



Pesticides and health

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OVERVIEW

- Pesticides are highly regulated products that control pests, weeds and diseases. They help ensure food supply, safety and affordability.
- People can be exposed to pesticides in different ways, including through direct or indirect routes.
- Direct exposure comes from professional use of pesticides (often leading to the highest exposure levels) or from domestic use.
- Indirect exposure occurs at lower doses through the environment, food and drink.
- Evidence has not established true causal links between low-level, long-term pesticide exposure and health impacts, but concerns from some stakeholders remain.
- UK surveillance programmes track: pesticide exposures for occupational users; exposures from residues in food and drink; levels of pesticides in drinking water; and the potential health risks from poisonings.
- The nations of Great Britain make independent decisions on pesticide approvals, while Northern Ireland complies with EU law under the Northern Ireland Protocol.
- Different decisions from the EU and within UK nations could bring regulatory challenges and potentially affect farmers' access to pesticides.
- The latest UK National Action Plan for the Sustainable Use of Pesticides is expected by the end of 2021.

BACKGROUND

Over 70% of the total land area in the UK is agricultural,¹ three quarters of which is estimated to be at risk of some form of pesticide pollution.^{2,3} Pesticides are strictly regulated to mitigate short- and long-term environmental and health risks. However, research on the potential long-term health impacts from pesticide exposure is still ongoing.

Each UK nation monitors the amount of pesticides used and the areas treated with pesticides in their agricultural, horticultural and amenity sectors.^{4,5} Data show that total UK pesticide use has remained fairly steady since 2012.⁵ However, these metrics do not capture information about risks to people or the environment. UK governments and stakeholders such as the Voluntary Initiative for Pesticides and the National Farmers' Union are reviewing and developing metrics that consider the health and environmental risks from pesticides in addition to amounts used.⁶⁻⁹

In 2020, the Government and devolved administrations consulted on a revised draft of the 2013 National Action Plan for the Sustainable Use of Pesticides (NAP), a requirement under retained EU legislation.^{10,11} The draft NAP aims to develop targets by 2022 to reduce the risk associated with pesticide use. The European Commission has proposed, in its Farm to Fork Strategy, to reduce the use of and risk associated with chemical pesticides by 50% by 2030; reduce the use of more hazardous pesticides by 50% by 2030; and to consider residue levels allowed in imported products for substances presenting high risk for human health.¹¹⁻¹⁴ The Department for Environment, Food and Rural Affairs (Defra) also identified a need to understand the biggest health and environmental risks from pesticides as one of its 2021 areas of research interests.¹⁵

Definitions

Pesticides are chemical and biological products used to kill, control or prevent harmful organisms ('pests') and plant diseases.^{10,16,17} They are formulated products composed of:

- **active substances**, which target pests or control growth of the plant,^{17,18}
- **co-formulants**, such as solvents or preservatives.¹⁹

Pesticides are also known as plant protection products.¹⁷ The main pesticides are herbicides, insecticides and fungicides, which control weeds, insect pests and fungal diseases, respectively ([PN 336](#)). They are used to reduce crop losses in farms, gardens, crop stores and within the forestry sector, as well as to manage vegetation in natural landscapes,

public infrastructure (e.g., roads and railways), and amenity areas (e.g., recreational areas and parks).^{10,16}

Role of pesticides

Pesticides help ensure food availability and affordability by enhancing crop productivity, improving appearance of produce and maintaining food safety.^{16,20-24} By preventing pest damage, moulds and toxins, they extend the shelf life of food and reduce food spoilage and waste.²¹⁻²⁴

However, there is debate on the amount of pesticide use necessary to provide food for a growing global population.^{25,26} Some academics, farming groups and charities suggest that reduced or minimal use of pesticides (such as in organic agriculture), combined with changes in diet and reduction of food waste, could produce enough food for people.²⁷⁻³⁴ Other academics state that this would require more land, potentially increasing greenhouse gas emissions.³⁵⁻³⁸ They, together with other farming stakeholders, maintain that a loss of pesticides would reduce food production, affecting food availability and affordability.^{39,40}

EXPOSURE TO PESTICIDES

Traces of pesticides have been found in the blood, urine and tissues of people across the world.^{41,42} When they occur, the highest-level exposures to pesticides are from direct use in occupational and domestic settings, or from deliberate misuse, such as in cases of self-harm ('direct exposure').^{43,44}

People may also be exposed to lower doses of pesticides over the long-term from the environment (air, soil, water and dust) and ingestion of residues in food and drink ('indirect exposure'). The use of pesticides and their levels in food and water are highly regulated to prevent harmful effects on human health and the environment.^{16,45}

Direct exposure

Occupational exposure

Occupational exposure is generally of a higher concern since people working with pesticides are exposed to higher doses more frequently than the general public, with exposure usually occurring through the skin or inhalation.^{46,47} Health risks have been minimised through use of personal protective equipment, required professional training, improvements in spraying equipment and more precise and targeted application methods (see 'Pesticide regulation in the UK').⁴⁸⁻⁵⁰

Domestic exposure

People may be exposed to pesticides from domestic use (e.g., garden products), although risks are generally lower than for professional users.⁵⁰ Non-professional products are authorised only if the risk assessment determines that personal protective equipment is not required for safe use.⁵¹ Any exposures exceeding predicted levels are usually accidental or from poor compliance with safety guidelines.⁵²⁻⁵⁴

Indirect exposure through the environment

People can be exposed to pesticides through their environment. Research from academia and regulatory agencies has focused on those living near pesticide-treated areas (e.g., farms and city green spaces) or in households with professional users, as they may be exposed to higher levels than the general public.^{50,55-57} Potential exposure risks to these groups must be assessed before pesticides are approved for use.⁵⁷⁻⁵⁹

Resident and bystander exposure

People that live ('resident') or walk ('bystander') nearby areas that have been recently sprayed with pesticides can be exposed to pesticide residues, pesticide drift in the air, dust coated with pesticides or released vapours.

After identifying resident and bystander exposure as a research priority, the Government funded research from 2006-10 to develop a model to determine exposures to these groups following crop spraying; this model was later incorporated into EU regulatory guidance.^{57,60,61-65} The Government then funded a further study in 2011/12 to track pesticide residues in the urine of approximately 150 residents living within 100 m of English farms spraying pesticides.⁶⁶ This research confirmed that the residential exposure estimates used in regulatory risk assessment models were sufficiently conservative to maintain safety.⁶⁷ It also concluded that there was no evidence of increased pesticide exposure for these residents during spray events.^{68,69} More recent academic literature reviews in 2020, which included studies worldwide (therefore in places with potentially different pesticide practices), identified that the distance between households and treated fields, size of treated fields and spraying season can influence residential and bystander exposure levels.^{70,71}

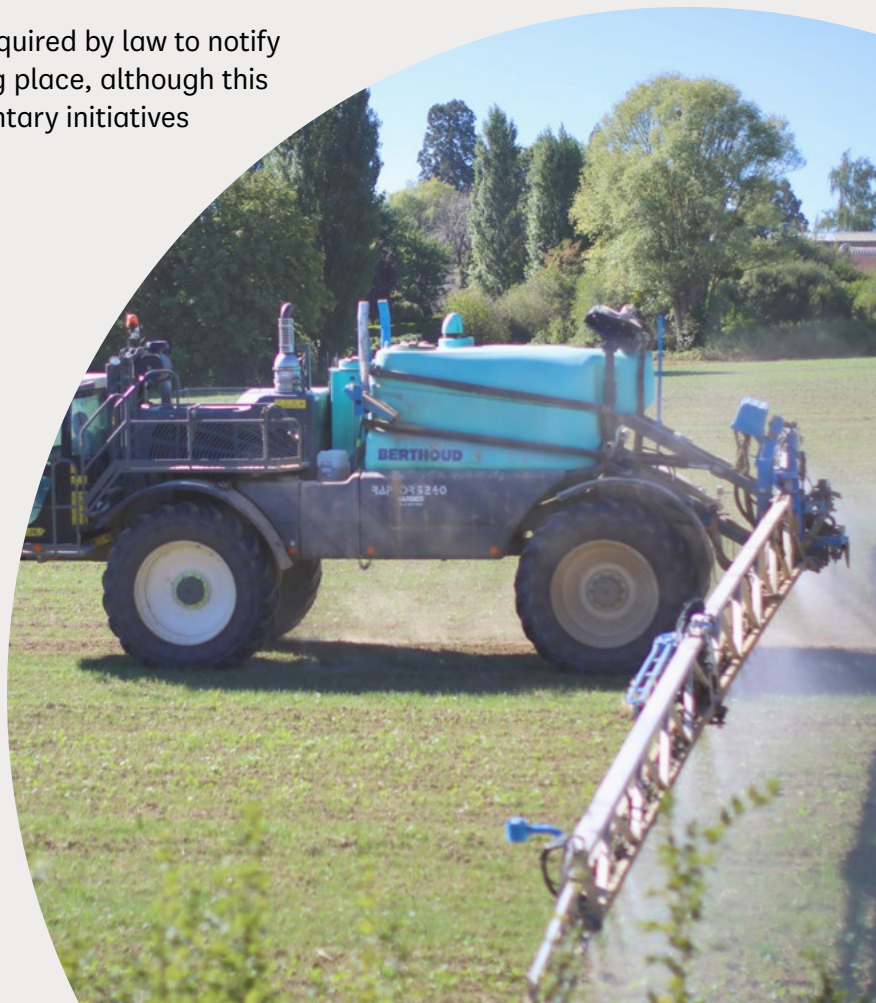
Some campaigners and Parliamentarians have expressed concern about resident exposure.⁷²⁻⁷⁵ Amendments to the Agriculture Bill 2020 that would have restricted spraying close to residential and public buildings were proposed, but then withdrawn or not moved forward.^{74,75}

Farmers and amenity users are not required by law to notify people nearby when spraying is taking place, although this is regarded as best practice and voluntary initiatives encourage this.^{76,77}

Exposure through living with occupational users

People living in households with occupational pesticide users ('para-occupational') can be exposed to higher levels of pesticides than residents and bystanders.^{78,79}

Residues have been found in workers' homes on clothing, carpets, pets, children's toys and in dust.^{56,78,80-83,84,85} Research concerns focus mainly on children, whose frequent hand-to-mouth



activity can lead to higher exposure levels (see ‘Impact of pesticides on health’ and Box 1).^{44,86-90}

In 2009-11, literature reviews conducted by UK expert committees on carcinogenicity and toxicity found no clear evidence for adverse health impacts from para-occupational pesticide exposure, although most studies reviewed had significant limitations. Specific health concerns for further research were also identified, including incidences of miscarriages, allergies in children and childhood leukaemia (following maternal exposure).^{79,91,92}

Indirect exposure through food and drink

Pesticide residues can occur in foods when pesticides are used on seeds, crops (including animal feeds, transferring into animal products) and during food storage (see ‘Pesticide regulation in the UK’ and Box 2). Since residues in food are regulated and usually occur at low levels in the UK, regulatory bodies generally do not consider this as a health concern.^{50,93} However, concerns are still expressed by some charities and consumers.⁹⁴⁻⁹⁷ Some studies evaluating pesticide levels in the body show that eating food produced organically, which uses minimal amounts of pesticides, can decrease dietary exposure to pesticides.⁹⁸⁻¹⁰¹ However, health impacts from dietary exposures to pesticides are unclear.¹⁰²⁻¹¹¹

IMPACT OF PESTICIDES ON HEALTH

Adverse health impacts from pesticides depend on the toxicity of the substance; dose (amount) of exposure; duration and frequency of exposure; route of body entry (skin contact, ingestion, or inhalation); and personal vulnerability.^{20,42,87,112-114} People that work with pesticides, are near areas of pesticide use or live with people that work with pesticides may have higher levels of exposure. Certain groups, such as unborn babies and children, may be more sensitive to small doses (Box 1).^{42,112,113,115} Regulatory risk assessments thus consider exposure levels for children, as well as potential reproductive and developmental impacts.^{57,116}

Acute exposure effects

Acute exposures are single or short-term exposures, which at high doses may result in poisoning.¹¹⁷ These occur mainly during direct use of pesticides, such as at work or in the home.^{52,54} Depending on the specific pesticide and exposure level, health effects can include immediate symptoms (e.g., headaches and nausea) and long-term health risks (e.g., on the nervous system).^{43,118-121}

In Great Britain (GB, i.e. England, Scotland, and Wales), the National Poisons Information Service (NPIS) tracks the cases of pesticide poisoning in which health professionals consult the NPIS for information.^{52,122} This thus excludes cases of exposure where NPIS has not been consulted.

NPIS received reports of 886 pesticide exposures in 2019/20, accounting for less than 1% of all reported poisoning cases.⁵³ 80% of these cases were unintentional acute exposures resulting in little harm. These occurred mostly from exposure to non-professional products in the home, often by children (36%). A small proportion were self-harm cases, which were the most severe and accounted for the only fatalities.⁵²



Chronic exposure effects

Proving causal relationships between chronic pesticide exposure and health effects is difficult, and the research available in this area is inconclusive and of variable quality.^{90,123,124} Limitations of current studies include:

- **Lack of specificity.** [Epidemiological studies](#) analysing potential health effects within a population often focus on overall pesticide exposure, making it difficult to attribute health impacts to an individual pesticide.
- **Difficulty quantifying exact exposure levels.** While the health of occupational pesticide users is monitored in the UK (see below), there are no large-scale studies that monitor exposure levels in the urine and blood of the general public to assess potential health impacts, as done in other countries such as the EU.^{41,125–128,129,130} In the UK, indirect exposures (through the environment and food) are not expected to be at sufficient levels to produce any permanent health effects.^{79,114,131}
- **Lack of control groups.** As almost everyone is exposed to pesticides and many other chemicals in some way, there are no true control populations for comparisons and investigating impacts from specific pesticides is difficult.¹³²
- **Role of other variables influencing health.** Aspects such as socio-economic deprivation and lifestyle factors (e.g., diet, exercise and sun exposure) make it difficult to attribute any health effects specifically to pesticide exposure.¹³³

Chronic health concerns and regulatory actions

Although pesticides have not yet been established as a definite cause for any chronic health effects, regulatory authorities may withdraw pesticides for use if there is [evidence of correlation](#) with health or environmental concerns or significant scientific uncertainty about potential impacts, without the need to prove causality.^{39,134} For instance, in 2016, the UK withdrew the approval of the widely-used organophosphate insecticide chlorpyrifos because of concerns about neurological development and genetic effects.^{135,136} Uncertainties in the available data meant that safe exposure levels could not be determined.^{136,137} Regulatory agencies regularly review new scientific evidence, which can lead to the removal of pesticides if health or environmental concerns come to light.

Occupational exposure and long-term surveillance in the UK

In GB, the Health and Safety Executive surveys occupational pesticides users annually to report health effects.^{125,126} It also studies long-term health effects through the:

- **Pesticides Users' Health Study (PUHS)** – includes approximately 60,000 pesticide users (94% men) recruited from 1994-2003 who are tracked for incidences of cancer and mortality within the National Health Service (NHS).¹²⁷
- **Prospective Investigation of Pesticide Applicators' Health (PIPAH)** – has approximately 6,000 participants (and still recruiting), who are tracked for similar health effects as the PUHS and annually surveyed for specific health issues (e.g., respiratory problems).¹²⁸

Current results from the PUHS found 42% and 15% decreases in overall risk of death and cancer, respectively, for men in this cohort compared to the general GB population.^{138,139} This is potentially due to healthier lifestyles (e.g., greater physical activity) among the PUHS cohort. However, men in this cohort had increased risk of testis cancer, multiple myeloma and non-melanoma skin cancer by 26%, 49% and 11%, respectively, possibly also reflecting differences in lifestyle. The limitations of this study included limited information on baseline health (e.g., physical activity and alcohol intake) and actual pesticide use by participants. Upcoming reports from the PIPAH study on respiratory and musculoskeletal health are currently being drafted.

Evidence on chronic health concerns emerging from international studies

Regulatory agencies also regularly review new scientific evidence on health impacts from pesticides. In 2013, the European Food Safety Authority (EFSA) reviewed over 600 epidemiological studies analysing the potential impact of pesticides on health, ranging from cancer to fertility.⁹⁰ The most recent and consistent evidence that EFSA reviewed showed a significant association between occupational pesticide exposure and a 50% increased risk of Parkinson's disease, as well as an increased risk of up to double for childhood cancers (especially leukaemia, Box 1) following exposure during pregnancy and childhood. This was confirmed again in a 2021 literature review from the French National Institute of Health and Medical Research, which analysed over 5,300 documents.¹⁴⁰

These reviews also identified associations between general pesticide exposure in occupational users and increased risk of: certain cancers (e.g., Non-Hodgkin lymphoma, Hodgkin's lymphoma, multiple myeloma and prostate cancer); neurological illnesses (especially amyotrophic lateral sclerosis, or ALS, and general cognitive impairment); and respiratory illnesses (especially chronic bronchitis, asthma, and chronic obstructive pulmonary disease, or COPD).^{90,140}

However, these reviews also included studies assessing pesticides now prohibited in the UK.

Box 1. Pesticides and children's health

Similarly to what happens with other chemicals, children may be affected by low levels of some pesticides that would have little or no adverse effect on an adult because their organs are still developing through early childhood.^{42,87} Effects could occur from exposures of parents prior to conception, in the womb (through placenta) or after birth (including through breastmilk).^{42,87,112,113} Children's exposure levels can be higher because of their behaviour (frequent hand-to-mouth activity) and intake levels relative to their body weight.^{86,88}

Research on children's health impacts is still inconclusive, with no true causal relationships established. Most health concerns are related to exposures during pregnancy and for children living with people who work with pesticides. A strong association between childhood leukaemia and general pesticide exposure was found in the 2013 EFSA review and confirmed by two 2021 literature reviews.^{86,90,140-148} EFSA's review also suggested an association between maternal occupational exposure and a 52% increased risk of spontaneous abortion.⁹⁰ Studies have also investigated associations with other health effects including adverse birth outcomes, cognitive development, and behavioural problems such as anxiety and attention-deficit hyperactivity disorder (ADHD), but evidence is still inconclusive.^{86,90,102,108-110, 140,149-165}

Emerging concerns: hormonal (endocrine) disruptors

There is increasing concern that some pesticides could interfere with human hormones, even at very low doses ('endocrine disruptors').¹⁶⁶⁻¹⁷⁰ These hormonal disruptions are associated with potential impacts on reproduction (e.g., pregnancy and birth), development, growth, fertility, metabolism (e.g., obesity, diabetes), immunity and behaviour.^{86,90,102,105-111,114,140,149-153,171-181}

However, evidence in this area is variable. A 2019 review concluded that pesticides such as organochlorines, organophosphates and carbamates, many types of which are no longer authorised in the UK, are more often associated with hormonal disruption (including fertility and metabolism disruptions) than more recently developed pesticides.¹⁸² In 2018, the EU introduced new measures to assess endocrine disrupting properties in pesticide approval applications.^{183,184} Active substances found to have the capacity to interfere with hormones are not approved.

Combined exposure from multiple pesticides

Pesticides are often applied together or used sequentially; thus, people may be exposed to a range of different pesticides during use, through the environment, or as residues in food.^{94,185,186} Substances that affect the body in a similar way (e.g., hormonal disruptors) may combine to create an amplified effect. Thus, pesticides could interact with each other, as well as

with other chemicals, to have synergistic (greater than additive) effects on the body ('cocktail effect').¹⁸⁷⁻¹⁸⁹

In some cases, the co-formulants within pesticide products can also enhance the toxicity of pesticides and increase exposure (e.g., by increasing skin absorption).^{19,30,190-192} This is more likely for people exposed whilst using pesticides than for those exposed through their diet.

Effects of combined exposures on health

Following the UK Committee on Toxicity's recommendation to evaluate risks from combined pesticide exposures in 2002,¹⁹³ the Food Standards Agency (FSA) funded a number of research projects, in addition to supporting EU research.^{194,195} One preliminary study modelled UK residents' combined exposure levels, from all exposure pathways, to a group of pesticides.^{194,195} Results showed that combined exposure levels for consumers were not a concern, but exposure levels for occupational users and people living near sprayed areas could exceed levels of health concern. However, it was concluded that the conservative exposure estimates used in the study overstated risk.¹⁹⁵ A need for more detailed information on sources of exposure, especially from the diet, was identified.¹⁹⁵

More recently, the European Food Safety Authority (EFSA) used monitoring data from EU nations to model consumers' dietary exposure levels to multiple pesticides, focusing on those that could affect the nervous and thyroid systems.¹⁸⁷ The additive effect from exposures to multiple pesticides did not exceed the threshold to trigger regulatory action, but work is ongoing.¹⁸⁷

Some academics and non-governmental organisations (NGOs) are still concerned that the risks from combined exposure to multiple pesticides are not evaluated in risk assessments for active substance approvals.^{73,94,196-198} In the UK, combined toxicity is mainly evaluated when there are multiple active substances within the same product, but not between different products.¹⁹⁹ However, human health risks are considered when multiple pesticide residues that affect the body in a similar way are found in foods.²⁰⁰

In the EU, EFSA is developing new methodologies to evaluate the risks from combined exposures to multiple pesticides, which will be included in pesticide risk assessments.^{187,201} In March 2021, the EU Commission also prohibited specific co-formulants for use in pesticides.²⁰² Although these changes do not apply to Great Britain (GB, i.e. England, Scotland and Wales), they are being reviewed and considered for adoption by the UK regulatory agency and GB administrations.²⁰³

PESTICIDE REGULATION IN THE UK

Under the European Union (Withdrawal) Act 2018, EU pesticide regulations were transferred, with amendments, into UK law ([CBP 8375](#)).²⁰⁴⁻²⁰⁶ Northern Ireland (NI) continues to be covered by the EU regulatory regime. For GB, responsibilities were re-assigned from EU to GB authorities. However, some NGOs, academics and Parliamentarians have raised concerns about the loss of oversight checks in pesticide regulation when these powers were transferred from the EU to GB ministers.²⁰⁷⁻²¹⁰

Defra is the lead UK Government department responsible for policy on pesticide use, along with relevant departments in the Devolved Administrations. The Health & Safety Executive (HSE) is the regulatory body for the whole UK that authorises pesticide products, regulates pesticide use and monitors occupational health impacts and pesticide residues in food. Under a series of Agency Agreements, Ministers provide written consent for HSE to carry out regulatory functions about active substance approvals in GB, product authorisations in UK and levels of pesticide residues allowed in foods (known as maximum residue levels, or MRLs, explained in Box 2) in GB.²¹¹⁻²²³ Relevant ministers in each GB nation are approached for final sign-off of active substance approvals and novel or contentious MRL proposals, and can intervene if they disagree with HSE's recommendations. Ministers may also intervene in other decisions if they wish to do so by giving HSE written notice of their intention. This may occur, especially in the case of novel, important or contentious cases such as the emergency authorisation of specific pesticides.

Pesticide approval and authorisation

Active substances must be approved before the pesticide products containing them are authorised for use.²²⁴ Companies must prove no harmful effects on human health and no unacceptable effects on the environment in active substance applications.^{225,226} For NI, active substance applications are reviewed and approved on an EU level.¹⁸ In GB, the HSE Chemical Regulation Division reviews applications and conducts risk assessments. It consults the Expert Committee on Pesticides (as well as other expert committees) for independent advice.^{227,228}

HSE will then authorise pesticide products based on the allowed active substances in each UK nation. Approvals of active substances are reviewed for renewal at least every 15 years, or sooner if research evidence or

concerns emerge. In GB, renewal reviews originally scheduled before December 2023 have been postponed for up to 3 years to allow time to plan and implement the GB review programme following EU withdrawal.²⁰⁶

Occupational safety

UK legal requirements ensure the safe and sustainable use and storage of pesticides in professional settings, through retained EU directives and statutory-based Codes of Practice.^{11,229-237} Requirements include:

- **regular testing of application equipment** at specified intervals via the National Sprayer Testing Scheme²³⁸
- **training and certification** of spray operators and those selling and storing pesticides.^{239,240}

Voluntary industry initiatives encourage best practice in pesticide use and consideration of alternatives.²⁴¹⁻²⁴³ Farm assurance schemes, such as Red Tractor, provide independent farm audits to ensure that the legal and best practice for pesticide use is followed. They are often required by most supermarkets and food processors in the UK.^{244,245}

Monitoring of pesticides in food and drink

HSE, in consultation with the Expert Committee on Pesticide Residues in Food (PRiF), plans UK surveillance programmes and monitors pesticide residues in domestically produced and imported food and drink.²⁴⁶ Sampling is targeted towards foods common in the UK diet and those where residues are expected. PRiF reviews monitoring results, assessing residues for compliance with legal limits (Box 2) and for potential health impacts.^{93,247} HSE assesses the risk to consumers every time a residue is detected, consulting the Food Standards Agency (FSA) for food safety concerns.^{246,248}

Box 2: Maximum Residue Levels

Maximum Residue Levels (MRLs) are the limits for pesticide active substances allowed in food by law for trading purposes.²⁴⁹ MRLs are based on the highest amount of residue expected when following the pesticide's authorised conditions of use; they must be set below levels considered to be safe for consumers, which are often much higher.^{200,250,251} For pesticides unauthorised in the UK, MRLs for are usually set at the lowest limit of detection (0.01 mg/kg default).^{252,253}

MRL non-compliance in the UK is low and generally higher for imported vs. domestically produced foods.¹²² In 2020, 2,460 samples were tested for up to 371 pesticides.⁹³ 2.5% of the samples contained a residue above the MRL, and only four were referred to the FSA for human health concerns. PRiF states that MRL exceedances in foods rarely result in any likely health concerns for UK consumers.²⁵¹

Monitoring drinking water

Pesticides are among the top pollutants that are putting nearly half of the Drinking Water Protected Areas (water bodies used for drinking) in England at risk of deterioration.^{254,255} The Drinking Water Inspectorate strictly regulates UK drinking water to prevent human exposure to pesticides and other chemicals, and water must be treated before use.²⁵⁶ Water companies must also comply with limits set for individual pesticides and total pesticide presence.^{45,257} In the rare cases where limits are exceeded, Public Health England is consulted to assess if exceedances could result in human health risks.²⁵⁸

Regulation in devolved nations post-Brexit

Although a devolved matter, the UK Internal Market Act and the Northern Ireland Protocol can affect how pesticide regulations are enacted and enforced in the UK nations.²⁰⁶

- **The UK Internal Market Act 2020** allows for the free flow of goods between the UK nations.^{259,260} Pesticides present an exception: if some pesticides are authorised in one nation but not another, these products cannot be sold or used across borders. However, this exception does not apply to MRLs. Thus, if a food product meets the MRLs set in the nation where it was originally produced or imported, it can be sold everywhere in GB (but not in Northern Ireland, see below) even if MRLs differ between GB nations.^{253,261}
- **The Northern Ireland (NI) Protocol** ensures that NI continues to operate under EU pesticide regulations, meaning there is potential for divergence between NI and GB.²⁶²⁻²⁶⁴ All food products placed on the market in NI, including those moved to NI from GB, must comply with EU MRLs, although NI retains “unfettered” access to the GB market ([CBP 9003](#)).

Scottish and Welsh Governments openly opposed the Internal Market Act, arguing that it can override devolved regulatory decisions, such as with MRLs.^{261,265-269} Divergences between UK nations are possible as the 2021 Scottish National Party (SNP) Manifesto clearly stated its plan to align with EU pesticide standards.²⁷⁰ New inspection requirements and divergence of standards between NI and GB could also complicate trade.^{271,272}

The UK Government and devolved administrations are thus establishing ‘common frameworks’ to define how they will work together to manage regulatory differences in areas where powers have returned from the EU to devolved administrations. Common frameworks for chemicals and pesticides, as well as for food and feed safety and hygiene, are currently being developed.^{261,273-275}

POTENTIAL CHANGES IN REGULATORY APPROACH

Withdrawal from the EU has raised speculation about how GB may change its regulatory approach to pesticide approvals in the future. Globally, there are two main approaches to pesticide approvals, often used at various levels in combination:²⁷⁶

- **A hazard-based approach** regulates substances on their intrinsic potential to cause harm ('hazard').²⁷⁶⁻²⁷⁸ This approach is used as the first step in EU and current UK assessments for active substance approvals. 'Cut-off criteria' are applied so active substances that are intrinsically highly hazardous to health (e.g., carcinogenic, mutagenic) or to the environment can be denied approval without assessing risk. The precautionary principle also underpins EU/UK legislation, so that in cases of scientific uncertainty, regulatory decisions are made to reduce potential harm.^{224,279}
- **A risk-based approach** recognises a hazard, but takes into account exposure levels and use of the product in the real world.²⁷⁶ Mitigation measures and ways to reduce risk (e.g., using a low dose) will be identified and considered before making a decision. This approach is used by the EU/UK if substances pass the hazard-based screen.²⁷⁶ It is also used as the main approach in most other countries around the world, including the US and Australia.

The EU's pesticide approval system is one of the strictest in the world.²⁷⁸ Over the past 30 years, the number of available active substances has halved in the EU (and the UK, as an EU member state) because of the EU's rigorous review process and the introduction of new regulations.^{280,281}

Whether the UK should maintain the EU's more hazard-based regulatory approach in the future is a matter of debate.²⁸² Many farming, environmental and health-based NGOs support this approach, asserting that it reduces impacts on human health, the environment and biodiversity.²⁸³⁻²⁸⁷ However, other farming and industry groups argue that it is not based on scientific evidence, it is too precautionary and it limits the



availability of newer pesticides, with concerns that a lack of product variety will lead to pest resistance issues ([PN 501](#)).^{288,289} They believe that a more risk-based and flexible approach would maintain health and environmental protections whilst supporting food production and encouraging industry growth.^{40,289–295} Some academics and stakeholders also assert that decisions on pesticide approvals need to consider consequences and trade-offs, such as on food production, in addition to risks.^{20,296}

International trade

As the UK Government has recently signed and is currently negotiating a number of free trade agreements, GB may come under pressure from trading partners to change its regulatory approach to facilitate trade.^{297–303} In recent years, over 25 member countries of the World Trade Organization (including the US, Australia and Canada) have raised concerns that EU (and thus current UK) MRLs are too precautionary and constrain trade.^{304,305} EU MRLs are generally lower (stricter) than the internationally agreed Codex MRLs, which are used as a basis to establish national regulations and harmonise standards for global trade.^{306,307} However, countries may adopt their own measures, which result in higher levels of health protection, if they have scientific justification and use a consistent approach.³⁰⁷

DIVERGENCE AND STAKEHOLDER CONCERNS

Since GB retained EU pesticide legislation on 1 January 2021, divergence in approved active substances and MRLs has already occurred between GB and the EU.²⁰³ The diverging GB regulatory regime, along with new trade deals, may impact pesticide manufacturers, distributors, farmers, agricultural advisors, the food industry and consumers.

Impact of EU divergence on exports

The EU is the largest agricultural export market for the UK.³⁰⁸ Farmers, agricultural supply companies, and food companies will now have to continually review and adhere to potentially diverging standards for EU export. If certain pesticides are not approved in the EU but are still allowed in GB production, GB growers will have to decide which pesticides to use depending on their intended market. NI and GB farmers may therefore have to use different production practices for crops destined for internal vs. export markets, potentially even growing and storing foods in separate locations to avoid compliance issues. NI may have to source foods normally obtained from GB from elsewhere, potentially impacting food prices.³⁰⁹

Since the review of active substance renewals are expected to be postponed in GB until 2024 (with the possibility that decisions can be taken beforehand), substances withdrawn in the EU may still be in use in GB, as is the case for the fungicide mancozeb.^{206,310} There is an expectation in the farming and food industry that similar non-renewal decisions will be taken in GB in time.³¹¹ However, food processors may be reluctant to purchase crops treated with these substances for long-life food products (e.g., crisps and frozen foods), as they may have to be destroyed later depending on regulatory decisions. The 2022 EU decision on whether it will renew approval for glyphosate, the most widely used herbicide in the UK and globally, is of particular interest as it may impact EU/UK and global trade (Box 3).^{312,313}



Box 3: Glyphosate renewal and controversies

Glyphosate is a widely-used herbicide that controls weeds on farms and other green spaces.³¹² A 2015 literature review by the International Agency for Research on Cancer (IARC) stated that glyphosate was “probably carcinogenic”, but later reviews by the European Food Safety Authority (EFSA) in 2015 and European Chemicals Agency (ECHA) in 2017, along with reviews by other regulatory agencies from around the world, did not class glyphosate as such.^{314–322} IARC criticised EFSA for their methodology and for not including all relevant studies, although EFSA included toxicological studies submitted by companies in approval applications that IARC could not access.^{323,324} EFSA also focused its assessment on the active substance (rather than also including studies on whole products, as done by IARC) and considered real-world use.^{325–327} In 2018/19, US legal action spurred more public debate when two individuals convinced juries that their cases of non-Hodgkin’s lymphoma were linked to occupational glyphosate exposure ([CBP 8066](#)).^{328–330}

The EU is currently reviewing glyphosate’s approval for use.³¹² In June 2021, its Assessment Group on Glyphosate again reviewed the scientific evidence and concluded that glyphosate meets the approval criteria for human health and does not classify as a carcinogen.³³¹ Public consultations from EFSA and ECHA are planned for September 2021, with further risk assessments to follow.³³² GB’s decision on renewal will take place by 2025. A 2017 report by the Crop Protection Association (representing pesticide manufacturers) estimated that a ban on glyphosate would result in a 15% decrease in UK cereal production and lead to a £940m reduction in farm output.³¹³ The National Farmers’ Union argues that glyphosate use is vital to British farming.^{333,334} Conversely, Pesticide Action Network UK continues to campaign for its prompt end of use in public spaces and its phase-out in agricultural use.^{335,336}

Cost to industry and farmers’ access to pesticides

Developing new pesticides and bringing them to market is costly and time-consuming for industry.^{337,338} Although expensive, EU approval grants market access to 27 member states. Some stakeholders argue that it may not be commercially viable for industry to undergo the same application process for the much smaller UK market. Separate authorisations for NI and GB will also bring additional costs. Farmers are concerned that this will limit access to pesticides, especially for smaller sectors (e.g., horticulture) and NI, thus potentially putting them at a competitive disadvantage to growers elsewhere.³³⁹ Uncertainty on pesticide availability makes it difficult for farmers to plan ahead and consider other options.³⁴⁰ HSE is working on how to streamline the pesticide application process for companies, but reducing application costs is unlikely due to HSE’s new responsibilities following EU withdrawal.²⁰³

FUTURE PESTICIDE POLICY IN THE UK

The Revised National Action Plan (NAP) for the Sustainable Use of Pesticides is expected to be published by the end of 2021.¹⁰ Its draft details how all UK administrations will support safe and sustainable pesticide use over the next five years. Encouraging the uptake of integrated pest management (IPM) is a core goal. IPM requires the consideration and combined use of all available crop protection methods (e.g., through variety selection or encouraging natural pest predators) to control pest populations whilst reducing risks to human health and the environment.^{10,11,341} Pesticides should be used only when alternatives are ineffective or unavailable.

In a combined response, over 37 different food, farming, environmental and health NGOs, including Pesticide Action Network UK, praised the draft NAP for committing to set pesticide risk reduction targets.^{285,342–344} However, they called for these targets to be ambitious, time-bound and focused on driving reduction in overall pesticide use, while also asking for commitments to phase-out the use of non-agricultural pesticides (i.e., for domestic or amenity use). The National Farmers' Union stated that any pesticide risk reduction targets should be well-reasoned and science-based, or else these could damage the ability to produce food and crops in the UK.^{345,346} It called for better approaches to ensure farmers have continued access to safer and more effective crop protection products.

Defra's Sustainable Farming Incentive Pilot also includes activities to reduce the need for and impact of pesticides, such as encouraging natural pest predators and preventing pollution.^{347,348} The pilot started in 2021 as part of the Environmental Land Management Scheme for England, which pays land managers for delivering public goods.³⁴⁹

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