#1 | CDE DEFEND-BIO Working Paper

Pesticide Regulation: A Giant in the Shadow*

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This discussion paper opens debate on an underexplored issue: the knowledge (epistemic) practices of pesticide approvals. It examines what remains insufficiently explained or left unspoken in risk communication: that it is impossible to ensure pesticides are safe, that scientific risk assessment is inherently discretionary, and that risk management decisions are imperfect and contestable – even in the most stringent regulatory settings. Making these silences explicit could strengthen the position of those defending diffuse social and environmental interests – from local communities to health and environmental ministries – and support biodefenders' knowledge claims. Speaking about the unspoken is particularly urgent these days, amid growing institutional pressure to further simplify pesticide approval procedures without first opening a genuine public debate about what has so far been left unsaid, or even silenced, in pesticide risk communication.

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The author takes sole responsibility for the content of this paper, which is intended as a contribution to further reflection and discussion.

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Contents

1 Introduction 1

2 Setting the stage: The regulatory framework 2

2.1 Key design features 2

2.1.1 Functional separation between risk assessment and risk management 2

2.1.2 The distinction between 'active substances' and commercial formulations 3

2.1.3 Pesticide law and administration 4

2.2 Protection objectives, approval criteria and authorisation procedures of the EU and Swiss pesticide framework 5

2.2.1 Stated objectives 5

2.2.2 Hazard assessment and risk assessment 5

2.2.3 Risk assessment and management procedures 6

2.2.3.1 EU-level approval of active substances 6

2.2.3.2 Member States authorisation of formulated pesticide products 7

2.2.3.3 The Swiss – EU procedural entanglement 8

3 Three areas of silencing 8

3.1 The fabric of 'regulatory science' and the 'uncertainty paradox' 8

3.2 The technical–political entanglement of risk assessment 10

3.3 Policy closure and 'no opinion' in risk management 12

4 Towards more 'open' risk-communication 13

4.1 Openly acknowledge that it is not possible to ensure that approved pesticides are safe 14

4.2 Make epistemic choices in risk assessment visible and contestable 14

4.3 Improve risk management communication 15

5 Implementation strategy 15

5.1 Legal bases and operational procedures 16

5.2 Transdisciplinary methods of regulatory oversight? 16

5.3 Funding 17

6 Conclusion 18

1 Introduction

Pesticides, defined here as chemicals used to kill or control pests and weeds to maintain crop yields, bring us to a complex and sensitive policy area. Because information about pesticide approvals is highly technical, public participation and oversight are limited. Yet this information is vital to the public interest as society navigates a toxic environment in which pesticides are ubiquitous in soils and water, and as residues in food and animal feed, raising environmental and public health concerns (Box 1). Many pesticides were approved as safe after lengthy procedures, only to be restricted or withdrawn later when environmental or health harms became evident.[1]

Box 1: Pesticide contamination in Europe

Soil contamination by pesticide residues in the European Union (EU) and Switzerland is concerning. A recent study by the EU Soil Observatory found pesticide residues in 74.5% of sampled agricultural sites across Europe; most sites contain mixtures of chemical substances, including substances no longer approved, with increased ecotoxicological risk compared to previous assessments.[2] Through multiple contamination routes, including runoff and aerial contamination, pesticides have leaked into refugee areas, organic fields and groundwater, with detrimental effects on biodiversity and ecosystem services associated with agroecosystems. In Switzerland, neonicotinoid insecticides, associated with declining bee populations and colony collapse disorder, were detected in 93% of sampled organic soils and crops – supposed to be free of pesticides.[3] In large areas of the Swiss plateau, groundwater is contaminated by the fungicide chlorothalonil,[4] a 'presumed human carcinogen'.[5]

This situation raises environmental and public health concerns. Growing epidemiological evidence links pesticides to cancer,[6] sterility,[7] birth defects,[8] autism spectrum disorders,[9] and Parkinson's disease,[10] among other conditions. Of particular concern are PFAS, which are commonly used in pesticides and linked to significant human health risks.[11] These substances have been detected in every human sample analysed during the pilot phase of the Swiss Health Study, often at levels exceeding acceptable toxicological limits.[12] Although epidemiological evidence cannot establish causality – since multiple intervening variables may explain disease occurrence and it is difficult to isolate the quantitative contribution of pesticides amid multiple stressors – it should act as a warning that prompts close monitoring.

The high stakes involved challenge the assumption that the technical complexity of risk assessment limits public involvement and oversight. The real question is how to communicate the scientific intricacies of pesticide risk analysis in a way that is intelligible to the public. This is a matter of 'risk communication' – the final step in the still-dominant (and highly disputable) framing of risk regulation as a linear process involving scientific 'risk assessment', political 'risk management', and 'risk communication'.[13] In this paper, I argue that **institutional risk communication on pesticides is not only insufficient but also misleading. It is misleading in what is left unsaid. What is silenced prevents and inhibits debate on major societal issues. It stands like a giant in the shadow, a presence that needs to be brought to light.** Society's demand that authorities communicate openly about pesticide risks is not merely a political claim. It is a legal right, carrying corresponding obligations for public entities. Legally, this falls under the principle of 'openness', which entails a 'pro-active duty' of administrations to 'genuinely open' their 'vault of information to the public and create new avenues of participation for civil societies'.[14] It reflects the principle that State activities must be conducted in the public interest, rather than special or private interests.[15] In environmental matters, it is enshrined in treaty law.[16]

Against this background, this paper draws on several strands of policy and academic literature to offer a discursive synthesis of the main areas of silencing in pesticide risk regulation. It first briefly outlines

the EU and Swiss institutional and regulatory frameworks for assessing and managing pesticide risks – a section that readers uninterested in legal and institutional questions may skip (section 2). It then examines three issues that are often muted or obscured in institutional risk communication: the tensions between 'regulatory science' and sound science; the technical–political entanglement of risk assessment; and policy closure in risk management (section 3). Finally, it considers how risk communication could be reoriented towards greater openness about these issues (section 4), and outlines a possible implementation strategy (section 5). A brief conclusion summarises the main takeaways. The paper is primarily descriptive, synthesising cutting-edge insights from diverse strands of academic and policy literature into a single account. It is exploratory in proposing solutions whose operationalisation and administrative implications warrant further examination.

2 Setting the stage: The regulatory framework

The EU pesticide approval process is governed by Regulation 1107/2009 (the Plant Protection Products Regulation, hereafter the 'PPP Regulation'),[17] widely regarded as one of the world's strictest regulatory frameworks. This results in fewer pesticides being approved in the EU than elsewhere,[18] and in tighter permitted residue levels in food and feed.[19] Switzerland's pesticide authorisation procedure, set out in the Ordinance on Phytosanitary Products (OPPh),[20] is closely aligned with the EU framework.

This section first outlines the key design features of the EU and Swiss pesticide approval regimes (section 2.1), then briefly reviews their protection objectives, approval criteria, and principal procedures (section 2.2), providing the foundation for the analysis in sections 3 and 4.

2.1 Key design features

2.1.1 Functional separation between risk assessment and risk management

Both the EU and Swiss approval systems are based on a **functional separation between risk assessment and risk management**. Under this 'linear' model, technical administrative units or independent agencies with specific expertise 'scientifically' assess risks. By contrast, risk management involves more political decisions about how best to address risk factors, drawing on the scientific risk assessment and other 'legitimate' – socio–political–economic – factors. Although highly contested,[21] the linear model remains the dominant paradigm in risk regulation and is firmly embedded in regulatory frameworks across jurisdictions.[22]

In the EU, risk assessment is conducted by the European Food Safety Authority (EFSA) and Member States' Competent Authorities (CAs). The European Commission acts as the risk manager, together with Member State representatives on the Standing Committee on Plants, Animals, Food and Feed (PAFF Committee). In Switzerland, risk assessments are conducted by the technical evaluation services of the Federal Office for the Environment (FOEN (BAFU)), the Federal Food Safety and Veterinary Office (FSVO (BLV)), the Federal Office for Agriculture (FOAG (BLW) & Agroscope), and the State Secretariat for Economic Affairs (SECO). FSVO is the official licensing authority and risk manager. It formally grants approval based on risk assessment and management decisions, in consultation with the other federal offices.

Table 1: EU & Switzerland – institutional framework

	Risk assessment	Risk management
EU	**EFSA** and **Member States' CAs**	**European Commission** and **PAFF Committee**
CH	**FSVO (BLV)** Assesses product toxicity for humans; residues in food and drinking water and setting of maximum limits; risks for non-professional users, local residents, and bystanders Classification and labelling based on health risks	**FSVO (BLV)**, in consultation with the other federal offices
	FOAG (BLW) & Agroscope Assesses agricultural efficacy, agronomic aspects, and pesticide risks to beneficial organisms like bees	
	FOEN (BAFU) Assesses environmental impacts and ecotoxicological risks for aquatic organisms, bees, birds, mammals, and non-target plants Classification and labelling based on environmental and physicochemical hazards	
	SECO Risks to professional users and workers exposed to them after application (to determine personal protective equipment and other risk mitigation measures)	

2.1.2 The distinction between 'active substances' and commercial formulations

To understand the EU and Swiss regimes, it is also important to distinguish between **active substances** – the chemical ingredients responsible for the pesticidal function – and finished **commercial formulations** – the end-use pesticide product (Figure 1). These formulations combine one or more active substances with 'non-active ingredients', such as safeners, synergists, and co-formulants. Under the EU PPP Regulation, they are called 'plant protection products' (PPPs); in the Swiss Ordinance, they are called phytosanitary products.

Figure 1: Components of a synthetic pesticide product



In the EU, the intrinsic properties of active substances are assessed at EU level, while Member States examine applications to authorise end-use formulated products for placement on the market. This distinction – scientifically disputable because it assesses active substances in isolation rather than as part of mixtures – arose primarily from the need to define the division of powers between the Union and its Member States in the highly sensitive area of pesticides. It reflects the EU's *sui generis* character as a complex political entity: less than a state, but more than an intergovernmental organisation.

Unlike the EU, and like most non-EU OECD countries, Switzerland used to assess active substances alongside their final formulations. The revised OPPh,[23] under which Switzerland automatically adopts EU decisions on active substances, has introduced into the Swiss framework the distinction between approval of active substances and authorisation of formulated products.

2.1.3 Pesticide law and administration

Another important aspect is the complex interplay among legislative acts, executive rule-making, and industry resources that shape pesticide approvals.

Both the EU and Swiss systems rely on a legislative framework[24] (PPP Regulation, OPPh) that outlines the procedural and substantive parameters of the authorisation process, while leaving the final authorisation decisions to the administration.[25] In the EU, active substances are approved through technical executive acts issued by the European Commission, known as 'implementing acts'. In Switzerland, these approvals are handled through administrative decisions.

Between the two ends – framing laws and administrative approval decisions – detailed evidence-use rules are buried in a 'sub-regulatory world'[26] of implementing acts, guidance, and assessor practices. These practices are framed by 'a network of hard law (legislation and implementing acts) and soft law (non-legally binding guidance documents and administrative and scientific practices)'.[27] While both govern how risk assessments are conducted, 'a significant role is left to the latter'.[28] For instance, EU

legal data requirements and risk assessment methodologies are broadly outlined in legislative acts but are detailed through executive rule-making, including the Commission's delegated or implementing acts. More specifics regarding the implementation of these data requirements are provided in EFSA's guidance documents and are further clarified in administrative and scientific practices. This guidance often draws on methodologies developed or supported by the private sector. According to a survey of pesticide risk assessment methodologies, 11 out of 12 methodologies studied were developed and/or promoted by industry, with the effect that industry is 'writing its own rules'.[29]

As in other areas of risk regulation, the result is an almost 'impenetrable tangle' of laws, policies, institutions, and processes, whose complexity and interdisciplinary nature – spanning science, law, and political science – have hindered systematic study.[30]

2.2 Protection objectives, approval criteria and authorisation procedures of the EU and Swiss pesticide framework

2.2.1 Stated objectives

The EU PPP Regulation aims 'to ensure a high level of protection of both human and animal health and the environment'[31] through 'an independent, objective and transparent' risk assessment of pesticides[32]. Although the Regulation also pursues additional objectives, i.e. harmonising the internal EU market for pesticides and enhancing agricultural productivity,[33] protecting human and animal health and the environment 'takes priority' over productivity objectives.[34]

Box 2. Objectives hierarchy in EU pesticide law

The provisions governing authorisation must ensure a high standard of protection. In particular, when granting authorisations of plant protection products, the objective of protecting human and animal health and the environment should take priority over the objective of improving plant production. Therefore, it should be demonstrated, before plant protection products are placed on the market, that they present a clear benefit for plant production and do not have any harmful effect on human or animal health, including that of vulnerable groups, or any unacceptable effects on the environment.

Source: EU PPP Regulation 1107/2009, preamble recital 24.

The overall framework is 'underpinned by the precautionary principle', aiming 'to ensure that pesticides placed on the market do not adversely affect human or animal health or the environment'.[35] Member States are entitled to apply the precautionary principle 'where there is scientific uncertainty as to the risks with regard to human or animal health or the environment' posed by the pesticide products to be authorised.[36]

The Swiss authorisation procedure is fully aligned with the EU system, although its legal text does not establish an objective hierarchy and places less emphasis on protection objectives than the EU text.[37]

2.2.2 Hazard assessment and risk assessment

The statutory objective of avoiding harm is reflected in the strict legal criteria for approving pesticides.

In the EU and Switzerland, the approval of pesticide active substances is subject to both **cut-off hazard criteria** and **risk criteria**. Hazard refers to the inherent dangers of a chemical, such as its carcinogenic potential, while risk evaluates both the hazard *and* exposure in use. Therefore, risk assessment also

considers practical measures to reduce risks, like using protective equipment or limiting pesticide use in greenhouses.

Following a precautionary approach, the EU and Switzerland prohibit the authorisation of pesticide substances that are inherently *most* hazardous. This includes substances classified as the most carcinogenic, mutagenic, reproductive toxic, and endocrine-disrupting, as well as the most persistent, bioaccumulative, or eco-toxic.[38] These substances are denied authorisation without further risk assessment. This hazard-based model, designed to eliminate the most extreme hazards at the outset, is specific to the EU and Switzerland. Almost all other countries follow a risk-based approach, whereby they assess all chemical substances for their risk in use, regardless of their hazard profile. They are approved if the risks can be adequately managed and mitigated.[39]

Only chemical substances that pass the preliminary hazard screening progress to the risk assessment phase. This process evaluates the risks associated with the chemical's use, taking into account exposure and control measures aimed at eliminating, reducing, or adequately managing the risk. The risk criteria and thresholds outlined in the EU PPP Regulation and the Swiss Ordinance are stringent on paper. It must be demonstrated that the pesticide residues will not have *any* harmful effects on human health or cause any *unacceptable* effect on the environment.[40] Formulated end-use pesticide products shall be 'sufficiently effective'; shall have 'no immediate or delayed harmful effect on human health' (whether directly or through drinking water, food, feed or air, or consequences in the workplace or through other indirect effects); nor 'any unacceptable effects' on plants and the environment, or 'unnecessary' uncontrolled suffering and pain to vertebrates.[41]

2.2.3 Risk assessment and management procedures

In the EU, the process for authorising pesticides follows a **dual system**. First, the active substance – the ingredient responsible for the pesticidal effect – is approved. After this, the formulated end-use pesticide products, which contain one or more active ingredients in admixtures with other non-active ingredients (Figure 1), are authorised.

2.2.3.1 EU-level approval of active substances

The scientific assessment and the approval of active substances take place at EU level, as outlined below.

Box 3: EU-level approval of active substances

RISK ASSESSMENT

1. A manufacturer submits an application to approve an active substance or to renew its approval. The manufacturer may choose any Rapporteur Member State (RMS) within the EU to evaluate the application. The application must be supported by a dossier containing relevant data and studies, in accordance with detailed legal requirements for data and testing methods. The dossier is publicly available, except for parts identified as confidential by the applicant and granted confidential treatment by the risk assessor for their commercial sensitivity.

2. An initial draft assessment report (DAR) or a renewal assessment report (RAR) is produced by a designated RMS or a group of RMSs based on the applicant's dossier.

3. The RMS's risk assessment is peer-reviewed by EFSA in cooperation with the competent authorities (CAs) of Member States. This stage includes public and expert consultations.

4. EFSA drafts a report ('Conclusion') on the active substance.

RISK MANAGEMENT

5. After EFSA has published its Conclusion, the European Commission, acting as the risk manager, prepares a proposal for approval or non-approval (a 'draft implementing act').

6. This proposal is then voted on by representatives of Member States in a dedicated 'Standing Committee', the Standing Committee on Plants, Animals, Food and Feed (PAFF Committee) – a procedure commonly referred to as 'comitology'. A qualified majority (55% of EU countries representing at least 65% of the total EU population) is required to approve or reject the Commission proposal. This process, commonly called '**comitology**' in EU jargon, is intended to give Member State representatives a say in Commission executive decisions that have an important bearing on societal matters.

7.1 If a qualified majority in the PAFF Committee votes in favour of the proposed act, the Commission must adopt it.

7.2 If a qualified majority in the PAFF Committee votes against the proposed act, the Commission may 1) drop it, 2) return it to the Committee with an amended proposal, or 3) send the rejected proposal to the Appeal Committee.

7.3 If there is no qualified majority either for or against the proposed act ('**no opinion**'), the Commission may either 1) return to the Committee with an amended proposal or 2) send it to the Appeal Committee.

In cases 7.2 and 7.3, if the Appeal Committee delivers 'no opinion', the Commission ultimately decides whether or not to include the substance in the EU's list of approved active substances. This determines whether the substance can be used in pesticide products in the EU.

Source: Author, based on EFSA and European Commission communications[42] and review of pesticide approval dossiers.

2.2.3.2 Member States authorisation of formulated pesticide products

After the approval of an active substance, companies wishing to place products containing the active substance on the market must seek authorisation by each Member State where they want to market the pesticidal formulation.[43] To help harmonise approval decisions, a 'zonal' procedure is implemented, grouping Member States into zones – North, Central, or South – based on (allegedly) similar agricultural and climatic conditions for pesticide purposes. The manufacturer submits a dossier that is assessed by the zonal Member State's CA, which serves as the risk assessor for its regulatory zone. Each Member State will either grant or refuse authorisation for the specific pesticide based on the assessment by the zonal Rapporteur. A Member State may impose additional risk mitigation measures, or even refuse authorisation altogether if it has 'substantiated reasons' to believe that the product poses an

unacceptable risk to human or animal health or the environment, based on its unique environmental or agricultural circumstances.[44]

2.2.3.3 The Swiss – EU procedural entanglement

Like the EU system, the Swiss framework functionally separates risk assessment from risk management, although both roles are carried out within the federal administration. During the risk assessment, four federal offices (FOEN, FSVO, FOAG, SECO) review the application from different perspectives. Based on their evaluations, the 'service d'homologation' at FSVO decides whether to authorize the application. Its decision sets out the conditions for using the product.

In practice, Swiss procedures are closely intertwined with EU procedures.

Switzerland automatically adopts EU decisions on active substances – as well as safeners and synergists.[45] When the EU approves a new active ingredient, Switzerland approves it too. However, Switzerland reserves the right to impose stricter conditions on the use of EU-approved substances or withdraw their approval, particularly to meet the requirements of the Federal Act on the Protection of Waters.[46]

Commercial formulations are assessed in Switzerland. However, a pesticide identical to one already authorised in a neighbouring EU country (Germany, France, Italy, or Austria) qualifies for the simplified procedure.[47] Overlapping formalities do not require separate testing by Swiss authorities: Switzerland can rely on the evaluation results of neighbouring countries. Swiss authorities still independently assess and enforce compliance in domestic priority areas with allegedly stricter regulations than the EU, including water protection and farmers' safety equipment.

3 Three areas of silencing

Official narratives tend to reassure the public that pesticides in use are safe. The EU frames its risk communication around 'how Europe ensures pesticides are safe'.[48] The Swiss Federal Council, in its responses to pesticide-related interpellations, likewise stresses the high level of protection maintained by the Swiss framework.[49] Both rest on the assumption that a strict approval process makes pesticide use safe. What these narratives leave implicit – and effectively shield from public scrutiny – is the contested regulatory model on which they rely, and its growing tension with contemporary understandings of chemical toxicity. I discuss three forms of silencing in official risk communication: how science is made relevant to regulation (sec. 3.1), the inevitable epistemic biases in risk assessment (sec. 3.2), and policy closure in risk management (sec. 3.3). The technical bodies conducting risk assessments are aware of these issues and highlight them in their conclusions (see, for example, Box 4). However, these nuances are often lost in subsequent risk communication to the public and in responses to parliamentary questions on pesticides.

3.1 The fabric of 'regulatory science' and the 'uncertainty paradox'

The first form of silencing is subtle: it concerns what counts as '**regulatory science**' and how its framing of questions can oversimplify rigorous scientific assessment, trapping risk regulation in paradoxes. Below, I summarise key insights from cutting-edge literature on the topic.

Chemical risk regulation still rests on a technocratic-economic model that treats hazards as tangible and quantifiable.[50] Adverse effects are presumed knowable, and their likelihood estimable through a narrow repertoire of probabilistic risk-assessment techniques. Socio-legal and (eco)toxicological research

increasingly calls this model into question,[51] because it systematically downplays scientific 'uncertainty' and 'ignorance'.[52] Uncertainty arises when the probability of an effect is unclear and inevitably rests on subjective, disputable assumptions; ignorance is more intractable still, referring to unthought issues – the 'unknown unknowns'.[53]

In the context of pesticides and chemical toxicity more broadly, scientific uncertainty and ignorance stem from practical and methodological challenges in properly evaluating the 'cocktail' of chemical admixtures.[54] 'Cocktail effects' can arise from the intentional combination of active substances and from mixing active substances with non-active ingredients – such as safeners, synergists, co-formulants or adjuvants – in commercially available end-use formulations. They also arise from the unintentional mixing of pesticides in the field, where various products are used concurrently, leading to incidental mixtures. The problem is compounded by multiple intertwined contamination and exposure routes: humans can be directly exposed to pesticides through occupational, agricultural and household activities, and indirectly via multiple environmental media, including air, water, soil and food.[55]

It follows that science cannot provide a conclusive assessment of chemical risks. Pesticides, like chemical toxicity more broadly, raise intractable complexities resulting from the cumulative and synergistic effects of chemical mixtures, multiple exposure pathways and intervening variables, delayed effects, social stressors and inter-individual variation, contested dose–response relationships, and implicit value judgments about what matters.[56]

In risk regulation, this generates what van Asselt and Vos call, in a seminal contribution, the 'uncertainty paradox':[57] risk regulations compel technical evaluation units to give a binary answer (safe or not safe) that they cannot scientifically provide, because science cannot deliver certainty about uncertain risks. As van Asselt and Vos put it, decision-makers demand 'certainty about uncertainty', yet science cannot furnish certainty about uncertain risks.[58]

The consequences are perverse. Government-mandated risk-assessment studies and legal data and methodology requirements frame questions in ways that offer risk assessors an escape route, but also widen the gap between science that is relevant to regulation – 'regulatory science' – and 'sound science'.[59]

Take the example of EFSA's 2023 Conclusion on glyphosate.[60] What was disseminated to the public was that EFSA did not identify 'critical areas of concern'. While this phrasing may suggest that glyphosate raises no serious concerns, it has a specific technical meaning in pesticide regulatory science: a 'critical area of concern' exists only where a major health/environmental concern affects all proposed uses of the substance under evaluation thereby precluding approval or renewal. In this technical sense, EFSA did not find critical areas of concern.

At the same time, EFSA qualified its assessment by pointing to a host of issues that could not be finalised or fully assessed due to data or methodological limits (Box 4). Van Asselt and Vos term these caveats 'uncertainty information'.[61] Such uncertainty information is how risk assessors deal with scientific uncertainty and irreducible non-knowledge, or ignorance. It is central to their scientific assessment. Yet it gets lost in translation – from risk assessment to risk communication, despite best efforts by risk assessors – for example, EFSA – to communicate it to the public.[62]

Box 4: EFSA's 'uncertainty information' in glyphosate risk assessment

Type of gap	Gaps (not / insufficiently assessed)
'**Could not be finalised**' - there is not enough information available to perform an assessment / available information is considered insufficient	• Assessment of one of the impurities in glyphosate • Magnitude of glyphosate residues in certain rotational crops & related consumer dietary risk assessment • Risk assessment for aquatic plants (macrophytes) due to contact exposure via spray drift
Other '**outstanding issues**' - data gaps that may lead to uncertainties in the assessment	• Short- and long-term toxicity of one of the components present in the formulation • Conflicting lines of evidence on glyphosate neurodevelopment toxicity (dossier-supplied testing concludes that there is no indication that glyphosate as an active substance has neurotoxic potential, while data from the public literature on glyphosate-based formulations and a study with a glyphosate salt show effects of developmental neurotoxicity) • No systematic assessment of indirect biodiversity impacts due to lack of harmonised methodologies and agreed specific protection goals • No internationally agreed guidelines for the risk assessment of microbiome

Source: Conclusions of EFSA's peer review[63] & EFSA factsheet.[64]

3.2 The technical–political entanglement of risk assessment

A second, related issue that risk communication fails to explain adequately is just **how subjective and contestable 'scientific' risk assessments can be**.

Scientific assessments of uncertain risks are contingent on the data, methods, and assumptions used.[65] These, in turn, are shaped by legal data requirements and the terms of reference for government-mandated studies – choices that determine which forms of scientific knowledge and practice ('epistemic' practices) are recognised in risk regulation.

The sociology of science points to different 'epistemic practices' within science,[66] including in the assessment of agri-biotechnology risks.[67] Epistemic cultures may be more oriented toward 'control' or 'complexity', depending on the scales and contexts considered, how far evidence is decontextualised, whether systemic complexity is reduced or preserved, and how uncertainty is treated.[68] These differences produce competing approaches to uncertainty and can lead experts to divergent hazard assessments. Disagreement over glyphosate's carcinogenicity, for example, reflects differences in the evidence base and methodology.[69]

Such epistemic choices remain discretionary, even within tightly regulated risk assessment. When discretion is constrained by legal data requirements, 'discretion is never removed, only shifted to different places or levels'.[70] Requirements that appear neutral can entrench preferences for some forms of scientific knowledge and evidence over others.[71] For example, rules on the disciplinary composition of expert bodies may shape which questions, endpoints and forms of evidence receive attention,[72] while requirements to use Good Laboratory Practice (GLP)-accredited facilities can disadvantage independent academic research, which often uses less standardised methods to reflect complex, context-dependent conditions.[73]

In pesticide assessment, the risk is that toxicological and standardised testing approaches are privileged over ecological perspectives that address broad spatial and temporal scale, multiple stressors and

ecosystem complexity. Research on pesticide assessment documents the limits of narrow evidence bases and the difficulty of capturing ecological complexity through standard tests alone.[74] The prevailing model of chemical risk regulation assumes a threshold of harm – captured by 'the dose makes the poison' – and tests substances in isolation rather than as mixtures.[75] It relies on short-term, tightly controlled experiments that overlook real-world conditions and focuses mainly on acute toxicity or carcinogenicity instead of long-term effects.[76] Environmental risk assessments face similar problems. They use few surrogate species to represent complex ecosystems; largely ignore ecological interactions; evaluate single pesticides on isolated crops without considering mixtures, repeated applications, or large-scale use; and may treat harmful effects as temporary despite limited recovery studies, which often use small, untreated plots that may understate lasting damage.[77]

These discretionary epistemic choices are political as well as technical. Prioritising one methodological approach over another – for example, narrow standardised testing over complex ecological modelling – can advantage certain actors, such as the pesticide industry and pesticide users, over public and private 'defenders' of diffuse health and environmental interests. It also shapes policy outcomes, for instance by entrenching commercial agriculture at the expense of agroecological alternatives.[78]

This technical-political 'entanglement'[79] raises normative and constitutional concerns. Political decisions about acceptable risk may take shape at the risk assessment stage, concealed within technical methodological choices.[80] In the EU, where pesticide law sets extremely high protection thresholds, questions arise as to whether risk assessment practices have steered pesticide authorisation toward less cautious approaches than the legislation envisages.[81]

Discretionary choices in this technical-political setting heighten the risk of 'regulatory capture',[82] whereby regulation shifts from the public interest toward industry interests. Several reinforcing dynamics contribute: asymmetries in expertise enable industry to shape risk perceptions through dominant 'chemical imaginaries'[83]; documented political strategies[84] – including lobbying, revolving doors, and close regulator–industry ties – further entrench influence; and practices bordering on scientific misconduct,[85] notably the selective production of evidence to manufacture scientific contestation (Box 5), can blur the line between expert advice and advocacy.

Box 5: The 'social production of ignorance'

A rich investigative and scholarly literature highlights the deliberate strategies employed by the pesticide industry to 'manufacture' contestation and uncertainty.[86] One common tactic employed by industry lobbyists is to question the scientific evidence supporting unfavourable outcomes for the industry and to undermine the credibility of research institutions in order to delay or block adverse decisions.[87] For example, in the aftermath of IARCs classification of glyphosate as 'probably carcinogenic to humans', Monsanto reportedly spent roughly 17 million $ on 'manufacturing uncertainty', including paying scientists to publish peer-reviewed articles critical of IARC.[88] Similar tactics are also used in other industries, for example, in the meat sector.[89] They are reminiscent of systematic strategies deployed by industries to create scientific uncertainty about the links between occupational exposure and various health issues, as seen in the cases of silica, asbestos, and lead.[90] These actions reflect epistemic imbalances between manufacturers or employers and those exposed to risks, including consumers, local residents or workers.[91]

At the heart of regulatory capture is a fundamental asymmetry of information and resources between the regulator and the regulated industry. On paper, the institutional risk assessors must carry out 'an independent, objective and transparent' assessment of the application 'in the light of current scientific and technical knowledge'.[92] In practice, this is difficult. In the EU, all authorities in charge of assessing pesticide risks are 'seriously and chronically understaffed' according to their self-evaluation.[93] As with

GMOs, EFSA's risk assessments are de facto 'meta-reviews' of the applicant's assessment instead of an independent cross-examination.[94] This also stems from the fact that the documentation submitted by the applicant forms the basis of the risk assessment process, making the process vulnerable to bias and undue influence.[95]

Official risk communication gives insufficient attention to these issues. The dominant framing of risk assessment as purely science-based creates a 'veil of objectivity', obscuring the space for choice and influence that exists during the risk assessment phase.[96]

3.3 Policy closure and 'no opinion' in risk management

Finally, transparency is noticeably lacking at the **risk management stage**, when licensing authorities decide whether, and under what conditions, to approve a pesticide. At EU level, these decisions are taken by the Commission through 'comitology' with Member State representatives in the PAFF Committee. Switzerland automatically adopts EU decisions on active substances. Although decisions draw on risk assessments, they may also reflect other considerations, including costs, benefits and societal perceptions. As pointed out in the transparency assessment of the pesticide approval process in the EU, 'most of the time the reasoning behind risk management decisions, the regulatory criteria adopted and how the discussions among decision-makers unfolded is not made explicit or public'.[97] It is therefore difficult to see how scientific assessment findings inform decisions, what other factors are considered, or how competing considerations are weighed.[98]

Several issues warrant scrutiny because, together, they can produce 'policy closure' towards alternatives.

First, decision-makers rarely elaborate on the **time horizon** – short or long – or **spatial scale** – farm, landscape, or watershed – used in decision-making. They seldom explain how choosing a different scale could change the cost-benefit assessment of pesticides. Nor do they provide much detail about the criteria and metrics used to compare the costs and benefits of chemical pesticides with those of non-chemical alternatives. As a result, it is unclear whether their decisions account for the full long-term and indirect costs of pesticide use, including water treatment, soil and ecological restoration, farmers' dependence on repeated chemical inputs, and post-market epidemiological and environmental monitoring.

The **framing of questions** also matters: in assessing alternatives, do risk assessors ask whether a readily available substitute exists at farm level, or whether different farming practices could protect crops more sustainably? In the glyphosate debate, emphasis on short-term farm-level economic viability sidelined longer-term, system-wide options for internalising socio-environmental costs.[99] The implications of this framing are rarely made explicit.

Furthermore, the practical application of the **precautionary principle** in risk management practice remains unclear. In its 2023 peer review, EFSA identified issues it could not finalise, including dietary risks for certain crops and risks to aquatic plants, as well as unresolved questions concerning biodiversity and microbiomes. It also reported conflicting evidence on glyphosate's potential neurotoxicity.[100] The Commission nevertheless renewed glyphosate's approval for ten years, subject to conditions and restrictions. The transparency question is how risk managers weighed these uncertainties. EU pesticide law is underpinned by the precautionary principle and requires protection of human health and the environment; the Court of Justice of the European Union (CJEU) has consistently reiterated in recent jurisprudence that pesticides cannot be marketed unless proved reasonably 'safe'.[101] The glyphosate decision brings into focus the enduring tension between legal standards and administrative practice.

Finally, the **technocratic rules governing the EU comitology procedure** could be explained more clearly to the public in both the EU and Switzerland – since the latter defers to the EU procedure for approvals of active substances. Under the comitology procedure (see Box 3), the Commission proposes whether an active substance should be approved, and Member State representatives vote on the proposal in the PAFF Committee. If neither the Standing Committee nor, on appeal, the Appeal Committee reaches a qualified majority ('no opinion'), the Commission makes the decision. 'No opinion' therefore leaves the political disagreement unresolved, while allowing the decision to move forward through an executive process. This procedure has created a paradox: the more socially sensitive and politically controversial a dossier is, the less likely the PAFF Committee is to reach a majority position – and the more likely it is that these highly contentious decisions will be made by an executive, non-political body (the Commission), on grounds – the EFSA conclusions – that could justify any decision, depending on the weight given to uncertainty information. This has created a major political and democratic deficit: crucial pesticide dossiers, as well as GMOs,[102] have never been politically approved in the EU. Instead, they were approved under a technocratic procedural rule that few understand. Political deliberations ended in a 'no opinion'.

Box 6: Renewing the approval of glyphosate in the EU

THE EUROPEAN COMMISSION

(…)

Whereas:

(…)

(33) The Standing Committee on Plants, Animals, Food and Feed has not delivered an opinion within the time-limit laid down by its Chair. An implementing act was deemed to be necessary and the chair submitted the draft implementing act to the appeal committee for further deliberation. The appeal committee did not deliver an opinion.

HAS ADOPTED THIS REGULATION:

Article 1 Renewal of the approval of the active substance

The approval of the active substance glyphosate, as specified in Annex I to this Regulation, is renewed, subject to the conditions and restrictions laid down in that Annex

Source: Commission Implementing Regulation (EU) 2023/2660 of 28 November 2023 renewing the approval of the active substance glyphosate in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council and amending Commission Implementing Regulation (EU) No 540/2011 [2023] OJ L 2660/1

4 Towards more 'open' risk-communication

We need **a new narrative** in front-line public risk communication – on websites and in brochures, for example – as well as in governmental responses to parliamentary questions on pesticides. Risk communication should 'bring the giant out of the shadows' and reveal what is most often left untold: that it is impossible to ensure pesticides are safe (sec. 4.1), that epistemic biases may arise (sec. 4.2), and that evaluations of costs, risks, and benefits are imperfect and contestable (sec. 4.3). This communication should be as 'open' as possible: proactive rather than request-based, and presented in a format the public can access and understand.

4.1 Openly acknowledge that it is not possible to ensure that approved pesticides are safe

At the outset, it is important to **openly acknowledge that it is simply not possible to *ensure* that pesticides are safe**. Risk assessors can only conduct best-effort exercises based on the limited scientific and technical knowledge available at the time of approval. Specifically, they can only assess *known* cumulative and synergistic effects of admixtures, which falls short of evaluating cocktail effects in real-world scenarios. Typically, they base their conclusions on experimental knowledge in highly controlled experimental settings, decontextualised from real-world situations. These limitations must be clearly communicated to the public, along with the acknowledgement that the EU and Swiss pesticide frameworks set protection goals and approval criteria that are unachievable in practice – unless we move to a pesticide-free environment.

As risk regulation scholarship has pointed out, regulators' open acknowledgement of irreducible scientific uncertainty and ignorance could help break the uncertainty paradox in risk regulation.[103] It would allow authorities to make explicit the normative preferences and choices shaping risk decisions – for example, a preference for avoiding situations in which substances are assessed as safe but later turn out to be unsafe, or the other way round.[104] Decision-making under uncertainty would thus become more transparent about why some risks are addressed, and why others are not or are treated differently, and on what normative grounds.[105]

Acknowledging the limits of pesticide risk assessment – and the aspirational nature of statutory protection objectives – should go hand in hand with rigorous post-market monitoring, which remains inadequate. In this regard, the European Commission's High Level Group of Scientific Advisors has recommended systematic monitoring for pesticides approved amid scientific uncertainty, such as glyphosate, with findings feeding into subsequent reapproval decisions.[106] This could include epidemiological studies, biomonitoring and landscape-scale monitoring.[107] The problem is the cost, as systematic pesticide monitoring is expensive. Switzerland illustrates the challenge: the Federal Office of Public Health piloted a human biomonitoring programme in 2018 and 2022 but did not expand it, citing costs.[108] Yet openly acknowledging that approval entails unresolved uncertainty makes the case for monitoring harder to dismiss. Otherwise, authorities risk appearing to approve a substance without being able to ensure its safety, while declining to track its effects because monitoring is too costly.

4.2 Make epistemic choices in risk assessment visible and contestable

Furthermore, it is crucial to make the **discretionary choices** made by expert bodies and administrations when evaluating pesticides more visible and, therefore, **open to public scrutiny and contestation**.

Risk assessors – authorities and administrators – shall clearly communicate to the public the science-policy choices that may appear neutral but can lead to vastly different assessment outcomes. This includes examining and explaining the implications of norms and practices governing who can serve on scientific panels, which criteria are used to include or exclude relevant studies, and how much weight is assigned to different types of evidence.

They shall clearly explain the extent to which standard tests focus on toxicity at the individual level (single pesticide, single crop) in controlled settings (laboratory and field tests) or incorporate ecological models that account for population structure, life histories, species interactions, and landscape context. They shall be transparent about how they address scale, multiple stressors, and ecosystem complexity, in ways that speak to the general public.

If standard tests cannot capture ecological complexity, authorities shall acknowledge this and prompt a democratic debate about how to move towards more ecologically realistic assessments that account for landscape-scale impacts and pesticide interactions.

4.3 Improve risk management communication

During risk management, greater transparency over how administrations apply pesticide authorisation criteria would help clarify **how decisions are reached**. This should begin with procedural aspects, including how the precautionary principle was interpreted and applied where scientific risk assessments contained significant data gaps or limitations – as in the glyphosate case. It is also important to communicate openly about the EU's comitology procedure, which has allowed highly sensitive dossiers to be approved despite the absence of political agreement.

Furthermore, it is important that institutional risk managers clearly explain which socio-economic factors they considered alongside scientific evidence when approving pesticides. To communicate openly, they should disclose whether they considered the long-term and indirect costs of chemical pesticides in their decision. These costs include:

- Contingency costs of water treatment, ecological restoration, and health impacts should a pesticide initially approved as safe later be withdrawn.
- The costs of systematic post-market monitoring – including epidemiological studies, biomonitoring, and landscape-scale monitoring – to detect impacts that current methods cannot adequately assess, such as indirect effects on biodiversity.
- Farmers' costs arising from the 'chemical treadmill', including recurring input expenses and losses linked to pest resistance and soil degradation.

More comprehensive quantification and public communication of these costs would support more rigorous cost-benefit analyses of both approving and refusing pesticide authorisation.

Likewise, risk managers need to communicate more proactively about the extent to which they considered non-chemical alternatives and low-risk biological pesticides in approval decisions. Research shows that pesticide use can be substantially reduced without compromising yields, and that non-chemical alternatives, including biological controls, can be cost-effective.[109] Open communication would require public authorities to mandate and disseminate comprehensive risk-cost-benefit analyses of conventional pesticides and their alternatives, accounting for all associated costs. Such transparency could help ease the perceived trade-off between agricultural production and competitiveness, on the one hand, and health and environmental protection, on the other – a trade-off that continues to shape economic cost-benefit analyses that fail to internalise externalities.

5 Implementation strategy

This shift in risk communication calls for an implementation strategy that assesses whether adequate **legal bases and procedures are in place**, how to **manage information overload and filtering**, and how to **cover the associated costs**.

5.1 Legal bases and operational procedures

As discussed, strong legal bases support open and proactive risk communication by public administrations. From an international law perspective, the 'triad' of access rights in environmental matters – to information, public participation in decision-making, and to judicial recourse – is a procedural element of the Human Right to a healthy environment.[110] The Aarhus Convention fully articulates these rights in treaty law.[111] The EU and all 27 Member States are Parties to the Convention, whose obligations have been transposed into EU law. The Aarhus Regulation (Regulation (EC) No 1367/2006) provides a clear legal basis for EU institutions, bodies, offices, and agencies to engage with the public.[112] Likewise, Switzerland's ratification of the Aarhus Convention, together with the Federal Act on Freedom of Information in the Administration[113] and relevant provisions of the Environmental Protection Act,[114] guarantees broad, interest-free access to environmental information held by federal administrations. Commercial interests may stand in the way, but only to some extent in the EU context.

Box 7: Access to official documents and commercial interests in the Court of Justice's case law

In the EU, the CJEU has promoted the widest possible access to environmental information.[115] According to the Court of Justice's case law, EU institutions cannot refuse access to official documents on the basis of protecting commercial interests if those documents contain information relating to environmental emissions – including pesticide emissions.[116] Pesticide dossiers trigger a presumption of overriding public interest, eliminating the need to balance disclosure against the protection of commercial interests.[117] This approach has significant practical implications and may pave the way for other jurisdictions that genuinely value transparency.

Source: Cases T-716/14 and T-329/17 and related literature (see endnotes).

Although the administrations involved have broad legal authority to communicate risks openly, an important question remains: does the relevant risk information actually exist? Access rights apply to information held by the administration, so when information has not been collected or documented, those rights can offer little practical help.

Guidelines and changes to administrative practices could help address this without necessarily legislative amendments. Administrations could ensure that the reasoning behind administrative decisions and the progress of discussions are carefully documented during pesticide working group or meetings across administrative units.

A more complex issue is keeping decision-making within formal settings, as stricter documentation requirements may push discussions outside meetings. This could be addressed through legally mandated agenda items that require reasons and decision records, along with a requirement to maintain video and audio recordings of all pesticide-related meetings.

5.2 Transdisciplinary methods of regulatory oversight?

A central challenge is engaging the public effectively on complex scientific and technical issues such as pesticide safety. Detailed disclosures can overwhelm people with information that is both voluminous and difficult to interpret. This risk is heightened by the proliferation of information sources and the rise of technology-driven, disintermediated science communication.[118] Although these developments can enable direct citizen engagement and participation,[119] they can also amplify information overload and disinformation – sometimes actively promoted by special interest groups, with the complicity of scientific experts.[120] Paradoxically, transparency without intermediaries may weaken rather

than strengthen public oversight.[121] Full disclosure also involves trade-offs with other legally protected interests, including commercial confidentiality, data protection, privacy, and the administration's 'space to think'.[122]

These challenges point to the value of structured, transdisciplinary oversight that connects regulatory bodies with participatory democracy. Such oversight would complement administrations' proactive duty to communicate openly, help guard against the misuse of administrative discretion, and strengthen feedback between citizens and public institutions.

One model would bring universities and research institutes together with public administrations to assess, manage and communicate pesticide risks. Its aims would be to broaden regulators' access to external expertise beyond industry and improve risk communication. This would require procedures enabling accredited academic and research institutions to 'back' the administration through the approval procedure, subject to confidentiality safeguards and building on existing or expanded legal bases (see section 5.1). Notably, EFSA already fosters links with and among a network of more than 300 universities, institutes, governmental, public, and other scientific bodies, which could provide fertile ground for developing further transdisciplinary risk-regulation models.

The academic network could work with citizens' initiatives, parliamentarians, environmental NGOs, and investigative journalists to reach the public. The network would support administrations in risk assessment and in evaluating the criteria and metrics for risk management decisions; journalists and civil society organisations would communicate findings; and citizen initiatives would provide a channel for gauging public views on proposed approvals. These parallel assessments and deliberations could inform administrative and parliamentary debates while reducing the risk of capture. No academic participant would be immune to capture, but peer scrutiny, public accountability, and the possibility of replacing institutions could provide safeguards.[123] Because the model would also require influencing multiple groups – including academics, journalists, parliamentarians, and civil society – capture would be more difficult and costly. The approach echoes proposals to diversify legislatures' access to external expertise and strengthen links between citizens and legislators, informed by research on democratic innovation.[124]

In the short term, this model could help institutional risk assessors independently review pesticide dossiers rather than merely act as 'meta-reviewers' of industry data. Over time, it could support a more ambitious role: complementing industry risk assessments with broader socio-ecological metrics. This raises the question of how to fund such transdisciplinary engagement.

5.3 Funding

Under the polluter-pays principle, those who generate the risks should bear the costs of socio-ecologically responsive risk assessment and management. This cost allocation is necessary to restore the legitimacy of risk regulation and liability regimes.

As discussed through this paper, risk regulation cannot guarantee that pesticides are safe: approval may be followed, sometimes years later, by withdrawal once harms or previously unrecognised risks emerge. Yet when harm occurs after a substance has been approved, responsibility is often difficult to assign. Pesticide companies may escape accountability because the substance passed a lengthy approval process, while strict causation requirements in liability regimes make it difficult to attribute harm in contexts involving multiple chemical and non-chemical stressors. Where regulation permits risks to be created but liability rules make resulting harm difficult to attribute, accountability can fall through the

cracks. This is a form of 'organised irresponsibility'[125] – a 'ticking time bomb' beneath the legitimacy of political and regulatory institutions responsible for risk governance.[126]

One way to address this regulatory failure would be to introduce or increase risk and contingency levies on pesticide manufacturers, importers, retailers, and users. Already used in some jurisdictions as fiscal tools to internalise the external costs of chemicals – including health risks, water contamination, and ecosystem damage[127] – these taxes could cover systematic post-market monitoring, independent reviews of pesticide dossiers, and comprehensive studies of pesticides' hidden costs, while also building a substantial contingency fund for remediation and compensation. The proceeds could support the transition in risk assessment, management, and communication proposed in this paper.

6 Conclusion

EU and Swiss pesticide frameworks invoke precaution and rigorous assessment, yet substances may still be approved when hazards or risks cannot be conclusively excluded. This gap between regulatory commitments and outcomes reflects discretionary science-policy choices – including which evidence to consider, how to weigh it, and how to balance costs and benefits against precaution. Framed as technical judgments, these choices can obscure their political significance: what level of risk society should accept, and what kinds of agriculture and food systems it should support.

Restoring public debate requires regulators to openly communicate the limits and potential biases of the approval process. They should explain what pesticide regulation can – and cannot – ensure; make visible the assumptions and choices embedded in 'science-based' assessment; and communicate the real costs of pesticide use and the availability of alternatives. This would support broader evidence bases and policy scenarios that account for environmental spillovers and intergenerational effects of pesticides.

Transparency alone, however, is not enough: an abundance of complex information, compounded by industry-driven scientific contestation, can hinder rather than enable scrutiny. One option is to pair proactive communication with structured, transdisciplinary oversight. Universities and independent research centres could work alongside administrations to strengthen the evidence base and identify risks of industry capture, while engaging the public through collaboration with NGOs, journalists, parliamentarians, and citizens' initiatives. This system could be funded through risk and contingency taxes designed to internalise the costs of uncertain risks – costs that have so far been externalised to ecosystems and society.

Endnotes

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[35] Art. 1(4), PPP Regulation (n. 17).

[36] Ibid.

[37] In the Swiss ordinance, protection objectives appear third among three listed objectives and are not accorded priority over the others. See OPPh (n 20), Art. 1.

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[43] Section 2, PPP Regulation (n. 17).

[44] Art. 36(3), PPP Regulation (n. 17).

[45] OPPh (n 20), Art. 5.

[46] OPPh (n 20), Arts. 6 and 7.

[47] OPPh (n 20), Art. 16.

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[60] EFSA, 'Peer Review of the Pesticide Risk Assessment of the Active Substance Glyphosate' (2023) 21(7) *EFSA Journal*. doi:10.2903/j.efsa.2023.8164, section 9.2 (hereafter, EFSA's Conclusion on glyphosate). An issue is listed as a critical area of concern "if there is enough information available to perform an assessment for the representative uses in line with the uniform principles in accordance with Article 29(6) of Regulation (EC) No 1107/2009 and as set out in Commission Regulation (EU) No 546/2011, and if this assessment does not permit the conclusion that, for at least one of the representative uses, it may be expected that a plant protection product containing the active substance will not have any harmful effect on human or animal health or on groundwater, or any unacceptable influence on the Environment" (EFSA's Conclusion on glyphosate, p. 31).

[61] van Asselt and Vos (n 57).

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[64] EFSA (n 62).

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[66] Galison and Stump (n 65).

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[73] Robinson et al. (n. 26).

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[77] Toppin, Aldrich and Berny (n 74).

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[79] Paskalev (n 70).

[80] G. C. Leonelli, 'The Glyphosate Saga Continues: "Dissenting" Member States and the European Way Forward' (2023) 12(1) *Transnational Environmental Law*, pp. 200–24; van den Brink (n 25); A. De Boer, M. Morvillo & S. Röttger-Wirtz, 'Fragmented Transparency: The Visibility of Agency Science in European Union Risk Regulation' (2023) 14(2) *European Journal of Risk Regulation*, pp. 313–31.

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[83] Hendlin (n 76).

[84] L. Schölin et al. 'Mapping Commercial Practices of the Pesticide Industry to Shape Science and Policymaking: A Scoping Review' (2025) 40(1) *Health Promotion International* daaf001.

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[87] See, for example, 'Monsanto Drags IARC Into the Depths of Its Disinformation Campaign on Glyphosate', Science and Democracy, The Equation, 11 Jul. 2018, available at: https://blog.ucs.org/genna-reed/monsanto-drags-iarc-into-the-depths-of-its-disinformation-campaign-on-glyphosate/; International Monsanto Tribunal, Advisory Opinion, The Hague, 18 Apr. 2017, available at: https://www.monsantotribunal.org/upload/asset_cache/189791450.pdf, at pp. 35-40.

[88] Paskalev (n 70), p. 522; L McHenry, 'Monsanto Papers: Poisoning the Scientific Well' (2018) 29(3-4) *International Journal of Risk and Safety in Medicine*, pp. 193-205.

[89] On the strategy of 'sowing scientific doubt' as regards the negative externalities of meat production and consumption, O. Ammann, 'How the Sausage Is Made, or Lobbying by the Meat Industry', Verfassungsblog, 6 Oct. 2025, available at: https://verfassungsblog.de/how-the-sausage-is-made-or-lobbying-by-the-meat-industry/.

[90] See, eg, E. Henry, 'Fabriquer des irresponsables' (2019) 61(2) *Sociologie du travail*, para 9; Paskalev (n 70), p. 522.

[91] Ibid. See, generally, D. Hess, *Alternative Pathways in Science and Industry: Activism, Innovation, and the Environment in an Era of Globalization* (MIT Press, 2007).

[92] PPP Regulation (n. 17), Art. 11(2) (Rapporteur Member State (RMS) assessment) and Art. 12(2) (EFSA Conclusion).

[93] European Parliamentary Research Service (EPRS), *Regulation (EC) 1107/2009 on the Placing of Plant Protection Products on the Market*, PE 615.668, Apr. 2018, pp. 19 and II-79-81.

[94] This also occurs for GMOs. For an analysis, M.B.A. van Asselt and E. Vos 'Wrestling with Uncertain Risks: EU Regulation of GMOs and the Uncertainty Paradox' (2008) 11 *Journal of Risk Research*, pp. 281–300, speaking of 'meta-review' at 284.

[95] Legal data requirements and the peer review of the applicant's dossier by risk-assessing public authorities are aimed at countering this potential, but in turn embed epistemic biases. For a discussion, Arcuri, and Hendlin (n 76); S. Rottger-Wirtz, 'Case C-616/17 Blaise and Others: The Precautionary Principle and Its Role in Judicial Review - Glyphosate and the Regulatory Framework for Pesticides Case Notes' (2020) 27(4) *Maastricht Journal of European and Comparative Law*, pp. 529–42.

[96] Paskalev (n 70).

[97] E. Bozzini, 'Assessing Criteria and Capacity for Reliable and Harmonised "Hazard Identification" of Active Substances', in European Parliamentary Research Service (EPRS), *Regulation (EC) 1107/2009 on the Placing of Plant Protection Products on the Market*, PE 615.668, Apr. 2018, Annex II, at II-11. See also Group of Chief Scientific Advisors, 'EU Authorisation Processes of Plant Protection Products - From a Scientific Point of View', Scientific Opinion 5/2018, European Commission Directorate-General for Research and Innovation and CEU, 2018, available at: https://data.europa.eu/doi/10.2777/238919.

[98] Administrations have an obligation to communicate openly about these issues. See para. 5 of the preamble of the EU Transparency Regulation (Regulation (EU) 2019/1381 on the Transparency and Sustainability of the EU Risk Assessment in the Food Chain [2019] OJ L 231/1).

[99] For a detailed study on France, Kinniburgh (n 78).

[100] EFSA (n 62).

[101] See, eg, CJEU, Judgment of 1 October 2019, *Blaise and Others*, C-616/17, EU:C:2019:800, and Cases C-308/22, C-309/22 and C-310/22 (n 34).

[102] For a discussion of comitology and GMOs, van Asselt and Vos (n 94). https://doi.org/10.1080/13669870801990806.

[103] Van Asselt and Vos (n 57) and (n 94).

[104] Ibid.

[105] Ibid.

[106] Group of Chief Scientific Advisors (n 97), pp. 9 and 34.

[107] Ibid., pp. 34-6.

[108] See, for example, Federal Council response (Avis du Conseil fédéral) of 27 August 2025 to Interpellation 25.3845 'Protéger nos enfants des pesticides. Renforcer la recherche et les mesures de prévention'.

[109] European Commission, 'Study supporting the REFIT Evaluation of the EU legislation on plant protection products and pesticides residues (Regulation (EC) No 1107/2009 and Regulation (EC) No 396/2005)', 10 Oct. 2018, p. iv. For a discussion of the cost-effectiveness of alternatives, J. Jacobi et al., 'Making Food Systems Safer: Time to Curb Use of Highly Hazardous Pesticides', CDE Policy Brief 15/2019, CDE, 2019).

[110] UN GA Resolution A/RES/76/300, of 28 Jul. 2022, on The Human Right to a Clean, Healthy and Sustainable Environment. Available at : https://documents.un.org/doc/undoc/gen/n22/442/77/pdf/n2244277.pdf. For a discussion, C. Ituarte-Lima, 'Biosphere Defenders Leveraging the Human Right to Healthy Environment for Transformative Change' (2023) 53(2–3) *Environmental Policy and Law*, pp. 139–51, at 140. In more substantive terms, chemical pollution – and State failure to prevent it – violates human rights law. On how to address state inaction regarding agrochemical pollutants through human rights litigation, V. Boillet and M. Levy, 'A Human Rights Approach to Agrochemical Pollution: Lessons to Be Learned from Climate Change Litigation?' (2025) 14(3) *Transnational Environmental Law,* pp. 500–524. https://doi.org/10.1017/S2047102525100046.

[111] Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, Aarhus (Denmark), 25 Jun. 1998, in force 30 Oct. 2001. Available at: https://digitallibrary.un.org/record/1491490?ln=en.

[112] Regulation (EC) No 1367/2006 of the European Parliament and of the Council of 6 September 2006 on the application of the provisions of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters to Community institutions and bodies [2006] OJ L OJ L 264/13.

[113] Loi fédérale sur le principe de la transparence dans l'administration du 17 décembre 2004 (Loi sur la transparence, LTrans ; RS 152.3).

[114] Loi fédérale sur la protection de l'environnement du 7 octobre 1983 (LPE ; SR 814.01).

[115] For a review, M. Morvillo, 'The General Court Orders Disclosure of Glyphosate-Related Scientific Studies: Tweedale, Hautala, and the Concept of Environmental Information in the Context of Plant Protection Products' (2019) 10(2) *European Journal of Risk Regulation*, pp. 419–27. https://doi.org/10.1017/err.2019.31.

[116] CJEU, Case T-716/14, *Anthony C Tweedale v European Food Safety Authority*, ECLI:EU:T:2019:141; Case T-329/17, *Heidi Hautala and Others v European Food Safety Authority*, ECLI:EU:T:2019:142. As stated by the Court, 'an EU institution, hearing a request for access to a document, cannot justify its refusal to divulge it on the basis of the exception relating to the protection of the commercial interests of a particular natural or legal person for the purposes of Article 4(2), first indent, of Regulation No 1049/2001, where the information contained in that document constitutes information which "relates to emissions into the environment" for the purposes of Article 6(1) of Regulation No 1367/2006' (*Anthony C Tweedale v European Food Safety Authority*, para 58).

[117] In the words of the CJEU, '(…) by establishing a presumption that the disclosure of information which "relates to emissions into the environment", with the exception of information relating to investigations, is deemed to be in the overriding public interest, compared with the interest in protecting the commercial interests of a particular natural or legal person, with the result that the protection of those commercial interests may not be invoked to preclude the disclosure of that information, the first sentence of Article 6(1) of Regulation No 1367/2006 derogates from the rule requiring the weighing up of the interests laid down in Article 4(2) of Regulation 1049/2001.' (*Anthony C Tweedale v European Food Safety Authority* (n. 116), para. 57).

[118] A. Volpato, M. Eliantonio & K. Wright, (2023) 14(2) 'Transparency and Participation in the Face of Scientific Uncertainty: Concluding Remarks', *European Journal of Risk Regulation*, pp. 371–381, p. 373 and references therein.

[119] Alemanno (n 14).

[120] O. Ammann & A. Boussat, 'The Participation of Civil Society in European Union Environmental Law-Making Processes: A Critical Assessment of the European Commission's Consultations in Connection with the European Climate Law' (2023) 14 *European Journal of Risk Regulation*, pp. 235–252, at 236.

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[122] De Boer, Morvillo & Röttger-Wirtz (n 80), p. 317 and references therein.

[123] For a discussion, O. Hamlyn, 'Assessing Member States' Capacity for Reliable "Authorisation of PPPs", and Its Uniformity', in European Parliamentary Research Service (EPRS), *Regulation (EC) 1107/2009 on the Placing of Plant Protection Products on the Market*, PE 615.668, Apr. 2018, Annex III, p. III-21.

[124] Ammann (n 15), at p. 473.

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[126] van Asselt and Vos (n 57), at 333, fn 11.

[127] For an overview of pesticide levies, R. Finger et al, 'Taxe incitative sur les produits phytosanitaires' (2017) 8(5) *Recherche Agronomique Suisse*, pp.176–183.