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# Considering evidence: The approach taken by the Hazardous Substances Advisory Committee in the UK

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ABSTRACT

The Hazardous Substances Advisory Committee (HSAC) provides expert advice to UK officials, Ministers and other relevant bodies on the protection of the environment, and human health via the environment, from potentially hazardous substances and articles. Hazardous substances are often the subject of controversy, on which individuals, and different groups in society, hold divergent views. This paper details the approach taken by HSAC when considering the evidence to provide advice on hazardous substances. Firstly HSAC reviews the range of evidence and determines its quality considering: transparency of aims, the methodology and results, completeness, independent review and accessibility. HSAC does not follow one explicit methodology as the wide range of hazardous substances we consider means they need to be addressed on a case by case basis. Most notably HSAC considers the evidence in the wider context, being aware of factors that influence individuals in their decision making when receiving a HSAC opinion e.g. trust in the source of the evidence, defensibility, conformity to a 'world view' and framing. HSACs also reflect on its own perspectives with the aim of addressing bias by the diversity of its membership. The Committee's intention, in adopting this rounded approach, is to reach opinions that are robust, relevant and defensible.

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## 1. Introduction

The Hazardous Substances Advisory Committee (HSAC) provides expert advice to UK officials, Ministers and other relevant bodies on the protection of the environment, and human health via the environment, from potentially hazardous substances and articles.[1] The Committee's membership is multi-disciplinary and independent, enabling it to approach the evidence from a range of different perspectives. The Code of Practise requires members to observe the highest standards of impartiality, integrity and objectivity in relation to the advice they provide; the Code also includes clear provisions for handling conflicts of interest.

Hazardous substances are often the subject of controversy, on which individuals, and different groups in society, hold divergent views. In formulating its advice, the Committee needs to analyse, interpret and assess the available evidence, often in situations where the uncertainties may be considerable. This paper documents the different kinds of evidence that might be available to the Committee; the criteria that HSAC adopts in its assessments; and the wider perspectives and concerns that have a bearing on the issues at hand. It also proposes a process through which the Committee's judgements about the quality of the available evidence could be communicated in an accessible form.

## 2. Types of evidence

HSAC recognises that evidence varies in its source, robustness and defensibility, and that these factors will influence the degree of confidence that assessors can assign to any given 'piece' of evidence, or to a body of evidence as a whole. While most of the scientific evidence assessed by HSAC derives from experimental or epidemiological studies, or is based on modelling of some kind, observational and anecdotal evidence may also be considered (Table 1). Evidence in the last two categories sometimes provides a first indication that a phenomenon is worthy of further investigation, and can lead to more systematic studies. It is likely that the availability of less systematic evidence will increase with the evolution of social media. Statistical evidence is often grounded on hypotheses which have been tested to a certain degree. However, it takes time and resources to collect statistically robust data, so that such studies may not reflect rapidly changing circumstances and emerging problems.

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[1] The HSAC Terms of Reference and its Code of practise can be downloaded from https://www.gov.uk/government/groups/hazardous-substances-advisory-committee

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**Table 1**
Categories of evidence.

| | Type of evidence | | | | |
|---|---|---|---|---|---|
| | Experimental | Model-based | Epidemiological | Observational | Anecdotal |
| | *Obtained through a methodological approach to experimental design and data collection.* | *Computer modelling of effects or exposures to provide a measurement of impact.* | *Data based on studies of populations under real-world conditions.* | *Based on observations and experience.* | *Based on personal accounts of effects.* |
| | Possible to show causality/association | Infers causality | Infers association | Infers association | Hypothetical association- potentially identifies issues of concern, not yet addressed in scientific research |
| Increasing quality → | Repeated experiments with a high degree of replication and controls following internationally accepted standards (e.g. OECD Test Guidance Documents) | Approach informed by empirical evidence, all processes and parameters revealed to allow repetition by others | Follows published guidance (e.g. WHO) with clear methods and rationale for data inclusion or exclusion | Field observations made in a systematic way, but without a specific experimental design | Relatively high incidence of specific effects; consistency between unconnected accounts; different accounts carefully collated. |
| | Not meeting widely-accepted experimental protocols; untested method, poorly reported | Model without antecedents, parameters from assumptions not measurements, processes a black box, i.e. cannot be repeated by others | Un-tested method, inadequately reported, using non-standard measurements of impact | Circumstantial evidence random or 'one off' events or phenomena | Uncorroborated, unconfirmed anecdotes: 'a friend of a friend…' |

*There can be significant variations of quality within each type of evidence. Examples (not exhaustive) are given of what might be considered 'high' or 'low' quality evidence within each column; in practice, there will be a gradation. No simple (horizontal) quality continuum between different types of evidence is implied; see sections 3 and 4 below.*

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## 3. Judging quality: considerations to take into account

In reviewing the scientific evidence, HSAC considers the extent to which any given study meets the following, widely-accepted criteria. HSAC may attach particular weight to evidence that conforms to these criteria, though 'weaker' evidence (in these terms) should not be dismissed: it can be part of the bigger picture when different sources of evidence are combined.

- Transparency of aims. A study should have a clearly stated purpose, in terms of the problem to which it relates and the research questions to be addressed. Conventionally, this is achieved through the statement of a hypothesis. The hypothesis to be tested should preferably link to previous work, and the study should be clear about the ways in which it builds upon, or challenges, the evidence base. The nature of HSAC's work is such that the Committee is often focusing on substances that have not been subject to exhaustive scientific studies (nanomaterials would be one example). In this case the hypothesis may be that a suspected causal agent is responsible for harm and it is important to recognise that this is essentially an arbitrary formulation. In assessing the stated hypothesis, it has to be clearly structured so that it is properly testable and falsifiable. HSAC recognises that findings based on statistical evidence are conditional on the structure of the hypotheses, and also on a potentially arbitrary decision about significance levels (e.g. a 10% or 5% probability of Type 1 error – i.e. incorrectly rejecting a true null hypothesis) and confidence intervals

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