to 10 years to reduce emissions) • Loss of pesticides may have implications for food security • May be no viable substitutes or risk of 'pollution swapping'. • Difficult to predict local water quality improvements • Environmental protection may not be guaranteed, as chemicals may enter from imported goods.
Pathway interventions Prevent sources of chemicals reaching the environment by blocking the 'pathway' to the environment or remediating local environments	• IED BREF reviews defining 'Best Available Technologies' for sectors to reduce industrial emissions • Abandoned mines remediation • Sustainable urban drainage • Prioritised Highways Agency improvements to treat contaminated road-run-off • Natural solutions, such as treatment wetlands, can filter, capture and neutralise pollutants • Methods of best practice adopted, to prevent and reduce diffuse pollution • Best practice for dredging (or local licence restrictions on dredging activities) in ports and harbours	• Targeted to tackle pathways causing problems elsewhere • Can be efficient as often tackle multiple pollutants that have the same pathway • Opportunities for local ownership and participation to address local pathways to the environment may result in more sustainable solutions	• Generic technical solutions may not always be suitable for local situations and site specific solutions may be appropriate • Often need local feasibility assessments to tailor to local circumstances • Less able to predict local environmental improvements • Not always easy to retrofit • Technological solutions tend to be a compromise between best technology , cost and practical application for the pathway concerned
End-of-pipe treatment Remove or reduce the chemical in wastewater by installing treatment before the effluent is discharged	• Reduce discharge limits in environmental permits	• Good for low numbers of localised sources. • Targets the solution to where the impact occurs. • Treatment may tackle several chemicals (reducing impacts of mixtures). • Improved treatment may minimise future risks. • Continued use of chemicals valued by society.	• Treatment technology can be expensive and energy intensive (anti-climate change)

Annex A (III), Chemicals of concern in Welsh water bodies

The table below identifies those chemicals considered to pose a risk to ecology or human health in surface and groundwater. The tables indicates what the sources of the chemicals are and therefore what types of actions will be used to address the risk that they pose. Natural Resources Wales will update this table following the publication of the 2021 River Basin Management plans utilising a refreshed monitoring data, classification and risk assessment of chemicals.

Only those chemicals that are at risk or probably at risk to human health or aquatic ecology are identified. In addition to those chemicals identified in the table there are several emerging issues which will be considered more explicitly in future revisions of our strategic approach. These are:

- Microplastics
- Pharmaceuticals and Anti-microbial resistance
- Those chemicals currently on the Environmental Quality Standards Directive watch list
- Those chemicals that have been identified in groundwater including DEET, plasticisers and anti oxidants, caffeine and cholesterol.
- Endocrine disrupting chemicals
- Chemical mixtures

Table A(III)a. S: surface water; G: groundwater; SG: surface and groundwater

	Risk status	Primary spatial scale for consideration			Grouped by source				Protection Goal			
		Widespread Concern	Local concern	Insufficient data to confirm	Chemicals from sector use/activity	Chemicals from abandoned mines	Legacy chemicals	Chemicals with significant release from domestic sources	Protecting aquatic life	Protecting food chains	Protecting surface water drinking water sources	Protecting groundwater drinking water sources
Mercury*	At risk	S					S			S		
Copper^	At risk	SG				SG			SG			
Zinc*	At risk	SG				SG			SG			
Cadmium*^	At risk	SG				SG			SG			
Lead^	At risk	SG				SG			SG			
Iron	At risk	SG				SG			SG			
Manganese	At risk	SG				SG			SG			
Nickel	At risk	S	G			SG			SG			
Atrazine	At risk		G				G					G
Flame retardants (Brominated diphenylethers)*	At risk	S					S			S		
Polycyclic Aromatic Hydrocarbons (PAHs)*	At risk	S		G			SG			SG		
Tributyltin (TBT)*	At risk		S				S		S			

Dioxins/Polychlorinated Biphenyls/Furans	Probably at risk		S				S			S		
Hexabromocyclododecanes (HBCDD)	Probably at risk			S				S	S			
Perfluorooctane sulfonic acid and its derivatives (PFOS)	Probably at risk	S		G				SG		SG		
Cypermethrin	Probably at risk			S	S			S	S			
Triclosan	Probably at risk		S					S	S			
Dichlorvos	Probably at risk			S			S		S			
Bifenox	Probably at risk			S	S				S			
Trichloromethane	Probably at risk			G				G				G
Organic Solvents	Probably at risk		G		G							G
Metaldehyde	Probably at risk		S		S						S	
Mecoprop	Probably at risk		S		S						S	
2-methyl-4-chlorophenoxyacetic acid (MCPA)	Probably at risk		S		S						S	

Key

Risk. At Risk – monitoring data shows failure of an environmental quality or drinking water standard, or increasing trends. Probably at risk – evidence shows that failure of an environmental quality or drinking water standard or, increasing trends is likely.

Primary spatial scale for consideration. Widespread concern: Sufficient evidence that risks are widely distributed, suggesting a common problem that has to be addressed through a national solution. Local concern: Risks are at a local scale and require local action to address.

Grouped source and action. See pages 4 and 5 for description.

Protection Goal. See page 1 for description.

Priority Chemicals.

***Surface Water** Greater than 20% of monitored water bodies fail an Environmental Quality Standard.

^Groundwater: Greater than 10% detection rate at groundwater monitored sites and a geometric mean concentration of 200% of (twice) the Drinking Water or Environmental Quality Standard.