

# The True Cost of Precautionary Chemicals Regulation

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This article explores the possible social costs of introducing an overly precautionary regulatory regime for chemicals. It begins by examining research by the UK Medical Research Council Institute for Environment and Health (MRC-IEH), which suggests that the resource implications of the proposals contained in the European Commission White Paper "Strategy for a Future Chemicals Policy"<sup>(1)</sup> are unrealistic and even unrealizable. The article then focuses on contemporary debates pertaining to endocrine disrupting chemicals (EDCs) and goes on to question whether a "right to know" is always necessarily a good thing, or whether in certain instances it can lead to a society that feels more sorry than safe.<sup>(2)</sup> Finally, problems relating to the representation and inclusion of public values in decision-making processes are raised prior to concluding with a call for an ambitious orientation toward social change rather than a self-limiting obsession with safety.

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## 1. INTRODUCTION

The European Commission White Paper, "Strategy for a Future Chemicals Policy," presented on February 27, 2001, identified an "overriding goal of *sustainable development*" and raised as "a cause for concern" the impact of chemicals on human health and the environment. It proposed a new single system, to be called REACH, for the Registration, Evaluation and Authorisation of CHEMicals, which have "proven or suspected hazardous properties" and are produced in volumes greater than one ton per annum.<sup>(3)</sup>

In the spirit of a recent article by Chauncey Starr for this journal,<sup>(4)</sup> as well as my own work in this area,<sup>(5)</sup> this article will examine what Starr called "the social cost of fear reduction." Starr was concerned that "some of today's hypothetical fear-based issues could develop into long-term doctrines that will be politically enduring, difficult to modify, and seriously destructive," comparing these to historical situations

"arising from the amplification of a minor popular concern into an apocalyptic dogma."

My earlier piece similarly suggested that "bringing up a generation of people in fear of everyday products, questioning the ability of science to improve their lives, and hence doubting the desirability of innovation and change, has a social cost which has yet to be calculated." I do not attempt to quantify these losses as part of a risk assessment modeling process, but nevertheless these social costs should be clearly identified in order to be mitigated against or prevented.

There is, of course, no doubting the need for clear priorities and purposes in the regulation of chemicals. However this article seeks to explore possible downsides of the recent flurry of activity in this area.<sup>1</sup> Society should continuously strive to ensure that the products and processes it uses are acceptable within the limits of the knowledge available to it at any particular time. Whether this is achieved through the proposals presented by the Commission, as well as the

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<sup>1</sup> HPV Chemicals (High Production Volume) program of the OECD, the *Endocrine Disruptor Screening Program* of the U.S. EPA, or *The Chemicals Study* of the UK RCEP.

identification of hidden problems and costs, is the purpose of this inquiry.

Ultimately, these matters are settled through political debate and contestation taking the form of support for a “scientific” risk assessment,<sup>(6)</sup> or calls for greater social equity through the application of a “precautionary” principle.<sup>(7)</sup> As the sociologist Frank Furedi has indicated, the fact that safety has now become such a dominant practical and moral framework for society is historically contingent.<sup>(8)</sup> It remains crucial, therefore, for all those interested in social progress and transformation to identify all the outcomes of proposed actions, including their opportunity costs, irrespective of the claims and purposes of those promoting them.

## 2. TESTING IMPLICATIONS

Predictably, many of the responses to the White Paper have focused on the economic costs to business of imposing such a framework. I will not dwell upon these, as representatives from industry will no doubt present their own views on that matter. However, a distinct line has also emerged from the UK Medical Research Council Institute for Environment and Health (MRC-IEH), based in Leicester.<sup>(9)</sup>

In a report commissioned by a UK Government Ministry, the then Department of the Environment, Transport and the Regions, DETR (now the Department for the Environment, Food and Rural Affairs, DEFRA), and published in April 2001, researchers from the MRC-IEH questioned the actual feasibility of the Commission’s proposals.

According to this report, the requirement to test all chemicals produced in volumes greater than one ton per annum, or roughly some 30,000 substances, by 2012 is entirely unrealizable for a number of reasons.

First, they identify a lack of testing facilities available to perform the task. There would appear to be only 16 contract research organizations (CROs) within the European Union both capable and willing to do so. One could add to this that it is unlikely, contrary to the speculation of some,<sup>(10)</sup> that these numbers could rapidly increase due to a greater demand coming from regulators. This is because we have for some time been witnessing a year-by-year decline in the number of graduate chemists emerging from universities.

Thus, according to this report at least, the time scale proposed by the European Commission for simply achieving base-level testing is unrealistic. Narrowing the sample size down to the 10,000 chemicals pro-

duced in volumes greater than 10 tons per annum could allow such tests to be achieved by 2017 (some five years later than the proposed schedule); otherwise it would take until 2048 to complete the full set. What’s more, such basic tests would not cover some quite contentious and increasingly high-profile contemporary issues, such as investigating for neurotoxicity or endocrine disruption, let alone allowing time for other higher-tier testing (such as for avian toxicity) or verification of the results by member states.

Implicit to all of this would be a quite dramatic cost in terms of the number of animals required to perform the necessary experiments. The MRC-IEH estimate these to be in the order of 8.4 million rodents (45.8 million with the inclusion of offspring) and a further 4.4 million fish. To give some perspective to these figures, the report indicates that since 1981 when regulations were introduced to ensure the testing of all new chemicals introduced into the market and to test existing substances on priority lists, roughly 870,000 vertebrates have been used for such notifications.

In conclusion, the report suggests that the costs anticipated by the Commission for such purposes to be wildly inaccurate and produces its own estimate of almost 8.7 billion euros, excluding reporting and verification.

Accordingly, while one might usually favor seeking to obtain the greatest possible amount of evidence in deliberating upon most matters, there would appear to be a clear need in this instance to maintain some sense of perspective and priorities. This is especially so as most of the chemicals now being required to be tested have been in use for a quarter-century or more and have effectively acquired billions of hours of exposure data through consumption or use.

Whether a truly holistic sustainability strategy—as the Commission upholds from the outset—would prioritize the removal of minute traces of those chemicals suspected of being toxic to humans or the environment from high-dose laboratory tests on rodents over, say, the provision of a clean water supply to many millions of people in the developing world is a moot point.<sup>(11)</sup> A common answer to this is that we should follow the wishes of the majority or “public values” in such matters—on which more later.

In the meantime, and in the interest of balance, it is worth pointing out that the MRC-IEH report has not been without its detractors. Foremost among these have probably been Friends of the Earth (FoE), who define themselves in their own literature as “the most extensive international environmental network in the world.” According to their response, prepared

jointly with the Worldwide Fund for Nature (WWF), the European Environmental Bureau (EEB), and Eurogroup for Animal Welfare, the MRC-IEH study is “fundamentally flawed.”<sup>(12)</sup>

This is, according to the FoE authors, because only the 10,000 higher-production volume (HPV) chemicals will be tested *in vivo* and further it can be assumed that much data already exists for these, if only protected by corporate property rights. In addition the MRC-IEH report is held to have ignored the possibility of testing elsewhere in the world despite the evidence of similar programs in the United States, Canada, and Japan, as well as the fact that some products may be removed from the market prior to testing due to existing concerns as to their safety.

The document goes further, suggesting that nonanimal testing methods such as *in vitro* assays or computer modeling using techniques such as quantitative structure activity relationships (QSAR), as well as simply evidence of persistence or bioaccumulation, would mitigate against the “large, unmanageable, increase in animal testing at prohibitive expense.”

Although it is possible that the MRC-IEH report presents worst-case estimates—an approach not uncommon to that used by the environmental movement or more generally advocates of the precautionary principle—it would appear that the latter points pertaining to nonanimal testing are open to significant doubt, which is not evident from, and despite the stated preference given in, the White Paper to promote these “as far as practicable.”

For instance, the European Commission itself has expressed concerns as to the use of *in vitro* data. Its Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) recently discussed toxicological test guidelines and testing strategies, concluding that “reliance on *in vitro* assays for predicting *in vivo* endocrine disrupter effects may generate false-negative as well as false-positive results. Thus the development of *in vitro* pre-screening test methods is not recommended.”<sup>(13)</sup>

Similarly, Dr. Leonard Levy, when presenting evidence on behalf of the MRC-IEH to the UK House of Lords recently, suggested that the European Commission had if anything “underestimated the resources required to undertake such a mammoth task.”<sup>(14)</sup> It is clear that *in vitro* tests capable of replacing *in vivo* studies while retaining the same level of scientific assurance as to the hazard profile of a chemical are simply not available, and are highly unlikely to become available within the time frame set by the European Commission proposals.<sup>(15)</sup>

Further, Levy points out that “obtaining meaningful exposure data is not quite so simple as implied” and whatever existing data may be available, it is unclear as to how long it would take to be released, brought together, and assessed as to homogeneity and scientific quality. Europe has the largest chemical industry in the world and in consequence a significant proportion of the world’s contract toxicology capacity. Collaboration with countries examining different endpoints or using alternative test protocols cannot be guaranteed.

The fact that further testing at the more detailed Levels 1 and 2 would be required for at least 5,000 chemicals (taking up to one year and 2.5 years, respectively, compared to the eight months necessary for Base set testing), and that the number of chemicals to be tested could actually be as high as 65,000, suggests that if anything, given the current rate of progress, the MRC-IEH calculation appears very much a best-case estimate.<sup>(16)</sup>

In concluding this section then, we should note some dispute as to the feasibility of the testing requirements contained in the White Paper proposals. Irrespective of who, how, or when, they are likely to place severe pressures on existing facilities and future resources for a period significantly in excess of a decade.

### 3. ENDOCRINE DISRUPTION

Endocrine disruption—testing for which, it is worth reminding ourselves, is not included in the resource estimates described earlier—has recently solicited significant attention, discussion, and controversy. It is cited as one of the key causes for concern by the European Commission in its White Paper. Yet, in the words of one researcher: “The study of chemically-induced endocrine disruption in mammals is a relatively new field of endeavour, and it has been assailed by an unusual level of disagreement amongst investigators.”<sup>(17)</sup>

The endocrine system is held to be that complex of processes whereby a number of fundamental bodily functions are kept in check through the action of an appropriate balance of hormones. An endocrine disrupter is, accordingly, any chemical that interferes with the synthesis, transport, binding, action, or elimination of the natural hormones that are responsible for homeostasis, reproduction, development, and/or behavior.<sup>(18)</sup>

Chemicals with such properties have become known by the popular media as “gender-bender”

chemicals, helping to generate many sensationalist headlines that cannot help advance a reasoned discussion of these matters.<sup>(19)</sup> This is particularly so because, while little is known as to their true extent, action, or effect, what is clear is that such substances occur naturally, and are ingested in concentrations many millions of times greater, in the food that we eat, as well as at even greater doses through oral contraceptives and hormonal therapies.<sup>(20)</sup>

The UK Royal Society's own investigation into endocrine disrupting chemicals (EDCs), concluded that "the limited information available suggests that intake of exogenous oestrogenic compounds would contribute little to the total oestrogen exposure of the fetus and would thus pose little, if any risk to the developing reproductive system" and, further, that "it could be argued that some exposure to environmental, man-made chemicals with oestrogenic properties could be potentially beneficial rather than potentially harmful."<sup>(21)</sup> The same report noted that secular trends in growth and puberty are "most easily accounted for by differences in nutrition."

Far from adding up to form a "lethal cocktail," as some would have it, it is evident that some substances may inhibit the activity of certain estrogens by preferentially binding to, or competitively occupying, the estrogen receptor and preventing more potent molecules from exerting their full effect.<sup>(22)</sup> Certainly, a lack of funding and research into the more positive attributes of EDCs will delay such potentially fruitful avenues of investigation and their benefits.

From a scientific perspective, a key problem has been the irreproducibility of results presented by certain researchers in the field. Possible reasons for this variability include the use of diets known to be high in phyto-estrogens, species variations as well as strain variations in rodents, and the use of subcutaneous injection as an experimental exposure method. Ashby has remarked: "The strongest assay response may not always be the most relevant response for human or wildlife risk assessment purposes." Evidently, it will continue to be difficult to reconcile assay outcomes until there is agreement as to a particular constellation of experimental conditions.

The consequences of piling worst-case assumptions onto worst-case data have previously been well documented in the case of phthalates that are used as softening agents in PVC.<sup>(23)</sup> This approach led to a ban on products for which the possibility of a baby exceeding the recommended exposure limits was rigorously determined to be "so rare that the statistical likelihood cannot be estimated."<sup>(24)</sup>

The ban even extended to phthalates that had not exceeded the standard, conservative margin of safety and prompted the chair of the CSTEE, Professor Jim Bridges of the University of Surrey, to comment: "I don't think the science is saying at all that there's an immediate risk." Erring on the side of caution in this instance led to restrictions on essentially benign and beneficial products and their replacement by some for which there was simply less toxicological evidence available.<sup>(25)</sup>

Some researchers have postulated the possibility of low-dose effects below the usual dose-effect threshold. But as Herman Staudenmayer recently remarked in a paper on this issue, accepting the low-dose response paradigm means accepting that "less is more, and more can be nothing at all."<sup>(26)</sup> Arguing that absence of evidence is not the same as evidence of absence is a circular argument that ignores the fact that absence of evidence is precisely the only evidence we can ever expect to accumulate for the absence of harm.

Nevertheless, campaigners now argue that the use of all EDCs, and even substances merely suspected of being such, should be banned altogether on precautionary grounds. For this they propose that restrictions should be determined on the basis of hazard classification alone, rather than risk assessments. The distinction is vital and one upon which the White Paper appears equivocal.

In "The EU Chemicals Policy" section of the White Paper we are informed that testing requirements will "depend on the proven or suspected hazardous properties, uses, exposures and volumes of chemicals produced or imported." This is further expanded upon in the section "Knowledge about Chemicals," where the distinction between hazard and risk through exposure is made clear. However, later sections on "Classification and Labeling" and "Information to the Public" would appear to restrict requirements primarily to "hazardous properties."

As every toxicologist knows, all substances produce an effect—it is the dose that makes the poison. The fact that a substance contains a toxin does not make it poisonous; if this was not true, all foods, which inevitably contain salt, a known toxin at high doses, would have to be banned. Similarly, labeling products on the basis of hazard alone would lead, for instance, to products such as contact lens cleaning fluid and certain toothpastes being identified as potentially explosive on the basis that in high enough concentrations hydrogen peroxide—the active ingredient in these—is also used as a rocket propellant.

Everything we do exposes us to hazards. It is how we do things, as well as how often, that determines the risk. The emphasis, promoted by some, on what could be, rather than what is, removes human action, understanding, competence, and will from the equation. It naturalizes issues, making them appear wholly external to, independent of, and hence unalterable by us. This lends itself to an unrealistic exaggeration of harm. Worse, if we prioritize too many chemicals for testing, short of banning them all, we would effectively have prioritized none and hence we would continue to expose ourselves to those that should have been real priorities for analysis in the meantime.

#### 4. SOCIAL COSTS

So far, I have addressed certain technical and scientific issues emerging from the White Paper and the discussion based around it. My main concern, however, is to focus on a far greater social or hidden cost that these proposals entail. Unlike the economic costs, which may indeed be quite significant, the social impact is likely to be more important—if harder to quantify.

One common assumption in much of the current debate on issues relating to scientific reporting and decision making is that the public have a “right to know” and should be informed whenever and wherever there is any scientific uncertainty associated with products and processes. This “right” is mentioned in the White Paper and was recently reiterated by European Commissioner David Byrne, who is responsible for the Health and Consumer Protection Directorate (DG SANCO).<sup>(27)</sup> Its emergence has, however, been criticized by others “as a sudden and political response to the BSE crisis.”<sup>(28)</sup>

Aside from the obvious fact that there is always uncertainty, this “right” would appear to suggest that consumers should be permanently bombarded by reams of information in order “to know” or “make informed choices.” There is, accordingly, an inherent difficulty in legally enforcing such arrangements—How much information? Who would be responsible for providing it? Where should it be made available?—although no doubt an army of lawyers and other experts are waiting in the wings to present consultant reports on such matters. But we should first examine whether a “right to know” is necessarily workable or beneficial in practice.

The British general practitioner and medical writer Michael Fitzpatrick has argued, in relation to contemporary obsessions with testing for prostate

cancer among young men in particular, that: “When clinics are swamped with the worried well, the really ill will suffer, a trend that is already apparent in many areas of the health service.”<sup>(29)</sup>

Ironically, while prostate cancer is mentioned in the White Paper, it is neither particularly prevalent among that particular age group nor readily detectable, giving rise to a significant percentage of false positives. It is also the case, as Fitzpatrick explains, that treatment for it is barely effective, requiring intrusive procedures that bring both guaranteed pain and significant risk to the recipient.

Another example pertinent to the issue of chemicals regulation relates to the widely reported growth in cases of testicular cancer, particularly, again, among young men. Here there is evidence for a doubling in incidence over the past 20 years, although, notably, this was from an extremely low base and—due to more effective treatment rather than prevention—the number of fatalities has fallen to below 100 per annum in the United Kingdom alone, less than a third of the total it used to be some 40 years ago. Fewer than 40 in every million men in their late 20s will suffer from it. To put this into perspective, one woman in 10 will suffer from breast cancer at some time in her life.

There has been a wide range of theories proposed, ranging from genetic to hormonal, environmental, and even cultural, as to why such rates may have increased. The only certainty is that nobody knows, and that the public health proposal of regular testicular self-examination is of little avail. If 50,000 men tested themselves regularly over 10 years it might save one life based on cutting the death rate by 50%, which would be an unusually high figure. In addition, apart from the waste of time and attention involved, the high level of misdiagnosis is more likely to cause needless and extreme anxiety.<sup>(30)</sup>

The public campaign around testicular cancer seems more like a high-profile, low-resource campaign that promotes the idea that good healthcare is about self-awareness rather than the availability—or lack of it—of doctors and treatments. Yet, despite this, the White Paper, presumably from a precautionary perspective, chooses to highlight purported links to EDCs, while admitting that “the underlying reasons for this have not yet been identified.”

The explosion of the “worried well” inundating doctor’s surgeries with demands subsequent to “awareness” campaigns is one consequence. Whether doctors would choose to prioritize their limited resources accordingly, however, is questionable.

Effectively, enhanced awareness through a purported “right to know” not only diverts society’s assets from where they are most needed, but could also leave us feeling far more sorry than safe.

These campaigns effectively sentence many hundreds of people to years of needless worrying and introspection. The “right to know” leads, in certain situations at least, to nothing more than the promotion of unnecessary, unfounded, and unassuageable lifelong anxiety, bitterness, and cynicism.

In fact, there is growing suspicion that we are literally worrying ourselves sick over an ever expanding number of agents and activities within contemporary society.<sup>(31)</sup> This is despite continuing evidence pointing to our improved health and longevity over the last 30 years.<sup>(32)</sup> Even the incidence of most cancers—after a period of increase, due largely to the achievements of enhancing longevity and improving detection rates through screening—are in steady decline.

Of significant concern to public health in the contemporary period has been reported rises in the incidence of minor or neurotic psychiatric disorders, mostly depression and anxiety.<sup>(33)</sup> Although this may well be a subjective phenomenon—like the worried well—these conditions are “associated with an increased likelihood of consulting a general practitioner,” and hence have implications both for resources and our general well-being.

Among these disorders have been the rise of so-called diseases of modern life<sup>(34)</sup> such as CFS/ME (Chronic Fatigue Syndrome or Myalgic Encephalomyelitis), ADD (Attention Deficit Disorder), PTSD (Post-Traumatic Stress Disorder), and, of greater relevance to this article, MCS (Multiple Chemical Sensitivity).

These illnesses have often falsely been characterized as being “all in the mind.” However, it is quite evident that the sufferers present real symptoms. The key area of dispute is as to the source of these symptoms. Unlike other diseases, victims claim a wide and disparate range of effects, including, in the case of MCS, headaches, sore throats, itchy eyes, coughs, tiredness, backache, gastro-intestinal disturbances, dizziness, and anxiety, among others. Patients also present a wide range of personal theories as to how they came to be ill.

Professor Simon Wessely, Professor of the Epidemiological and Liaison Psychiatry at the Institute of Psychiatry, King’s College London, is one of the world’s leading experts in the analysis of such syndromes. In his work he has explored the correlation between those countries where there is a heightened

awareness of potential chemical toxicity and the incidence of psychosomatic symptoms.<sup>(35)</sup>

According to Wessely, Sweden, one of the countries at the forefront of restricting chemical use within Europe,<sup>(36)</sup> with a policy goal of making its environment “toxic-free” by 2020, and the country that led the Commission in the preparation of the Chemicals White Paper, has one of the highest levels of self-reported sensitivities to chemicals in the developed world. It would appear, then, that too much risk awareness can quite literally make you sick.

Staudenmayer used double-blind placebo-controlled (DBPC) experiments to confirm the key drivers of somatic symptoms to be: beliefs, suggestion, vigilance, social amplification, anxiety, and stress. More recently, a team based at the University of Leuven in Belgium has investigated the extent to which warnings about environmental pollution can directly facilitate the acquiring of symptoms in relation to chemical substances.<sup>(37)</sup> Participants who had been given warnings about environmental pollution reported more symptoms to benign odors than those who had not.

Advances in clinical psychology on the understanding and management of health anxieties have also established, through empirical investigations and other clinical trials, that repeated attempts at reassurance can serve to drive anxiety rather than assuage it.<sup>(38)</sup>

These findings all point to an extremely significant conclusion with widespread consequences and ramifications for risk communication, awareness-raising, and the “right to know.” That is, that official recognition of, and responses to, perceived problems—either through advocacy groups, public officials, or the media—provide confirming models through which people understand and articulate their anxieties and often become the driver of real problems.<sup>(39)</sup>

It will be crucial in the period ahead, particularly in the aftermath of the events of September 11, 2001, to unravel the broader effects on social psychology of continuously elevating risk awareness in the name of transparency and an individual “right to know,” as opposed to taking a more measured approach to risk communication in the interests of broader social advance, cohesion, and well-being.

## 5. PROCESSES AND VALUES

There have been growing calls from many quarters to include public views or values into scientific decision making. In the United Kingdom these have

included the Royal Commission on Environmental Pollution,<sup>(40)</sup> the House of Lords,<sup>(41)</sup> the Parliamentary Office for Science and Technology,<sup>(42)</sup> and the authors of an Economic & Social Research Council publication.<sup>(43)</sup> An earlier exemplar from the United States is a 1996 edited compilation by Stern and Fineberg.<sup>(44)</sup>

Much of this discourse echoes the work of Sheila Jasanoff in the United States and Brian Wynne in the United Kingdom who, in a variety of articles,<sup>(45)</sup> have explored what they consider to be the disparate cultures of specialist science as opposed to that of the public in general. The sociologist Ortwin Renn in Germany has separately studied mechanisms for reconciling these assumed differences through negotiated dialogic processes,<sup>(46)</sup> although it should be noted that the purported effectiveness of these aims and methods have not gone uncontested.<sup>(47)</sup>

The White Paper itself steers clear of identifying with this agenda explicitly, preferring to call for more information to the public. However implicitly, in its drafting, the Commission paid heed to the critics, consulting with a significant number of stakeholders “and in particular the NGOs representing consumer interests.” Ironically, one of the criticisms that could be made of the Paper has been a lack of consultation with the contract research organizations (CROs), who would be the agencies in the front line should the proposed testing schedule ever see the light of day.

Clearly, there is a tension between those who wish to include the public in order simply to keep them informed or on-side,<sup>(48)</sup> as opposed to those who genuinely hold that the public voice is a missing element for establishing accountability through a better balance of scientific and public values. This latter view appears to propose a narrowly empirical model of science whereby objectivity, or an approximation to it, is to be reached through an averaging-out process of competing interested parties.

One significant difficulty for all concerned is as to how to include what is perceived to be an increasingly disengaged public into such processes. The claims made by NGOs, such as environmental campaigners or consumer advocates, to being representative of this wider audience have increasingly been questioned.<sup>(49)</sup> At best such bodies have a passive membership comprising a few percent of any national population, ranging in the major economies of the European Union from 1% in Ireland to 10% in the Netherlands.<sup>(50)</sup> Whether directly belonging to such a lobby, or being a hand-picked and carefully vetted outsider sitting on a

government established committee, such approaches remain broadly unsatisfactory as both the motivations behind them and their representativeness are open to question.

To get around these limitations, there has in recent years been much greater emphasis placed on the use of quantitative research, such as polls and surveys, as well as qualitative research, including more in-depth interviews, focus groups, and other stakeholder dialogue forums. The danger here is well documented. It includes projecting views and values through question-framing and/or selectively finding these self-same views and values among the responses. Even recording what is left unsaid<sup>(51)</sup> requires prejudicial priorities among interviewers.

Hence, there is a great danger that, rather than recording the wishes of the majority, as was suggested earlier, the inclusion of public views or values may merely record a small subset of these, which researchers look for and find reflected back at them. In the past, such views would have been labeled as public opinion. Opinions are open to being challenged, interrogated, and altered. Labeling these as values, on the other hand, appears to set them apart from further inquiry.

But we should first ask whether science truly benefits from the inclusion of “lay opinion” or “public values” into its processes and decisions. Although science is necessary to inform democratic decision making within society, it is not in itself democratic. Scientists do not simply record or measure—they assess, infer, and prioritize. To relegate the experienced and considered judgments of scientists to being just a sectional interest dilutes the science, denigrates and demoralizes the scientists, and both patronizes the public and panders to the conceit of those who claim to know or represent their “values.”<sup>(52)</sup>

Of course, science has never been value-free, but maybe it should continuously strive to become so and to preclude, rather than to include, external influence. Those from outside its institutions who have made major contributions to its development did not achieve this by introducing personal views and values but rather by pointing to the assumed values of the establishment that needed to be removed, proving their case through evidence and hence convincing their peers.

It is for those who wish to see more values brought in, or writ large, rather than ignored, to justify themselves further. Far from being egalitarian, it is real exclusion that begins when prejudice or opinion are taken to be a sound basis for decision making.

Ironically, in many instances, it is now corporations, governments, and the scientific establishment itself that appear increasingly willing to take on board such public views and values into the decision-making process. The reasons for this may be varied, including the misguided belief that doing so will thereby obtain greater regulatory stability. This may prove to be very shortsighted as policy determined from opinion is likely to prove far more unpredictable than that based on evidence. Another possible and more perverse motive is an unwillingness to be held to account independently and a preference to deflect, diffuse, shift, or share the blame should things go wrong in the future.<sup>(53)</sup>

## 6. CONCLUSIONS

The European Commission White Paper “Strategy for a Future Chemicals Policy” comes at a time when favorability toward the chemical industry in general is at a low ebb.<sup>(54)</sup> Ironically, over the last decade this coincides with a period when the industry has done much to put its house in order, introducing a range of initiatives, including attempts to audit product use and disposal across the full life cycle. Red list discharges—which record emissions of more noxious substances—have come down by more than 95%, reportable accidents to employees and contractors have halved, to levels below those of many other industries, while output has continued to increase.

The industry is understandably concerned about its image and hence is examining ways, largely to do with greater transparency, communication, and information provision to the general public, to enhance this. Yet, clearly, public perceptions bear little relation to these efforts and rather more to ignoring the recommendations of scientists when these suggest the evidence gives little cause for concern<sup>(55)</sup> and a generalized loss of trust in industry, scientists, and politicians alike.

But if the reason for the poor image is not entirely self-generated, then it will not suffice to combine improved performance with sensitive promotion, consultation, and communication. Accordingly, adhering to the increasingly cautionary and restrictive approach advocated by a precautionary or sustainable agenda may prove to be a mere short-term palliative as opposed to the more profound changes in social attitudes that may genuinely be required. These would include a more balanced approach to understanding the necessity of risk-risk tradeoffs, as well as

a generally more positive attitude to the inevitability of change and the desirability of social progress.

It would be unfortunate if, in their genuine aspiration to recreate public trust in science and industry, political initiatives such as the White Paper ended up fomenting further discontent. By raising the specter of problems at a time when these are in decline, and positing widespread testing that may be neither achievable nor necessarily desirable, there is a danger of feeding the climate of risk aversion rather than assuaging it.

Although it is good that we no longer accept a culture of unquestioning deference toward science, business, or the state, we should be wary of creating a culture of unnecessary fear, which may prove to be just as limiting and incapacitating in its stead.

Rather than embracing the opportunities latent within uncertainty and change as did previous generations, today we appear to reject them and highlight the risks. What may really have changed is not so much the scale of the problems that we face, but the outlook with which society perceives its difficulties, both real and imagined. These issues, while different, cannot really be described as greater than those facing previous generations, nor are they uniquely insurmountable. But our collective will and imagination to resist and overcome them appears to be much weaker.

Life has become safer as human society has progressed. We could turn our back on inventiveness and ambition, and get used to living within the limitations imposed by the cautious moral code of our time—or we could do the opposite.

I suggest the latter would be a better legacy for future generations.

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