
This submission comments on the Environment Agency's consultation which can be found at <http://www.environment-agency.gov.uk/yourenv/consultations/306630/?version=1&lang=e>

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Dear Dr Passmore

**'Managing Chemicals for a Better Environment' :
Consultation Document on the Environment Agency's Chemicals Strategy**

The following submission has been prepared under the aegis of the Environment, Health and Safety Committee of the Royal Society of Chemistry.

The RSC's Royal Charter obliges it to serve the public interest by acting in an independent advisory capacity and we are happy for this submission to be put into the public domain.

GENERAL COMMENTS

Key points

We welcome this consultation in principle. The overall approach is sensible. It recognises that there are 'natural' sources of chemicals as well as anthropogenic sources. The emphasis on organic chemicals is correct and the emphasis on weighing up the costs and benefits of any action is good. However, we are less convinced about the proposals for achieving the objectives. EA's resources and remit are limited and we are concerned about a number of issues in particular :

- The main function of the Environment Agency [EA] is defined by law and this must be the Agency's first priority. The document gives the impression that EA is the only organisation active or responsible for the impact of chemicals on man and the environment. In fact it is only one of a number of regulatory bodies, government departments and others, involved in this area. Furthermore the EA's locus is restricted to England and Wales rather than the whole of the UK. We believe the strategy should be revised in terms of EA's geographical and delegated areas of responsibility. It should also be placed in the context of the UK's European, international and bilateral obligations.
- Conversely EA should look carefully at those areas where its authority abuts that of other bodies and should establish cross-boundary partnerships to ensure that potential problems are not ignored because they do not fit neatly into a defined legal responsibility and therefore fall into a legal or administrative gap.

- EA should not 're-invent the wheel', for example by repeating work that others have done. The Agency should put more effort into building partnerships and into 'influencing' others, if possible getting them to carry out necessary work in their areas of expertise.
- Our understanding is that most of the legislation enforced by EA is written in terms of risk rather than hazard. However the strategy seems ambiguous in places on the key issue of distinguishing hazard and risk. It is vitally important to maintain an emphasis on risk-based approaches and conversely to emphasise that 'hazard-based' approaches are simplistic [as is the notion that any chemical has only one 'hazard']. An RSC Position Statement on risk-based substitution is attached [Annex 1] for reference.

Other points

In terms of the approach to pollution reduction we believe that the initial strategy should be one of voluntary and industry wide agreements which deal with high priority issues with enforcement action being reserved as the last recourse. However, when enforcement action is initiated it should seek to obtain redress in the courts at a level that reflects the environmental impact and seriousness of the issue which precipitated the enforcement action. In this respect we would wish to see EA engage in a greater degree of stakeholder involvement. This should include partnerships to influence industrial and societal behaviour.

We welcome the Agency's recognition of the importance of diffuse pollution as well as point source impacts. We believe EA should pursue this theme in partnership with others so as to encompass the role of commercial and domestic activity in introducing substances with adverse effects on the environment.

We support the Water Framework Directive's concept of "good ecological quality" and support moves by EA to introduce control mechanisms to manage the impact of substances on the aquatic environment. In particular we welcome control strategies, which manage water (environmental) quality on a fit for use basis. We accept there are still lengths of controlled waters where society may wish to achieve an improvement over the existing water quality.

Where emission controls are placed on individual or classes of substances with known adverse properties (eg endocrine disruptors), EA should consult with relevant stakeholders to identify and establish a priority list for those substances that are needed for specific uses, within the group of chemicals in question. This should be based on risk assessments rather than controlling by hazard alone.

The section on monitoring and surveillance appears over-optimistic in its view of monitoring as a tool for identifying problems. For example the two examples quoted, TBT and endocrine disruptors, are both cases where the problems were picked up by "surveillance" by non-statutory agencies - shell fishermen on the one hand and academics on the other.

EA needs to develop mechanisms for picking up anecdotal evidence of problems. There is also a need to encourage the development of rapid (real-time, preferably), lower cost, robust screening methods as well as higher precision/sensitivity systems. The development of suitable standards to allow inter-laboratory comparisons is also essential if results are to be legally challengeable. EA should work with the Research Councils and the EU to encourage these developments.

Overall the strategy will need substantial resources. For example the proposals for position papers and for pollution reduction plans are not unlike the processes that the former Department of the Environment went through when developing a "Pollution Paper". Our understanding is that drafting the paper was time consuming but getting consensus on a plan of actions was much more so. EA should consider getting others to do the work wherever possible and should where appropriate monitor their results - possibly through a licensing procedure.

SPECIFIC QUESTIONS RAISED IN THE CONSULTATION DOCUMENT

1a. *How well do you think our suggested approach to assessing priorities and determining actions will help us improve environmental protection?*

This depends on how important you think the issue of chemicals is. However it should be a modest improvement on the present approach within the Agency. There should be more emphasis on building partnerships and influencing others.

2a. *How important do you think our key tools (Position Statements, Pollution Reduction Programmes, a framework for setting targets and biological effects measures) are in developing a more focused and coordinated approach to chemicals?*

They are all potentially important tool but need to be applied to suit specific circumstances, ie "horses for courses".

2b. *Are there any significant gaps in our suggested approach where you would like to suggest alternative solutions?*

The Agency needs a mechanism for picking up and evaluating anecdotal information on possible problems from unofficial sources.

3a., 3b. *Have we identified the right research priorities? If not, where should our chemicals research be targeted?*

EA should research better test systems and their validation. The information from such systems is the key to preventive action but its proper interpretation requires first hand experience and this can only be obtained by direct involvement. However in general the Agency should not re-invent the wheel. To a considerable extent it should be possible to adapt priorities identified by others.

4a. *What priority should the Agency give to endocrine disruption and effects of complex effluents in the environment?*

These are potentially very important issues but the need is to be ready to act quickly should the science indicate that the potential is or is likely to be realised.

4b. *How do you envisage biological effects measures being used in future?*

This depends on the specific effect. They could be used in standard setting or as early warning of possible problems in the environment.

4c. *Which groups of chemicals should be priorities for further investigation and control?*

Those with known hazardous properties that are consistently found in the environment in significant concentrations. Priority should be given to those reaching the aquatic environment.

5a., 5b. *Which substances should be priorities for Agency Position Statements? Which substances should be priorities for Agency Pollution Reduction Programmes?*

Where there is proven significant exposure and/or proven effects on man and/or the environment.

6a., 6b. *What role should the Agency take in building partnerships to address chemical issues? Which partnership activities are the most important for the Agency to pursue?*

This should depend on circumstances. Where the issue is largely controllable by actions of the Agency then EA should take a leading role and use its statutory powers to ensure that partners/stakeholders participate. Where the lead lies elsewhere, the Agency should at least identify potential partners in its sphere of influence and muster what influence it can to ensure their participation.

7a. *Which chemical policy initiatives should be a priority for the Agency?*

Those identified in the paper; improved testing methodologies and their validation; best practice/ benchmarking for SMEs.

8a. *Which of the communication initiatives identified are the most important parts of the strategy?*

The EA is uniquely placed to develop, apply and explain the significance of indicators of environmental quality. Also SMEs require special attention as they often lack the expertise required to minimize environmental damage. EA could initiate work to help SMEs perhaps by producing guidance similar to HSE's 'COSHH Essentials' which goes directly from risk assessment to practical advice on risk minimization.

8b. *Are there other communication approaches you would like us to consider?*

We have no comment to make.

I hope that the above comments are helpful.

Yours faithfully

Mr P Whitehead

Chairman, Environment, Health and Safety Committee of the Royal Society of Chemistry

The Royal Society of Chemistry is the UK Professional Body for chemical scientists and an international Learned Society for the chemical sciences with 46,000 members world-wide. It is a major international publisher of chemical information, supports the teaching of the chemical sciences at all levels and is a leader in bringing science to the public.

ANNEX 1

Royal Society of Chemistry, Environment, Health and Safety Committee (EHSC)

POSITION STATEMENT ON 'RISK-BASED' SUBSTITUTION IN CHEMICAL PROCESSES - Version 24/1/01

What is 'substitution'

For the purposes of this paper 'Substitution' refers to replacing one substance by another with the aim of achieving a lower level of risk. The paper assumes a basic understanding of the distinction between hazard and risk as it applies to the use of chemicals.

The RSC believes that the 'hazard based' substitution process being proposed as a basis for EU legislation in this area is flawed. The RSC believes that it is only through 'risk based' substitution that the lowest reasonably practicable level of acceptable risk can be achieved.

The principle of 'hazard based' substitution (HBS) is to replace a material of high or unacceptable hazard with a material of lower hazard. The process works simply by providing a ranked list and selecting the lowest ranked substance. Hazard criteria are often limited to toxicity, persistence and bio-accumulation.

What is the purpose of substitution ?

Life itself depends on chemicals and chemical processes. Chemicals, both man-made and naturally occurring, are vital to modern society, and cannot simply be eliminated. The RSC believes the guiding principle should be to reduce the overall risk to man and the environment from exposure to chemicals. This involves the identification of hazards, the assessment of subsequent risks and the effective management of those identified risks. The COSHH regime introduced in the UK in 1989 has led to considerable improvements in safety by following this type of procedure.

In many cases, replacing (substituting) one chemical by another can make an important contribution to producing a lower overall risk. Substitution is, however, not necessarily a simple process since it is necessary to ensure that the overall risk is reduced and that a decrease in one risk is not overshadowed by the increase in another.

Risk assessment is often seen as a cumbersome and time consuming process and in recent years a number of organizations have suggested that faster progress could be made by taking action on the basis of hazard identification alone. The RSC is concerned that basing a substitution policy on such proposals could, perversely lead to an increase rather than a decrease in overall risk.

Why is risk based substitution preferable to hazard based substitution ?

Although it sounds simple to identify a material's 'hazard' and to then replace it with a substance of lesser hazard, this is really far too simplistic. In some cases it may actually be counter productive.

In order to understand why this is so it is necessary to recognise that no substance has just one 'hazard'. In reality *all* substances possess a range of hazards, such as toxicity, flammability, corrosivity etc. Furthermore the magnitude of each hazard will vary from one substance to another, often in opposite directions. For example, a highly flammable solvent may be less toxic than an alternative solvent of lower flammability. Thus although substances can be readily ranked in terms of a specific hazard such as flammability, substances cannot be ranked in terms of their overall hazard.

For simplicity we have referred to the range and magnitude of the hazards possessed by a substance as its '*hazard profile*'. This paper argues that the decision to replace one substance by another should be on the basis of *overall risk*. This requires an assessment of the risks involved, taking account of both the hazard profiles of the substances concerned and the way they will be used.

For example CFCs have low toxicity to man, low flammability, but a powerful effect on the earth's ozone layer. They have been replaced by other substances with less effect on the ozone layer. For example in some refrigeration systems they have been replaced by hydrocarbons which have high flammability or ammonia which has high toxicity to man, but both of which have little effect on the ozone layer.

Problems with simple hazard based substitution

Advocates of a simple 'hazard based' approach to substitution start from a false assumption. By failing to distinguish between risk and hazard they reason that all that is required is to identify materials with a single unacceptable hazard and to then replace them with materials which are 'lower' in this hazard. This takes no account of the full hazard profiles of the substances concerned nor of way in which the materials are used [and therefore of who or what may be exposed to them].

Materials, products and chemical processes cannot be considered in isolation. In the real world chemicals exist in the context of a life cycle of activities in which people, animals and the environment may be exposed. Whether or not substitution is justified depends upon the relative acceptability of each of those risks as they are affected by such substitution.

For example materials to which exposure in use offers little risk to human health may still pose considerable risks to the environment and vice-versa. Thus considering CFCs again, the decision to ban their use was a good example of risk based substitution. If there had been foolproof ways of preventing their escape to the environment then it might have been better not to replace them : the alternative materials though posing less risk to the ozone layer, are often more dangerous [eg flammable] or toxic to man. However given the impracticality of preventing CFC escape to the atmosphere, the risk they posed to the ozone layer was judged less acceptable compared with the risks to human health from their replacements. Therefore CFCs were withdrawn from use. In contrast a simple hazard based approach focused on a single hazard such as human toxicity would have led to the conclusion that CFCs should be retained because of their low human toxicity compared to the alternatives.

It is clear from this example that risk based substitution may not always be simple. It involves weighing up and comparing different hazards and their magnitudes. It also requires value judgments about the acceptability of different risks to different targets, such as judging that the risk to the ozone layer from CFCs was more important than the risk to human health from the materials that replaced them.

While the alternative hazard based approach to substitution looks simple it is actually simplistic. In addition because it focuses on hazard and ignores how the substance is used in practice, it is potentially counterproductive and in some situations can be dangerous. For example :

- replacing a toxic raw material by one which is of lower toxicity but greater volatility or flammability may decrease overall safety. For example, diethylether may be much less carcinogenic than benzene but the relative flammability needs to be considered carefully before enforcing substitution based on a toxicity criterion. Similarly a lower toxicity material may be much more volatile, thus the user may be subjected to a greater overall risk since there is likely to be a much greater exposure albeit to a material of lower toxicity.

- hazards may not all be equally well characterized and understood. For example the hazards of materials that cause immediate damage to human health [eg cyanide] are usually well understood. However the hazards of materials that cause longer-term damage to the environment are often much less well understood. The temptation with hazard based substitution is to replace substances on the basis of the easy well understood hazards rather than seeking out information on hazards that may be less well understood.
- there may be adverse 'downstream' effects. For example the use of a lower toxicity raw material may lead to an increase in the amount of waste produced or to the production of a waste that is more harmful to the environment. The use of a less hazardous material does not automatically mean that a less hazardous waste will be produced.
- fitness for purpose. A material with a lower hazard may be less effective for the application. This in turn may have knock on effects such as use of more material or an increase in other risks. Reducing exposure to materials used in any chemical process is generally desirable. Consequently it may be better to use a smaller quantity of a more hazardous material in a well contained process than to have to use a much larger quantity of a somewhat less hazardous material if the subsequent process cannot then be contained as efficiently.

How should decisions be reached on substitution ?

It will be clear from the issues outlined above that the views of 'stakeholders' need to be taken into account when assessing what risks are acceptable when balanced against the benefits provided and against the risks and benefits of alternative materials.

The 'stakeholders' involved will vary with the level at which substitution is being discussed. For example at the level of an individual chemical plant the stakeholders are likely to include employees, local residents, emergency services, etc. At the national level, such as when framing legislation, the stakeholders are likely to include representatives of the public, industry, workers, relevant professions, etc.

The RSC recommends the Health and Safety at Work Act 1974 [HSWA] as a suitable legislative model for the control of substitution. The principle of reasonable practicability by which the Act operates also involves complex judgments about risk and would provide a suitable test by which to assess the need for substitution. The test of reasonable practicability would allow appropriate balances to be made between costs and benefits, including the costs of modifying existing plant and equipment. By analogy with the HSWA the onus to initiate substitution would rest with the user but would be goal oriented rather than prescriptive. It would also allow the development of guidance and approved codes of practice on difficult issues such as how to balance environmental risks against workplace health and safety risks.

Finally the Health and Safety Executive which enforces the Act is itself overseen by the Health and Safety Commission [HSC]. The HSC is a tripartite body which attempts to bring together the views of some of the principal 'stakeholders', in this case employers, employees and 'independent' members from other bodies such as Local Authorities.

SUMMARY

The RSC believes that in order to be effective substitution :

- Should be based on an assessment of the risks involved rather than on the hazards of the materials per se.
- Should be seen as a tool to reduce risk rather than as an end in itself.
- Will often involve complex judgments which have to be made on a case by case basis.
- Should ideally be made on the basis of a 'cradle to cradle' evaluation.
- Must be set within a proper legislative framework which identifies the conditions in which substitution is required and identifies who is responsible for selecting an appropriate substituent including the relevant stakeholders.
- Requires that those involved in the decision process properly appreciate the various factors involved and the distinction between hazard and risk.
- Is too complex to be reduced to an automatic process based on a simplistic ranking of materials by hazard.

This policy is intended to maximise the potential benefits of substitution while reducing the pitfalls inherent in its superficial applications. The complexity of risk based substitution should not be used as a reason to abandon it in favour of less satisfactory and potentially harmful approaches based solely on hazard.