House of Commons

Environmental Audit Committee

Insects and Insecticides

Written evidence

Only those submissions written specifically for the Committee for the inquiry into Insects and Insecticides and accepted as written evidence are included

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Written evidence submitted by Professor Dave Goulson, University of Stirling.

Insecticides

- I write with regard to the possible role of neonicotinoid pesticides in harming bee health, and other potential impacts on the environment. This class of compounds are widely used in the UK (1.3 million ha treated in 2010) and worldwide, mainly as a seed coating. They are absorbed by the growing crop and protect it against herbivorous insects. Concern has focused on the impact of neonicotinoids in the pollen and nectar of crops such as oilseed rape and sunflowers, which are consumed by both honeybees and wild bees such as bumblebees.
- I am an academic with 20 years' experience in studies of ecology, biodiversity and conservation, with a particular focus on bumblebees. I am author of a recent study on the impacts of neonicotinoid insecticides on bumblebees, published in *Science* in March 2012, which has been much-quoted during the recent controversy over insecticides (Whitehorn et al. 2012).
- Firstly, I would like to flag up my willingness to discuss any aspect of this study, and its implications, should this be useful.
- I am concerned that Defra's response to this work, and other studies, seems to be focused on trying to pick small holes and then using them as a justification for inaction. No study is perfect, and in practice it is impossible to carry out the ideal study. I would be happy to explain this in detail, but in essence a proper experiment requires natural, free flying bees in multiple areas with and without neonicotinoids. There are not areas without neonicotinoids in Europe. Hence if Defra are waiting for the perfect experiment to be performed, they will be waiting a very long time.
- There are major knowledge gaps which require further study. When neonicotinoids were first introduced for application as a seed dressing (rather than an aerial spray), they were welcomed as this was assumed to give better targeting of the crop and reduced environmental damage. However, this may not be the case, for the following reasons:

A) Published research by Bayer's scientists suggests that about 2% of neonicotinoid seed dressings are absorbed by the crop, leaving the fate of 98% unknown. These compounds are water soluble, and degrade very slowly in soil water. If they are drawn up by non-target vegetation, such as hedgerow shrubs, they could impact directly on numerous insects such as butterfly larvae. There appears to be just one study of levels in non-target plants, from the US, which found concentrations of neonicotinoid sufficient to kill herbivorous insects in dandelions growing near treated crops (Krupke et al. 2012, PlosONE). We do not know whether farmland vegetation in the UK is similarly contaminated.

B) Recent studies from Italy suggest that, no matter how carefully dressed seeds are drilled, neonicotinoid dust is created, sufficient to deliver lethal doses to flying insects nearby and presumably able to drift into non-target vegetation (Tapparo et al. 2012; Marzaro et al. 2011).

It seems to me that there is an urgent need to establish the fate of the 98% of neonicotinoids which are not in the crop, and to find out what impacts they might be having on the environment. Funding permitting, I am currently attempting to pursue this line of research.

26 September 2012

Written evidence submitted by Brighton and Lewes Beekeepers

The Committee of the Brighton and Lewes Beekeepers commend and support the decision to look into the issue of insecticides and honeybees.

1. The Committee of the Brighton and Lewes Division of the Sussex Beekeepers Association commend the decision to look into the issue of insecticides, in particular the group neonicotinoids, and their potential effects on honeybees and other pollinators.

2. As beekeepers we, and the members we represent, are concerned with increasing mortality rates of our bee colonies.

3. There are many scientific papers in the public domain which implicate systemic insecticides, specifically the neonicotinoids: Imidacloprid, Clothianidin and the carcinogenic phenylpyrazole: Fipronil, in the deaths of bees.

4. There is increasing evidence that these insecticides impair the bees' immune system rendering them more susceptible to other parasites and diseases, specifically Nosema. Synergistic action between insecticides and other pesticides and chemicals can also be lethal and need investigation.

5. We are also concerned that the initial short term toxicity testing required for licence is inadequate and has not detected chronic and sub lethal effects on pollinators, and worry that the testing may be inadequate for the safety of human beings as well.

6. We are concerned that the multinational chemical companies may be having undue influence in the granting of licences and the continued availability of their products in spite of widespread public concern.

7. The refusal to accept peer-reviewed scientific evidence by Syngenta and Bayer reinforces this view.

8. The failure of Defra to put a precautionary ban on these products, in spite of such bans being applied to certain uses of these chemicals in a number of European countries; France, Germany Italy, Slovenia, causes us to lose confidence in the British Government, and question who is the beneficiary of this inaction as it certainly is not the public, the environment, bees or beekeepers.

25 October 2012

Written evidence submitted by William Summers

Honeybee pollination services raise farmers profits. Any deleterious effects on honeybees caused by systemic seed dressings is an unintended consequence. Farmers should support a strategy to not kill bees if universally applied. They see no point or purpose in using undressed seed if other farmers do use it, killing or damaging bees. Only the law can ensure this by "restraint for mutual benefit". The way forward is to investigate with the farming industry a strategy of not using systemic neonicotinoid seed dressings and sprays on rape seed, field beans and other (bee pollinated) flowering crops. Farmers once relied on contact non-systemic insecticides and can do so again, but not between sunrise and sunset. To preserve pollinating insects is collective, enlightened self interest, but goverment must first lead with a law banning neonicotinoid use in any form on flowering crops. There would be no losers, not even the chemical manufacturing companies who would sell more, less dangerous insecticides and be better targeted.

Using contact sprays only between sunset and dawn for crops in flower is not an unreasonable request given that nights are already worked fetching in the harvest. Why not to save the bees without which there would barely be a harvest as in 2012 when bees were unable to forage and pollinate?

There is a time in the affairs of men which taken at the flood lead on to fortune—so let this be done now—or we shall lose the tide.

29 October 2012

Written evidence submitted by the Soil Association

Summary

- The UK Government is ignoring the strong and quickly growing body of scientific evidence which points to the damaging impact of neonicotinoid pesticides on pollinating insects, including bumblebees and honey bees (see Annex 1).

- Scientists have established that very, very low doses of neonicotinoids, well below what European governments consider a 'safe' level of toxic chemical, can disrupt bee behaviour in ways likely to contribute to the collapse in numbers of honeybees, bumble bees and other pollinating insects.

- Defra has made commitments to put in place new research to explore further the impacts of neonicotinoids on bumblebees and have acknowledged that the risks of pesticides to bees needs to be updated, but these plans ignore the weight of existing evidence, and will delay the action that the Government should take now.

- The European Food Standards Agency has admitted that neonicotinoid and other systemic insecticides have not been properly evaluated ever since their introduction and use of some neonicotinoids has been either banned or suspended in the USA, Germany and France. Italy banned neonicotinoid insecticide use on maize and this led to a halving of winter honey bees deaths over three years.

- There are a range of methods which farmers can use which do not require the use of neonicotinoid pesticides – in Italy government research showed banning neonicotinoid use on maize did not affect farmers' profits.

- UK and EU pesticide safety testing is not of an acceptable standard. First, it relies not on science but on industry data, which is not subject to scientific peer-review and publication. Second, there is no requirement for companies to publish all the research they conduct, with the risk that cherry-picked, favourable studies are used to obtain regulatory approval. Third, no safety testing which looks at the impact of repeated, very low doses (below accepted 'safe' levels) of pesticide are required. Fourth, little or no research is done on the impact of likely combinations of pesticides (the cocktail effect) that insects like honey bees and other insects will actually encounter on farms.

Introduction

1. The Soil Association is a UK charity, campaigning for healthy, humane and sustainable, food, farming and land use. We welcome fact that the EAC has launched this inquiry and we are pleased to have the opportunity to submit evidence to it.

2. *“The world of systematic insecticides is a weird world, surpassing the imaginings of the brothers Grimm… It is a world where the enchanted forest of the fairy-tales has become the poisonous forest in which an insect that chews a leaf or sucks the sap of a plant is doomed.”*

Rachel Carson, Silent Spring (2012 marks the 50th anniversary of the publication of the book).

Background

3. It is estimated that pollinating iinsects add some £430 million to the British economy by pollinating crops[1]. Insect pollinated crops have become increasingly important in UK crop agriculture and, as of 2007, accounted for 20% of UK cropland value. Future land use and crop production patterns may further increase the role of pollination services to UK agriculture, highlighting the importance of measures aimed at maintaining both wild and managed species[2].

4. Over the past few years there has been mounting evidence of a global decline in pollinator numbers. There are number of theories for why pollinators have been suffering such declines, including the intensification of agriculture (causing loss of suitable habitats), poor weather and disease. A major cause is thought to be the type and extent of pesticide use on farmland.

5. The University of Reading concluded that: *“even when correctly applied pesticides can have adverse impacts upon bees by reducing their breeding success and resistance to disease, and by reducing the availability of valuable forage plants.*[3]*”*

6. A relatively new group of insecticides called neonicotinoids has been most strongly implicated. Scientific evidence against these chemicals is strong, which is why some of the individual neonicotinoid pesticides have been suspended on certain crops in several European countries (e.g. France, Germany and Italy). However the UK government has not yet accepted this scientific evidence.

7. Neonicotinoids are a relatively new class of insecticides, launched in 1991. They are synthetic derivatives of nicotine, the tobacco toxin. They are designed to be persistent and target the insect’s immune system, binding with its nicotinic receptors and interrupting the sending of nerve impulses. These pesticides are systemic, i.e. they permeate throughout the plant.

8. There are seven different active ingredients: acetamiprid, clothianidin, dinotefuran, imidacloprid, nitenpyram, thiacloprid, and thiamethoxam.

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[1] http://planetearth.nerc.ac.uk/news/story.aspx?id=988
[2] Pollination services in the UK: How Important are Honeybees?
Breeze T.D., Bailey A.P., Balcombe K.G. and Potts S.G.
Agriculture, Ecosystems & Environment (2011) Vol 142 no. 3-4 (Pages 137-143)
[3] www.foe.co.uk/beesreport

9. The most popular of these is imidaclprid. It is one of the fastest growing insecticides in terms of sales and is one of the most widely used insecticides in the world[4]. It is highly toxic to bees and is the best researched neonicotinoid in terms of the threat is poses to wild pollinators and honey bees.

10. These pesticides are used in a number of ways. The most popular use in the UK is as a seed treatment, in particular for the crops oil seed rape and maize. Scientists are now discovering that very, very low doses of neonicotinoids, well below what European governments consider a 'safe' level of toxic chemical, can disrupt bee behaviour in ways that are likely to be contributing to the collapse in numbers of honeybees, bumble bees and other pollinating insects.

- ***The use (or abuse) of evidence in this particular case, for setting policy and regulations on pesticides.***

11. Methods used during development and initial safety and efficacy testing of pesticides should be changed as it is clear that they are insufficient to demonstrate safety. This is for four main reasons.

12. First, the current UK system of pesticide regulation relies on the use of industry data, which is not subject to scientific peer-review and publication. Second, there is no requirement for companies to publish all the research they conduct, leading to the risk of only cherry picked, favourable studies being used to obtain regulatory approval. Third, no safety testing which looks at the impact of repeated, very low doses (below accepted 'safe' levels) of pesticide are required. Fourth, there is no research on the impact of likely combinations of pesticides (the 'cocktail effect') that insects like honey bees and other insects will actually encounter on farms.

13. The continued decline in bird numbers and biodiversity generally in the UK makes it clear that further efforts to reduce pesticide risks and impacts should be prioritised and pursued.

14. The recent draft UK National Action Plan for the Sustainable Use of Pesticides (NAP) highlights the relative lack of concern the UK Government appears to have with regard to pesticide use, as compared to other EU countries. The draft lists existing regulatory measures and non-regulatory initiatives aimed at reducing risks and impacts. In doing so it makes no commitment to change or further reduce pesticide impacts and risks or dependency on the use of pesticides. Contrary to the relevant EU Directive which stipulates that National Action Plans should be "aimed at setting quantitative objectives, targets, measures, timetables and indicators to reduce risks and impacts of pesticide use in human health and the environment" the UK NAP completely fails to implement this requirement.

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[4] Yamamoto, I. "Nicotine to Nicotinoids: 1962 to 1997", in *Nicotinoid Insecticides and the Nicotinic Acetylcholine Receptor*, eds. Yamamoto, I. and Casida, J. Springer-Verlag, Tokyo, 1999 pp. 3–27.

15. In March 2012 Defra said that it would review the evidence on neonicotinoids and take action if necessary. Before the review was published, Defra's Chief Scientist until September 2012, Professor Sir Bob Watson, acknowledged that the Government's focus on managed honey bees means that it knows a lot less about other pollinators and the effects chemicals may be having on them:

16. *"I fully recognise that the issues that have been raised are not just about honey bees but are relevant to a broader range of bees and pollinator species. We are considering the research in that wider context…we have less baseline knowledge of the effects of all pesticides, not just neonicotinoids, on pollinator species other than honeybees. We also have a less developed basis for interpreting the available evidence."* (Letter to Friends of the Earth, Buglife, Soil Association and ClientEarth, June 2012).

17. The EU as a whole is also taking stronger action with regard to this problem. The European Food Safety Authority (EFSA) has recently published an opinion on how the pesticide risk assessment for bees should be conducted[5]. The body has concluded that neonicotinoid and other systemic insecticides have not been properly evaluated ever since their introduction. The EFSA opinion will form the basis for new guidelines for the tests (to be published in late 2012) required to be carried out by the pesticide manufacturers and how member states should assess the information submitted.

18. These guidelines will only be relevant for new products, or those being reviewed. It is not clear what the situation for systemic insecticides already on the market will be. Individual member states could choose to suspend all neonicotinoid product approvals until the new protocols are introduced. The European Parliament is calling for stronger regulations and a review of the risk assessment, along with more independent research and public scrutiny of the system. We strongly support this approach and urge the UK Government to fully support such calls.

19. A number of other European countries have recognised the weight of evidence in terms of the case against neonicotinoids.

20. Italy temporarily suspended use of three neonicotinoid products in 2008 – the suspensions have been renewed each year. Research in Italy found that the ban has led to a halving of winter deaths of honeybees over three years. France has recently banned the use of the neonicotinoid, Thiamathoxam, due to concerns about its impact on bees. This chemical remains in use in the UK – in fact its use has increased substantially over the past few years.[6]

21. In France the use of Gaucho (Imidacloprid) on sunflower seeds was banned in 1999 after one third of bees died following its widespread use; in 2004 use on sweetcorn seeds was also banned. Bee populations are reported to have increased again after the ban. In 2012, the French Government announced plans

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[5] http://bees.pan-uk.org/assets/downloads/Bee_factsheet4.pdf
[6] Food and Environment Research Agency (2012) Pesticide Usage Statistics

to suspend the neonicotinoid, Thiamathoxam due to concerns about its impact on bees.

22. In 2008 Germany suspended use of some seed treatments containing clothianidin, imidacloprid or thiamethoxam because of mass bee deaths caused by dust arising from seed drilling which drifted crops where bees were feeding.

23. In the US Imidacloprid was voluntarily withdrawn by manufacturers from use on almonds in 2011, under pressure from the state government of California,

- ***The application of real-world – 'field' – data. What monitoring there is of actual – rather than recommended – levels of pesticide usage, and the extent to which that influences policy on pesticides.***

24. Until recently there had been relatively little research using real world 'field' data. We welcome the fact that there is now better evidence for such field risks, yet the UK Government is still not taking such evidence into account strongly enough.

25. The Government's review of evidence with regard to pollinators and neonicotinoids was published on 18th September 2012[7]. The review acknowledged that there was evidence of harm in laboratory studies but that more research is needed in field conditions. It acknowledged the need for more research into impacts on solitary and bumble bees. It recommended changes to the regulatory process to ensure that the risk assessment for pesticide products considers the impact on all bee species, but still took the decision not to suspend or place any restrictions on the use of neonicotinoid pesticides.

Any potential impacts of systemic neonicotinoid insecticides on human health.

26. The impact of systemic neonicotinoid insecticides on human health is a relatively under-researched area. The World Health organisation (WHO) put the neonicotinoids imidacloprid, thiacloprid (the only neonicotinoids listed) as Class II (moderately hazardous).

27. Most neonicotinoids show much lower toxicity in mammals than insects, but emerging science demonstrates that many may also have neurodevelopmental effects, and some are considered likely carcinogens by US Environmental Protection Agency (EPA)[8].

28. The fact that these insecticides are systemic means that they cannot be washed off food. Neonicotinoid pesticides are regularly found in food consumed in the UK. The regular Expert Committee on Pesticide Residues in Food (PRiF) reports show details of the pesticides found in food purchased in the UK. For example

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[7] http://www.defra.gov.uk/publications/2012/09/18/pb13818-pesticides-bees/
[8]US EPA Factsheets. http://www.epa.gov/ opprd001/factsheets/.

the 2010 report shows that the neonicotinoid pesticide imidacloprid was found in grapes, beans and basil. The neonicotinoid which the French Government have recently announced plans to ban (thiamethoxan) was also found in lettuce and grapes. The most recent report (first quarter of 2012, published Sept 2012) showed that imidacloprid was found in beans, broccoli, grapes, lettuce, okra and peppers.[9]

What alternative pest-control measures should be used, such as natural predators and plant breeding for insect-resistance, in a bid to make UK farming more insect- and bee-friendly.

29. There are a wide range of pest-control alternatives to the use of pesticides for insect control.

30. Many crop pest species have natural predators (e.g. ladybirds for aphids) or parasites (e.g. nematodes for slugs and snails). These can be deliberately introduced to a crop or encouraged by providing suitable habitat (e.g. rough un-farmed areas around fields). Often natural predators get removed from the system by pesticides, either directly or through dramatic reduction in prey, resulting in die-off of the predators and subsequently disrupting ecosystems by adversely affecting food webs. Therefore reducing pesticide usage and encouraging natural predators can help control pest species as well as improving the health of the whole ecosystem.

31. Methods such as crop rotations, (as opposed to monocultures) and a variety of measures to encourage natural predators of pest species are widely used in farming worldwide.

32. Such methods are widely used in organic farming, which does not use neonicotinoids and does not rely on pesticide use. Biodiversity, in terms of a wide range of plants, insects and animals, is key to organic farming. Each plant or animal has a specific role in the life of the farm, and this is especially true of the bee. Bees and other pollinators play a crucial role in pollination, so that we can grow fruits and vegetables.

33. Intensive agricultural techniques are causing such concern that new research is being carried out at the laboratory of Apiculture and Social Insects at the University of Sussex. Professor Francis Ratnieks, who heads the laboratory stated: "The use of herbicides and intensive forms of agriculture means that fields of wheat and barley now have few weeds. Fields of grass now have few wild flowers, clover is less used and much of the heather moors have been ploughed up.[10]"

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[9]http://www.pesticides.gov.uk/Resources/CRD/PRiF/Documents/Results%20and%20Reports/2012/Q1%202012%20Final.pdf
[10] http://www.sussex.ac.uk/lasi/sussexplan/agriculture

34. The focus on natural ecosystems and native species, as well as the lack of pesticides used in organic farming, make it a haven for pollinators. Organic farms also provide the wild spaces at not just at field margins and in hedgerows, where bees nest and shelter, but also providing a diversity of flowers and habitats for bees to feed throughout the field.

35. In particular, red and white clover are mainstays of organic farming systems. Red clover (*Trifolium pratense L.*) is used extensively as part of the rotational farming systems that maintain soil fertility without the use of chemical fertilisers. In addition it is one of the bumble bees favourite foods. White clover (*Trifolium repens*) is also found in abundance on organic farms. Honeybees are particularly drawn to this plant.

36. *"In the economy of nature the natural vegetation has its essential place…Such vegetation is the habitat of wild bees and other pollinating insects. Man is more dependent on these wild pollinators then he usually realises. Even the farmer himself seldom understands the value of wild bees and often participates in the very measures that rob him of their services….These insects, so essential to our agriculture and indeed to our landscape as we know it, deserve something better from us than the senseless destruction of their habitat. Honeybees and wild bees depend heavily on such weeds".*

Rachel Carson, Silent Spring.

Annex 1

In 2009 the NGO Buglife wrote a detailed overview of the evidence in this area: 'The impact of neonicotinoid insecticides on bumblebees, honey bees and other non-target invertebrates[11]'.

Since then, a number of other scientific research papers have been published which add further evidence. A selection of these is outlined below.

Title: Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production
Authors: Penelope R. Whitehorn, Stephanie O'Connor, Felix L. Wackers, Dave Goulson
Journal: *Science* (2012); vol 336 no. 6079 (pages 351-352)
DOI: 10.1126/science.1215025
Summary: Exposed colonies of the bumble bee Bombus terrestris in the laboratory to field-realistic levels of the neonicotinoid **imidacloprid**, then allowed them to develop naturally under field conditions. Treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with control colonies.

11 http://www.buglife.org.uk/Resources/Buglife/Documents/PDF/REVISED%20Buglife%20Neonicotinoid%20Report.pdf

Title: A Common Pesticide Decreases Foraging Success and Survival in Honey Bees
Authors: Mickaël Henry, Maxime Beguin, Fabrice Requier, Orianne Rollin, Jean-François Odoux, Pierrick Aupinel, Jean Aptel, Sylvie Tchamitchian, Axel Decourtye
Journal: Science (2012); vol 336 no. 6079 (pages 348-350)
DOI: 10.1126/science.1215039
Summary: Exposed on free-ranging honeybee foragers labeled with a RFID tag to non-lethal levels of **thiamethoxam** (neonicotinoid pesticide) resulting in high mortality due to homing failure. Levels of mortality were high enough to put a colony at risk of collapse.

Title: *In situ* replication of honey bee colony collapse disorder
Authors: Chensheng Lu, Kenneth M. Warchol, Richard A. Callahan
Journal: Bulletin of Insectology (2012) Vol 65 n. 1 (pages 99-106)
ISSN: 1721-8861
Summary: 16 hives were treated with **imidacloprid**, at dosages reflecting imidacloprid residue levels reported in the environment previously. Treatment lasted for 13 weeks after which all hives were alive. However, after 23 weeks 15 of 16 imidacloprid treated hives (94%) were dead. Dead hives were remarkably empty except for stores of food and some pollen left, a resemblance of CCD. The survival of the control hives that were managed alongside with the pesticide-treated hives suggests this was down to the treatment and not other environmental factors.

Title: Pesticide exposure in honey bees results in increased levels of the gut pathogen Nosema
Authors: Jeffery S. Pettis, Dennis vanEngelsdorp, Josephine Johnson & Galen Dively
Journal: Naturwissenschaften (2012) Vol 99 no.2 (pages 153–158).
DOI: 10.1007/s00114-011-0881-1
Summary: Exposed honey bee colonies over three brood generations to sub-lethal doses of **imidacloprid**, and then subsequently challenged newly emerged bees with the gut parasite, *Nosema spp.* The pesticide dosages used were below levels demonstrated to cause effects on longevity or foraging in adult honey bees. *Nosema* infections increased significantly in the bees from pesticide-treated hives when compared to bees from control hives demonstrating an indirect effect of pesticides on pathogen growth in honey bees. Interactions between pesticides and pathogens could be a major contributor to increased mortality of honey bee colonies, including colony collapse disorder, and other pollinator declines worldwide.

Title: Influence of dinotefuran and clothianidin on a bee colony
Authors: Toshiro Yamada, Kazuko Yamada & Naoki Wada
Journal: Japanese Journal of Clinical Ecology (2012) Vol.21 No.1 (pages 10-23)
Summary: Treated eight colonies of ~10,000 honeybees with **dinotefuran** or **clothianidin**. Treatments were foods containing **dinotefuran** of 1 ppm to 10 ppm or **clothianidin** of 0.4 ppm to 4 ppm fed into a beehive. Three levels of concentration for each pesticide were 10, 50 and 100 times lower than that in practical use. The changes of adult bees, brood and the pesticide intake in each colony were examined and suggest that each colony with the pesticide administered collapses to nothing after passing through a state of CCD. The high-concentration pesticides seem to work as an acute toxicity and the low- and middle-concentration ones do as a chronic toxicity.

Title: Multiple Routes of Pesticide Exposure for Honey Bees Living Near Agricultural Fields
Authors: Christian H. Krupke, Greg J. Hunt, Brian D. Eitzer, Gladys Andino, Krispn Given
Journal: PLoS ONE Vol 7 no.1: e29268.
DOI: 10.1371/journal.pone.0029268
Summary: Neonicotinoid insecticides have been found in previous analyses of honey bee pollen and comb material but the routes of exposure have remained largely undefined. Used LC/MS-MS to analyze samples of honey bees, pollen stored in the hive and several potential exposure routes associated with plantings of neonicotinoid treated maize. The results demonstrate that bees are exposed to these compounds and several other agricultural pesticides in several ways throughout the foraging period. During spring, extremely high levels of **clothianidin** and **thiamethoxam** were found in planter exhaust material produced during the planting of treated maize seed. Neonicotinoids were also found in the soil of each field we sampled, including unplanted fields. Plants visited by foraging bees (dandelions) growing near these fields were found to contain neonicotinoids as well. This indicates deposition of neonicotinoids on the flowers, uptake by the root system, or both. Dead bees collected near hive entrances during the spring sampling period were found to contain **clothianidin** as well, although whether exposure was oral (consuming pollen) or by contact (soil/planter dust) is unclear. We also detected the insecticide **clothianidin** in pollen collected by bees and stored in the hive. When maize plants in our field reached anthesis, maize pollen from treated seed was found to contain **clothianidin** and other pesticides; and honey bees in our study readily collected maize pollen. These findings clarify some of the mechanisms by which honey bees may be exposed to agricultural pesticides throughout the growing season.

Title: RFID Tracking of Sublethal Effects of Two Neonicotinoid Insecticides on the Foraging Behavior of Apis mellifera
Authors: Christof W. Schneider, Ju¨ rgen Tautz, Bernd Gru¨ newald, Stefan Fuchs
Journal: PLoS ONE (2012) volume 7 No1: e30023.
DOI: 10.1371/journal.pone.0030023
Summary: In addition to testing according to current guidelines designed to detect bee mortality, tests are needed to determine possible sublethal effects interfering with the animal's vitality and behavioral performance. Several methods have been used to detect sublethal effects of different insecticides under laboratory conditions using olfactory conditioning. Furthermore, studies have been conducted on the influence insecticides have on foraging activity and homing ability which require time-consuming visual observation. This experiment tested an experimental design using the radiofrequency identification (RFID) method to monitor the influence of sublethal doses of insecticides on individual honeybee foragers on an automated basis. Electronic readers were positioned at the hive entrance and at an artificial food source to obtain quantifiable data on honeybee foraging behavior. This gave detailed information on flight parameters. By comparing several groups of bees, fed simultaneously with different dosages of a tested substance it was possible to monitor the acute effects of sublethal doses of the neonicotinoids imidacloprid (0.15–6 ng/bee) and clothianidin (0.05–2 ng/bee) under field-like circumstances. Both substances led to a significant reduction of foraging activity and to longer foraging flights at doses of ≥0.5 ng/bee (clothianidin) and ≥1.5 ng/bee (imidacloprid) during the first three hours after treatment. This study demonstrates that the RFID-method is an effective way to record short-term alterations in foraging activity after insecticides have been administered once, orally, to individual

bees. Field relevant doses of imidacloprid in sunflowers and oilseed rape were estimated to be around 0.13 ng and 0.023–0.03 ng, respectively. At these doses there was no effect of treatment.

Title: Combined pesticide exposure severely affects individual- and colony-level traits in bees
Authors: Richard J. Gill, Oscar Ramos-Rodriguez & Nigel E. Raine
Journal: Nature (2012)
DOI: doi:10.1038/nature11585
Summary: Reported widespread declines of wild and managed insect pollinators have serious consequences for global ecosystem services and agricultural production. Bees contribute approximately 80% of insect pollination, so it is important to understand and mitigate the causes of current declines in bee populations. Recent studies have implicated the role of pesticides in these declines, as exposure to these chemicals has been associated with changes in bee behaviour and reductions in colony queen production. However, the key link between changes in individual behaviour and the consequent impact at the colony level has not been shown. Social bee colonies depend on the collective performance of many individual workers. Thus, although field-level pesticide concentrations can have subtle or sublethal effects at the individual level, it is not known whether bee societies can buffer such effects or whether it results in a severe cumulative effect at the colony level. Furthermore, widespread agricultural intensification means that bees are exposed to numerous pesticides when foraging, yet the possible combinatorial effects of pesticide exposure have rarely been investigated

These experiments show that chronic exposure of bumblebees to two pesticides (neonicotinoid and pyrethroid) at concentrations that could approximate field-level exposure impairs natural foraging behaviour and increases worker mortality leading to significant reductions in brood development and colony success. It was found that worker foraging performance, particularly pollen collecting efficiency, was significantly reduced with observed knock-on effects for forager recruitment, worker losses and overall worker productivity. Moreover, this provides evidence that combinatorial exposure to pesticides increases the propensity of colonies to fail.

The importance of Insect pollinators

Title: Pollination services in the UK: How Important are Honeybees?
Authors: Breeze T.D., Bailey A.P., Balcombe K.G. and Potts S.G.
Journal: Agriculture, Ecosystems & Environment (2011) Vol 142 no. 3-4 (Pages 137-143)
DOI: 10.1016/j.agee.2011.03.020
Summary: Insect pollinated crops have become increasingly important in UK crop agriculture and, as of 2007, accounted for 20%of UK cropland and 19% of total farmgate crop value. Analysis of honeybee hive numbers indicates that current UK populations supply 34% of pollination services, falling from 70% in 1984. In spite of this decline, insect pollinated crop yields have risen by 54% since 1984. Future land use and crop production patterns may further increase the role of pollination services to UK agriculture, highlighting the importance of measures aimed at maintaining both wild and managed species.

Title: Contribution of Pollinator-Mediated Crops to Nutrients in the Human Food Supply
Authors: Elisabeth J. Eilers, Claire Kremen, Sarah Smith Greenleaf, Andrea K. Garber, Alexandra-Maria Klein
Journal: PLoS ONE (2011) Vol 6 no. 6: e21363.
DOI: 10.1371/journal.pone.0021363
Summary: This study evaluates the nutritional composition of animal-pollinated world crops. By calculating pollinator dependent and independent proportions of different nutrients of world crops, revealed that crop plants that depend fully or partially on animal pollinators contain more than 90% of vitamin C, the whole quantity of Lycopene and almost the full quantity of the antioxidants b-cryptoxanthin and b-tocopherol, the majority of the lipid, vitamin A and related carotenoids, calcium and fluoride, and a large portion of folic acid. On-going pollinator decline may exacerbate current difficulties of providing a nutritionally adequate diet for the global human population.

29 October 2012

Written evidence submitted by Rosemary Mason and Palle Uhd Jepsen

Rosemary Mason, MB ChB FRCA, Former Consultant Anaesthetist

1) Assistant Editor, Anaesthesia, Journal of the Association of Anaesthetists of Great Britain and Ireland from 1990-2000.
2) Familiarity with the actions of drugs and toxins on central nervous system receptors.
3) Noted that successive Governments had dismantled the Statutory Conservation Bodies, closed the Wildlife Research Stations and abolished pesticide committees that had one (or more) independent members to represent public interest.

Palle Uhd Jepsen, Former Senior Adviser to the Danish Forest and Nature Agency

1) In charge of Nature Reserve Network in Denmark
2) Represented Denmark at Wildlife Conventions such as IWC, Ramsar Convention, Chairman of Seal Group for ASCOBANS (Small cetaceans in the Baltic).
3) Gave advice on conservation projects such as in Thailand, Malaysia, Estonia, Lithuania and Northern Ireland.
4) Worked for several seasons at the Polar Research Institute in Svalbard.

Together

1) As environmentalists we have seen the disappearance of wildlife in the last 50 years. Acceleration of this has occurred in the last 15 years. In particular, amphibian, bees, bat and bird populations in the US have been wiped out by a variety of pathogens. Since about 2008 the same has been happening in Europe. News has been suppressed.
2) In 2006, we established a small reserve for bumblebees and birds in South Wales.
3) In 2008, I read Michael Schacker's book about neonicotinoids in the US. "*A Spring without Bees. How Colony Collapse Disorder has Endangered our Food Supply.*"
4) In November 2010, we read Dr Henk Tennekes' book: *The Systemic Insecticides – a Disaster in the making.* We linked up with him and a massive global network. We started to 'engage' with Environmental Protection Agencies around the world.
5) We discovered that it wasn't just bees that were affected. It was humans as well.

Executive Summary

We have divided the evidence into three parts.

1) Our communications with Defra, ACP, CRD and Ministers since 03/12/2010.
2) Our comments on the Defra website on 'Neonicotinoids and Bees'.
3) Contamination of surface and ground-water by the neonicotinoid insecticides which is not being monitored.

Paper 1 From our communications with Defra, ACP, CRD and Ministers, we have discovered that the pesticides industry (Syngenta and now Monsanto) is at the heart of the UK Protection Agencies. CRD has about 60% of its budget paid by industry. The staff may feel that their loyalty lies with the major employers, rather than with human health and the environment. Defra/Fera/CRD appears to have much of its 'science' done, either with industry scientists in the UK, or by Rapporteur Member States (RMS) in Europe (directed by EFSA and the EC). The RMS (they are relatively few in number) in turn obtain it from Draft Assessment Reports submitted by the applicant. These documents are "*commercially sensitive*", so it is difficult to obtain them. They dismiss independent research (see Defra's analyses of new papers) but not those from their own side (see Cresswell and Blacquière). That is why Defra, ACP and the CRD are refusing to ban clothianidin and thiamethoxam. They are using delaying tactics in demanding more research, taking their lead from EFSA

and the industry. Our question about contamination of water was ignored by CRD, Defra, Commissioner Dalli, the US EPA and the Australian Minister of Agriculture.
The domestic and public amenity places (including golf courses and playing fields) are possibly the biggest hazard to the public because the situation is not controlled. In the UK, much of the information has been suppressed by the media because of the Science Media Centre and its relationship with the BBC and with government Civil Servants. Thus, in the UK, the public has no idea. They are encouraged by the Royal Horticultural Society and the BBKA in endorsing the safe use of insecticides. In the end it was a French journalist in Le Monde who exposed the fact that James Cresswell's Department in Exeter was receiving funds from Syngenta. But UK journalists never even reported it.

Paper 2 Here we examined Defra's website on Neonicotinoids and Bees. We compared their claims about keeping the "*evidence on neonicotinoids under close and open-minded scrutiny*" with the minutes of committees and various Defra documents. In almost three years of the Healthy Bee Plan Management Board and SEAG meetings, the neonicotinoids were never mentioned as a cause of bee declines, only the *Varroa* mite.
[Dr Peter Campbell from Syngenta was on the Panel that chose the nine Pollinator Projects. Syngenta had donated £1m in 2009 for bee research. On the Committee on Toxicity of Chemicals in Food (COT) there is one member from Syngenta and two from AstraZeneca, Syngenta's parent company. None of them declared any conflict of interest. Syngenta had also applied to EFSA for GM maize. *"The UK Competent Authority and Syngenta have applied for placing on the market of a GM, herbicide tolerant (glyphosate) maize GA21 for food and feed uses, import, processing and cultivation."* EFSA adopted it on 16/12/2011].

Paper 3 We report the absence of global monitoring of levels of neonicotinoid insecticides in surface and ground-water. An example had probably been set by the US when imidacloprid was introduced in 1991. It was the same year that water quality assessments were established for monitoring pesticides by USGS NAWQA (see para 1, doc 3) but only the old pesticides were (and still are) being monitored. Neonicotinoid insecticides and GMOs (which usually have the insecticides attached to the seeds) now occupy a dominant position in the global market and they are persistent in the soil (clothianidin in particular has an aerobic soil metabolism half- life of up to 1,155 days). Wherever they have been measured (para 2, in The Netherlands and para 5, New York State) alarming levels were found as early as 2003/2004. In para 6, bees in Indiana were exposed to clothianidin and thiamethoxam when they took pollen and nectar from <u>wild flowers</u> not just the maize pollen from the crop (Krupke *et al* 2012).

Post-script We included the US Kids Health Report (October 2012) because it contains crucial evidence against the current pesticides and shows how the US EPA is manipulating the statistics to avoid blame for human health effects.
<u>A Generation in Jeopardy. How pesticides are undermining our childrens' health and intelligence</u> "*From childhood cancers to autism, birth defects and asthma, a wide range of childhood diseases and disorders are on the rise. Our assessment of the latest science leaves little room for doubt: pesticides are one key driver of this sobering trend.*" On page 30, <u>Pesticides industry well served by current policies</u> the authors explain how it has happened. "*These multinational corporations wield tremendous control over the system, from setting research agendas to financing, crop selection and inputs throughout the production and distribution chain*"… "*…investing millions of dollars every year to influence voters, lawmakers and regulators at both the state and federal level to protect the market for pesticides*"… "*And the health of children across the country is compromised by exposure to*

pesticides used to control pests in agriculture and where they live, learn and play. In short, the system is broken."
Yet, the Agrochemical Corporations even now appear to be protected from blame for this dramatic increase in birth defects, neurobehavioural disorders and brain tumours by the fact that the US EPA/USDA figures in **Appendix B** page 38 'Top pesticides used in agriculture and at home' are fraudulent. They do not include either the neonicotinoid insecticides or GMOs. We have copied maps (pp34/35) on the USGS NAWQA website from 2002 for imidacloprid and thiamethoxam to show the extent of use on crops even 10 years ago.

Corruption. Para 13 paper 3 reports the state of corruption in some of the agencies at European level, with the 'revolving door' between industry and senior positions in Europe. This is precisely what happens in the US. Even now in the UK, the effects of pesticides are being seen both in children and adults.
Most mainstream UK journalists reported directly from the 'Science Media Centre'. Most (apart from John Vidal in the Guardian) claimed that EFSA was right to dismiss Séralini's recent work (Criigen, Caen) showing that rats fed GM food for 24 months (Monsanto and EFSA only test for 90 days) developed tumours, starting in males at 4 months, only 1 month beyond the time that EFSA recommends for testing ("*wrong sort of rats, not enough rats, bad statistics, fraudulent science, etc"* were the cries from the SMC). In fact Monsanto inadvertently did a 'clinical trial' on humans in South American countries in 1996, when they forced GM Maize and Roundup Ready soya on rural populations. The populations most exposed to pesticides experienced reproductive problems, had children with major congenital defects (neural tube, such as meningomyelocele in which the spinal cord is exposed), an increase in childhood and adult tumours, cell damage and genetic changes. Prof Andrés Carrasco and his team in Buenos Aires confirmed that Roundup® produced teratogenic effects in vertebrates.
Paganelli, A. Gnazzo, V., Acosta, H., Lo´pez, S. L., Carrasco, A. E. Glyphosate-Based Herbicides Produce Teratogenic Effects on Vertebrates by Impairing Retinoic Acid Signaling. *Chem. Res. Toxic*. 10.1021/tx1001749 (2010).
A new book (2012) has a chapter by Prof Carrasco and colleagues in Argentina and Paraguay which reviews the scientific literature on the health effects of the pesticides used in large amounts on GM soy and other GM crops: Advances in Molecular Toxicology, Vol. 6, published by Elsevier: ISSN 1872-0854 http://www.amazon.com/Advances-Molecular-Toxicology-Volume-6/dp/0444593896 ***Abstract:*** *In South America, the incorporation of genetically modified organisms (GMO) engineered to be resistant to pesticides changed the agricultural model into one dependent on the massive use of agrochemicals. Different pesticides are used in response to the demands of the global consuming market to control weeds, herbivorous arthropods, and crop diseases. Here, we review their effects on humans and animal models, in terms of genotoxicity, teratogenicity, and cell damage. We also stress the importance of biomarkers for medical surveillance of populations at risk and propose the use of biosensors as sensitive resources to detect undesirable effects of new molecules and environmental pollutants. The compatibility of glyphosate, the most intensively used herbicide associated to GMO crops, with an integrated pest management for soybean crops, is also discussed.*
Monsanto suppressed it and the US never looks at research outside the US.

Dr Don M. Huber, Emeritus Professor of Plant Pathology, Purdue University, US, spoke to the All-Party Parliamentary Group on Agroecology about glyphosate on 01/11/2011. The title was: "The effects of glyphosate (Roundup®) on soils, crops and consumers: new diseases in GM corn and soy and animals fed with it" He later said: "*Future historians may well look* *back upon our time and write, not about how many pounds of pesticide we did or didn't apply, but by how willing we are to sacrifice our children and future generations for this massive genetic engineering experiment that is based on flawed science and failed promises just to benefit the bottom line of a commercial enterprise."*

Conclusions

1. The UK must ban the neonicotinoids for the sake of our bee populations, for the health of both adults and children and for biodiversity.
2. Europe and the UK must be prevented from authorising GMOs (as Huber said: *"this massive genetic experiment")*. The experiences of Argentina and Paraguay, and now the US, have already demonstrated what happens to humans.
   In addition, Monsanto has recently purchased a firm that specialises in growing GM crops to produce GE pharmaceuticals. This is the area of expertise of Prof Maurice Moloney, appointed in April 2010 as Director and Chief Executive of Rothamsted Research, UK.
   According to the BBSRC website: *"Before moving to Calgary, Professor Moloney led the Cell Biology group at Calgene Inc. in Davis, California, developing the world's first transgenic oilseeds, which resulted in RoundUp Ready® Canola and other novel crops. He was previously a Royal Society European Postdoctoral Fellow at the University of Lausanne, Switzerland. Professor Moloney is currently Chief Scientific Officer of SemBioSys Genetics Inc, based in Calgary, Canada. He founded the company in 1994 and has maintained this role alongside a successful academic career at the University of Calgary, where he serves as NSERC/Dow AgroSciences Industrial Research Professor of Plant Biotechnology."*
   Prof Moloney was considered by experts in genetics in Canada to be '*reckless with the environment'*. His company SemBioSys focused on producing pharmaceuticals in the oil crops canola (rapeseed) and safflower.
   One Canadian geneticist said: *"Currently safflower-grown human insulin has been open field tested in the state of Washington in a sagebrush wild area of the state which is the habitat for a number of threatened wild species that can be poisoned by ingesting insulin"…"In Canada and the United States open field tests of crop bio-pharmaceuticals are undertaken with little or no respect for the environmental consequences of the open field releases."*

Evidence to the Environmental Audit Committee Paper 1
Communications with Defra, ACP and CRD

Contents

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6) Reply to our 2 docs from Defra Minister
7) Our docs to a member of the ACP in December 2011
8) ACP reply 12/01/2012

9) ACP minutes in 2002 when clothianidin was first registered. [US EPA in 2003]
10) The original assessment for clothianidin in 2002 was carried out in Belgium; (the Rapporteur Member State RMS). For thiamethoxam the RMS was Spain.
11) Defra document 13/10/2012 '<u>Neonicotinoids and Bees. The state of the Science and the Regulatory Response</u>'
12) Immune suppression from neonicotinoids associated with global wildlife declines
13) The truth about neonicotinoid insecticides
14) Domestic and public gardens are probably the biggest hazard to the public
15) Bayer expands its domestic market

1. **Letter to James Paice MP 03/12/2010.** We wrote to the then Minister of Agriculture to inform him about new work done in Holland by a Dutch toxicologist, Dr Henk Tennekes: <u>The neonicotinoid insecticides: a disaster in the making</u>. He reported progressive contamination of Dutch surface waters by the neonicotinoid imidacloprid which is toxic to all invertebrates and was causing declines in insect-dependent birds. We enclosed a copy of the photo-journal of our small nature reserve: <u>The Year of the Bumblebee</u>. This was a book about the importance of biodiversity in 2010, the year that the UN declared to be the International Year of Biodiversity, and the year by which 200 countries had promised to halt biodiversity loss. The front cover shows a pair of red-tailed bumblebees; the male is being carried round on the new queen's back like a small rucksack while she foraging on tufted vetch. In truth, she has probably forgotten he is there. In July 2010, we had many red-tailed queens and workers on the reserve.

   On the back cover was the photograph of a pollen-covered bumblebee emerging from a crocus: "*In October 2010, a pioneering report The Economics of Ecosystems was published by the UN, which sought to put values on nature's free resources to human society, in the hopes that governments will save threatened ecosystems that are a vital source of food, water and income. The economic value of insect pollinators to global crop production was estimated to be £134bn each year.*" On page 59 was a 12-page postscript: *'A history of the UK Governments' responses to the Biodiversity Crisis.'* It was far from complimentary. We also enclosed a photocopy of Dr Tennekes' conclusions. At the end of the letter we referred to Michael Schacker's book published in 2008 in the US. "<u>A spring without bees. How colony collapse disorder has endangered our food supply</u>". We sent out about 60 copies of our journal. It was acknowledged by Prof John Beddington and Lord Chris Smith, both of whom said that Defra was responsible for regulation of pesticides. Defra and the Defra Ministers were in total denial (as were the regulatory agencies in Europe and the US). It was a uniform reply; that there was no evidence that the neonicotinoids were harmful to bees. By this stage we were in communication with beekeepers all over the world. The UK ones wrote to all their MPs; but only a small proportion of MPs signed the EDM put forward by Martin Caton MP.

   It was a waste of effort. Two years later the disaster is upon us. In July 2012, our red-tailed bumblebee populations had crashed; we found only one queen. She was on the ground and clearly dying. There were no workers, only a handful of males. Defra has rejected the Whitehorn 2012 study as not being "*field realistic*." Defra has a study PS2371 in hand and says it will be complete it by the end of 2012. No-one has told Defra that the bumblebee lifecycle is different from that of the honey bee. The colony dies at the end of the season. Only the new queens survive the winter in hibernation, ready to start a new colony the following spring. The Whitehorn study showed that 85% of the new queens failed to survive. We have no arable crops in the immediate vicinity; but there are gardens (and a golf course within 2 km). We have no idea which of our neighbours is using Bayer Garden products for their Vine Weevils, their lawn grubs or their ants. The Royal Horticultural Society website recommends neonicotinoids to treat Vine Weevils.

2. **Response from Chemical Regulations Directorate**. On 24/12/2010 we received a 2-page reply from the CRD on behalf of James Paice. It only talked about bees and nothing about contamination of water. The letter stated: "*that the neonicotinoids are primarily used as commercial and horticultural pesticides and that the Directorate routinely restricts the ways in which products can be used (e.g. specifying dose rates, timing and place of application) to ensure protection of human health and the environment*" It went on to talk about bee incidents and research on bees.

3. **Our reply to CRD**. On 06/01/2011, we sent an 11-page open letter to the CRD: Extract: 'Dr Tennekes says that his book*: "catalogues a tragedy of monumental proportions regarding the loss of invertebrates and subsequent losses of the insect-feeding (invertebrate-dependent) bird populations in all environments in the Netherlands. The disappearance can be related to agriculture in general, and to the neonicotinoid insecticide imidacloprid in particular, which is a major contaminant of Dutch surface water since 2004. The relationship exists because there are two crucial (and catastrophic) disadvantages of the neonicotinoid insecticides: They cause damage to the central nervous system of insects that is virtually irreversible and cumulative. There is no safe level of exposure, and even minute quantities can have devastating effects in the long term. They leach into groundwater and contaminate surface water and persist in soil and water, chronically exposing aquatic and terrestrial organisms to these insecticides. So, what, in effect, is happening is that these insecticides are creating a toxic landscape, in which many beneficial organisms are killed off."* Amongst other things, we asked, if was so important that neonicotinoids are applied correctly, who instructs the public on their use on garden plants, on lawns, in greenhouses, on golf courses, on sports fields, on amenity grasslands, on pets, and horticulturalists who apply it to plants and bulbs and some composts that are sold to our nurseries (but without being obliged to label that they are so treated)? We received no reply.

4. **Defra responses to MPs**. Many people wrote to their MPs about neonicotinoids and bees. The standard reply that the MPs forwarded from Defra (or a Minister) was that there was no evidence that the neonicotinoid insecticides were harmful to bees (we received similar answers from the US EPA, Commissioner John Dalli in Europe, and later from the Minister for Agriculture in Queensland, Australia to whom we had also forwarded evidence).

5. **Two documents sent to Defra 12/12/2011.** One was about neonicotinoids in general (The truth about neonicotinoid insecticides 23 pages) and the other with the hypothesis that they were causing global immune deficiency in wildlife (Global wildlife AIDS 19 pages) Graham White, a beekeeper and Philipp Mimkes CBG network had gone as witnesses to the Permanent Peoples' Tribunal in Bangalore 3-6/12/2011 where they gave evidence on behalf of European Beekeepers against the Trans-National Agrochemical Corporations. Both documents were registered by the Tribunal. www.agricorporateaccountability.net

6. **The reply from the Defra Minister 24/12/2011**. We received a brief reply to these two documents from Lord Taylor of Holbeach: "*I understand that HSE's Chemicals*

Regulation Directorate has previously explained the position on the US Environmental Protection Agency (EPA) hazard assessment on Clothianidin. There is nothing further to add to this, and your other documents raise no new information which requires a change to the Government's position on this."

7. **The same docs to the ACP**. We had sent both documents to a member of the ACP, an expert in aquatic ecotoxicology, who had told us that the effects of clothianidin on aquatic ecosystems were acceptable. We had informed him that they were "highly toxic". He passed our documents to Jayne Wilder. Jayne.Wilder@hse.gsi.gov.uk

8. **The ACP replied 12/01/2011.** I received an 11-page reply signed by Dr Andy Povey. Dr Povey was the only doctor on the ACP. He is an expert in cancer genetics. He signed as deputy chairman of ACP in the absence of the newly appointed chairman due to illness (She died 7 months later. Her colleagues established a post for a researcher to continue her molecular work on cancer research). The reply included the following extracts: "*The ACP considered an application for first approval of clothianidin for use as a seed treatment on fodder and sugar beet in 2002. You can find a summary of our findings in our annual report 2002" "Immune effects of clothianidin The ACP evaluation in 2002 identified some findings in mammalian toxicity studies suggesting compromise of the immune system. These findings were all at high doses, mostly in short term studies and we were satisfied that there were clear no observed adverse effect levels (NOAEL) derived from which we could recommend regulatory risk assessments." "…the ACP did not consider there was a need for any further clarification of the immunotoxic effects of clothianidin as we were satisfied there were clear No Observed Adverse Effect Levels (NOAEL)."*
"*Toxicity in the aquatic environment of clothianidin: As you might expect the ACP considered environmental data that were specifically relevant to the UK situation as well as the basic data on the chemistry of clothianidin. In the UK (as in EU) Predicted Environmental Concentrations in surface and groundwater (PECsw and PECgw respectively) are derived based on the environmental fate data and the use proposed."*
And in conclusion the ACP said: "*Having reviewed the information you have provided in these areas and compared it with the data we have evaluated we conclude that there is no additional information that would suggest we need to review the current approval, as the concerns you have highlighted have all been specifically evaluated during the initial consideration of approval. The risks arising from each new use proposed are identified and evaluated by CRD*".
From this letter, and from the 2002 minutes, ACP/CRD gave the impression that all the work had been done in the UK. There was no mention of Belgium (see para 10).

9. **ACP Minutes from 2002**. We found the ACP Annual Report ("*although very persistent in the environment…groundwater contamination is unlikely*") and Minutes from 2002. "*First evaluation of Clothianidin in the UK*". It consisted of four short paragraphs in which the ACP commended the quality of the application and agreed that Ministers should be advised to approve it for 3 years (attached). It is of interest to note, this was before the Conditional Registration in the US, relevant extracts of which are seen below. On May 30, 2003, Daniel C Kenny of the US EPA Registration Division granted conditional registration for *clothianidin* to be used for seed treatment use on corn and canola (oil seed rape) to Bayer Corporation. In the 19-page document, the EPA scientists had assessed the risks as: "*Clothianidin is highly toxic to honey bees on an acute contact basis. It has the potential for toxic chronic exposure to honey bees, as well as other non-*

target pollinators, through the translocation of clothianidin residues in nectar and pollen. In honey bees, the effects of this toxic chronic exposure may include lethal and/or sub-lethal effects in the larvae and reproductive effects in the queen. The fate and disposition of clothianidin in the environment suggest a compound that is a systemic insecticide that is persistent and mobile, stable to hydrolysis, and has potential to leach into ground water, as well as run-off to surface waters. There is evidence of effects on the rat immune system and juvenile rats appear to be more susceptible to these effects."
Summary of Data Gaps. (Page 18). There were gaps in **Toxicology**; **Residue Chemistry**; **Environmental Fate Data** and **Ecological Effects Data**. These included: Additional studies on *Developmental Immunotoxicity and Mutagenicity. Data on aerobic aquatic metabolism and a Seed leaching study. Whole sediment acute toxicity to freshwater invertebrates. Field test for pollinators.* There is no evidence that these were done. Nor was the life cycle study on bees ever completed. The Cutler and Dupree Study 2007, originally submitted by Bayer as a field study (Cutler 2006 was rejected by the Canadian Pesticides Management Authority). The 2007 version had subsequently to be downgraded by the US EPA (the test area was only 2 ha and bees often forage for miles). After clothianidin has been on the market for nine years (ten in UK/Europe), there is still no proper field study that shows that clothianidin is safe bees. 'Conditional' registration is granted by the Registration Division of the US EPA, regardless of what the US EPA scientists have said; after this Bayer (or any other company) can put it on the market. Once a product is on the market, registration is unlikely to be revoked (see next page).
On 13/12/2010 the US EPA Office of Pesticide Programs had run a workshop: ***Streamlining the Risk Assessment Process.*** Robert Schulz had designed an electronic programme (e-Builder Dossier) to facilitate the registration of pesticides by the applicants. The prime benefits were stated to "*reduced cost to the EPA*", and "*quicker processing*". One slide boasted that they hadn't revoked a licence in the last 10 years.

Minutes from 2005 UK Environmental Risk Assessment [ACP7(311/2005)] This was for use of clothianidin on wheat and barley seed. There were two short paragraphs before giving approval: *"following the normal procedure for extended use if the active substance has already commercial approval in the UK."… "The Committee confirmed that the environmental risk assessment was acceptable and advised that provisional approval could be recommended for this new seed treatment."*

10. **The original registration document for clothianidin in 2002** was recently requested from the CRD. It was carried out, not in the UK as we had been led to believe from all our correspondence. Belgium was the Rapporteur Member State (RMS) for clothianidin, which accounts for the sparse documentation in the UK. We would have to request Belgium to send it. The RMS for thiamethoxam was Spain. Would the Select Committee consider this as a suitable question for CRD/Defra? Did the UK, or the Belgium RMS, ever conduct a life cycle study on bees?

11. '**Neonicotinoids and Bees. The state of the Science and the Regulatory Response'**. On 13/09/2012 Defra published the above document with which the EAC will be familiar. It stated: "*this work has been carried out by Government and independent experts, taking account of parallel work in Europe.*" The Independent newspaper reported that the UK Government Scientists had concluded that nerve agent pesticides, clothianidin and thiamethoxam: "*should not be banned despite four independent studies strongly linking them to sharp declines in bees around the world. The reports were reviewed by the Chemical Regulation Directorate and the Advisory Committee on Pesticides (ACP), the*

independent statutory body that advises ministers. Following the line taken by the European Food Safety Authority (EFSA), all bodies said that more research was needed."

About the same time, we received notification from our US colleagues that Environmental and Public Interest Groups in the US were ready to take legal action against the US Environmental Protection Agency (US EPA) over its approval of pesticides which endanger wildlife. These were the very same pesticides that the European Commission (EC), EFSA and UK Scientists claimed "*needed more research*." The US notification stated: "*The 60 Day Notice of Intent to Sue follows a previous legal petition filed by several environmental organizations and many beekeepers, which demanded that EPA immediately suspend use of the pesticide clothianidin, which poses a grave threat to pollinators. The EPA refused to issue an immediate suspension of clothianidin, but did agree to open a public comment docket to review additional points raised in the legal petition.*"
In the legal petition in March 2012 Pesticide Action Network North America had presented the EPA with a State of Science document about the Systemic Insecticides.
http://www.panna.org/sites/default/files/CFS%20Petition%20App%20B_Science.pdf

12. **Immune suppression in wildlife associated with global wildlife declines**
This paper was accepted for publication (in press) on 17/07/2012 for the first issue of the new *Journal of Environmental Immunology and Toxicology* (Nov/Dec 2012): Mason, R.A., Tennekes, H.A., Sanchez-Bayo, F., Jepsen, P.U. 'Immune suppression by neonicotinoid insecticides at the root of global wildlife declines'. Abstract: '*Outbreaks of infectious diseases in honey bees, fish, amphibians, bats and birds in the past two decades have coincided with the increasing use of systemic insecticides, notably the neonicotinoids and fipronil. A link between insecticides and such diseases is hypothesised. Firstly, the disease outbreaks started in countries and regions where systemic insecticides were used for the first time, and later they spread to other countries. Secondly, recent evidence of immune suppression in bees and fish caused by neonicotinoids has provided an important clue to understand the sub-lethal impact of these insecticides not only on these organisms, but probably on other wildlife affected by infectious diseases. While this is occurring, environmental authorities in developed countries ignore the calls of apiarists (who are most affected) and do not target neonicotinoids in their regular monitoring schedules. Equally, scientists looking for answers to the problem are unaware of the new threat that systemic insecticides have introduced into terrestrial and aquatic ecosystems.'*

In May 2011, we sent our original hypothesis (fully referenced) to the following people: Caroline Spelman MP the then Environment Minister, Sir John Beddington the Chief Scientific Officer for the Government and Sir Robert Watson the Chief Scientific Officer for Defra. All said that they had read it, but they thought we did not have enough proof. We sent the final version of the documents (which had been submitted by our two delegates who were witnesses to the PPT in Bangalore, which took place Dec 3rd to Dec 6th 2011.) On 14/12/11 we forwarded these versions to Defra. By the brevity of his email, Lord Taylor of Holbeach clearly did not read it. You can also see that Dr Helen Thompson Bee Scientist at Fera must have read it. In her '*expert assessment'* of my letter to Dr Shugart, Editor-in-Chief of Ecotoxicology advising that it should be rejected, she made the mistake of mentioning it, even though there had been nothing about it in my letter (see Doc 2). We also sent it to Eric Poudelet, Safety of the Food Chain Directorate in the European Commission. He replied likewise. It was sent to Dr Andy Povey and

Peter Matthiessen, both members of the ACP. PM forwarded it to Jayne Wilder the ACP Secretary. In para 8 the ACP claimed to have done further studies on immune suppression but found no evidence. Later we sent it to the Queensland Government when they had flooding and wildlife disasters.

13. **The truth about the neonicotinoid insecticides**. This is the first third of the first page. "*The pesticides industry stands accused of failure to investigate the hazards of systemic neonicotinoids fully and of failure to establish standard tests and protocols. The protection agencies stand accused of failing to protect human health and the environment*, with reference to the Executive Summary of the Workshop on Pesticide Risk Assessment for Pollinators January 15-21, 2011, SETAC, Pellston, Florida"
Authors: David Fischer from Bayer CropScience &Thomas Moriarty from the US EPA Office of Pesticide Programs and Team Leader, US EPA Bee Unit set up 22/06/2009.
http://www.setac.org/sites/default/files/executivesummarypollinators_20sep2011.pdf
This summary proves that the pesticides industry and all of the environmental protection agencies were aware of the following, which up until now, they had consistently denied:
a) That the systemic neonicotinoid pesticides are harmful to bees.
b) That the tests and protocols that had allowed registration of the systemic pesticides were not adapted to assess potential hazard and risk from this type of pesticide.
c) Despite knowing all this, the Protection Agencies have allowed the pesticides industry to keep neonicotinoids on the market.
d) That many of the projects suggested for the future have already been done by independent scientists.

14. **Domestic and public gardens may be the biggest hazard to the public**. They are an environment from which beekeepers cannot protect their bees and in which the pregnant woman cannot protect her foetus (see doc 2). There is an absence of training for gardeners. They are not trained by Defra/CRD: "*the Directorate routinely restricts the ways in which products can be used (e.g. specifying dose rates, timing and place of application) to ensure protection of human health and the environment*" but only for the commercial use. The public has no idea of the dangers of applying pesticides. Information has been completely suppressed, in a conspiracy between Defra/CRD, the industry, newspaper journalists and the BBC (via the Science Media Centre). There are many television and radio programmes on gardening; it has become a national obsession. The BBC had a public row with Monty Don in which they criticised him for not mentioning "*chemical alternatives*". He defended his rights by pointing out that when he was appointed they knew he was an organic gardener. On the Royal Horticultural Society website, members are told that it is safe to use pesticides, provided that the instructions are strictly followed. Advice on Vine Weevil treatment recommends either Bayer or Scott's neonicotinoid preparations. It suggests that treatment should be continued even when the Vine weevil has apparently gone. In Kew Gardens if one tries to find a bird or an insect it becomes apparent (and by admission of staff) that there is widespread use of neonicotinoids on trees and in greenhouses. The pesticides industry cooperates with agricultural colleges on research, so they able to influence farmers, horticulturalists and gardeners from the beginning of their careers.

15. **Bayer expands its domestic market**. Now that some of their commercial markets are potentially under threat, Bayer is cynically trying to expand its Bayer Garden market. (From a trade forum on garden produce in 2012.).
http://www.gardenforum.co.uk/tradeforum/peoplenews/?artid=2382

Consumer specialist appointed Head of Bayer Garden. Darren Brown, an individual with a strong track record in both consumer marketing and business growth, has been appointed Head of Bayer Garden. His appointment builds on the company's recent investment in the development of the Bayer Garden brand. *"Last season Bayer Garden introduced new packaging designed to create a 'family' feel across its products. The aim was to make sure gardeners would know the product they were about to purchase was manufactured by a company they already knew and trusted through favourite products, including Provado Ultimate Bug Killer, Bio Slug & Snail Killer and Super Strength Glyphosate. The company also returned to the television, running a high profile advertising campaign that focused on its unique Simple Soluble Sachets. Speaking on his appointment, Darren said: "The marketing team have already made great progress in building a strong Bayer Garden brand here in the UK. My aim is to advance this momentum and work hard on delivering excellent products for our customers: "I hope I can also bring some of the best practices from my Consumer Healthcare experience and am excited by the potential ahead for Bayer Garden in the UK."* Prior to this appointment, Darren was based in New York, working as the Vice President for Global Brand Management for the Bayer Diabetes Care Division. He helped the division deliver year on year growth and make the company the fastest growing in the market. Prior to working the US he held a number of senior sales and marketing roles in Bayer's UK Consumer Health division, where he again helped deliver growth ahead of the market. He began his career in product management at Smith and Nephew plc.

Evidence to the Environmental Audit Committee Paper 2
Comments on Defra website on 'Neonicotinoid insecticides and bees'

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1. **Statements by Defra**: "*We have kept the evidence on neonicotinoids under close and open-minded scrutiny…working in partnership with beekeeping groups on a 10-year plan to protect and improve the health of honey bees in England and Wales"*

We have found very little to support these statements by Defra. We submit the following evidence.

2. **Early Day Motion** in Westminster Hall 25/01/2011. Martin Caton MP for Gower requested suspension of neonicotinoid pesticides whilst doubts remained about their effects, not only on honey bees, but on many other invertebrates. He questioned Mr Paice's assurances, and those that Lord Henley had made previously, about the 2009 Buglife Report. (This was a 45-page report written by Buglife, The Invertebrate Conservation Trust: *The impact of neonicotinoid insecticides on bumblebees, Honey bees and other non-target invertebrates*). Mr Paice had said: *"The then Government fully reviewed that Report and took advice from the independent Advisory Committee on Pesticides… conclusion drawn at that time was that the Buglife Report did not raise new issues…and did not require changes to pesticide approvals.* When Mr Caton revealed that the ACP had not conducted a review and the CRD had not completed its report and had not even completed collecting the data, Mr Paice said: *"His assertion is news to me."* This led to a flurry of activity in the ACP and Defra. Eventually, an undated, 4-page document written by Helen Thompson (ICPBR secretary) appeared on the Fera Website**.** Subsequently, the ACP did conduct a review of the Buglife Report. They decided that there was no need for a ban, but that a study on over-wintering bees should be undertaken to assess the effects of neonicotinoid insecticides on colonies.

3. **Defra website: 'Myth-busting' section**. January 2011. *US Study on neonicotinoids.* The myth: *The Independent claimed that the findings of an unpublished US Scientific Report suggested neonicotinoid pesticides could be killing bee colonies all over the world.* February 2011. *Bob Watson and the neonicotinoids.* The myth: *The Independent claimed that Defra's Chief Scientific Adviser had ordered a review of the evidence used to justify the safety of neonicotinoids to bees.* Fera: Neonicotinoids and honey bees. An update February 2011: *A recent US memo and various articles published in the UK media, on the risks of neonicotinoids, provide* **NO NEW EVIDENCE** (sic) *on this issue."* The *'US memo'* they are referring to was a 101-page document from US EPA scientists on the assessment of *clothianidin*. It is a memo from the ecologists of the Environmental Risk Branch to the Registration Branch of the USEPA, dated 02/11/2010.

4. **The UK National Ecosystem Assessment** This was published by Defra in June 2011. Page 8 of the Synthesis was entitled: *Changes in the past 60 years*. Defra managed to rewrite the whole post-war history of the destruction of the countryside by industrial farming, without any mention of insecticides or herbicides.

5. **The EU Directive (2009/128/EC) on the Sustainable Use of Pesticides**: The UK Consultation and Government Decisions, published December 2010 The government voted every time on the side of industry. Article 10 concerns Protection of Water Courses from pesticide pollution, including establishing buffer zones to protect aquatic environments, surface and ground water. The government rejected the EU Directive Advice. Instead it said that it would "*primarily seek to work with the pesticides industry*" to enhance voluntary measures. It also rejected EU Directive advice to ban aerial spraying: "*We do not consider that the responsible application of pesticides by aerial spraying poses an unacceptable risk to human health or the environment and, consequently, we will use the derogation.*" In fact, in July 2012, the Defra website issued a guidance document for aerial spraying. Article 11 Use of pesticides in specific sensitive areas: "*We do not consider it necessary to prohibit the use of pesticides in public spaces or conservation areas or to impose new statutory controls on pesticide use in these areas."*

6. **Impossible to avoid exposure, either as a beekeeper, or during early pregnancy** Neonicotinoid insecticides are so ubiquitous that beekeepers don't know how to avoid exposing their bees to them (Mark Clook, CRD, says there is no mitigation for systemic pesticides). There is no difference between plants from pesticide-coated oil seed rape and uncoated (although the paucity of insects might suggest a difference). In *The Butterfly Isles*, by Patrick Barkham (2010), on page 68 the author wrote the following, apparently unconnected (to the author, at least) observations. It was a hot day in late April 2009 and the author was admiring the field of yellow oilseed rape in full bloom. Further down the page, he said: "*it was 25 minutes before I saw any insects*". No insects? On a hot day in late April? In our time, that would have been unimaginable. Just from that small incident, one can see how people's baselines only relate to how it was in their own childhood, until suddenly a time of plenty turns into a collapse. Just as the beekeeper cannot protect his bees, how can the pregnant patient avoid exposure of her foetus to invertebrate-killing pesticides when the size of the foetal brain is no more than that of an insect? A member of the British Beekeepers' Association (BBKA) who had lost some hives recently suggested that farmers sowing seeds with systemic pesticides should report the location to Defra, who could map the area on a GPS (the same way as some police authorities can alert communities to the location of crimes in their area). This proposal was rejected by Defra and Richard Benyon MP, the Defra Minister at the time.

7. **Healthy Bees Plan Project Management Board** (HBPP PMB) Fera. Initial meeting: 23/07/2009. [*The Board will guide the work to deliver the desired outcomes in the Plan: Effective management of pests and diseases, improved husbandry standards through a coordinated beekeeper learning programme, effective biosecurity to minimise risks from pests, diseases and undesirable species, sound science and evidence to underpin bee health policy and its implementation, and coordinated and effective communications.*]

   Up to 01/03/2011, the minutes of ten meetings had been published. BBKA representatives, Tim Lovett and Martin Smith, withdrew after first meeting and missed the four subsequent meetings. They only agreed to return provided they could have three members on the Board. Years 2009/2010, £285,000 spent and £179,000 returned to Fera unallocated. 23/07/2010 Insufficient samples from the Random Apiary Survey for diseases, poor uptake of training the trainers and poor partnerships working with bee associations to help in the delivery of the plan. The BBKA wanted 50% of the funding for training. 13/12/2010: According to Martin Smith BBKA, the survey of beekeeping husbandry practices and overwintering losses is being carried out in three different ways: Fera's is a self-selecting group of beekeepers; the BBKA is a random survey; National Bee Unit inspectors only make visits to high priority areas. Smith said he would make a proposal for options for a coordinated survey for consideration by the board. Medicines for *Varroa* had been raised by BBKA members on several occasions. Tim Lovett said there was a lack of progress on authorised medicines – this could have a large impact on bee health and needed to be considered fully. He said a new system of presenting bee medicines would be in place from 2012. Bees were food producers so medicines given to them needed to be via prescription. 10/03/2011: Still no unified survey method for overwintering bees so the **earliest** it could be started would be 2011/12. Draft proposals had gone to the National Bee Unit, but no feedback. There were still no courses being run in Wales.

8. **Science and Evidence Advisory Group (SEAG)** [*The work of the SEAG included ensuring that honey bee health policy underpinned by sound science, translation of scientific developments into practical beekeeping to advance knowledge and skills and identify gaps in evidence base*.] 12/02/2010 was the first meeting and there were five meetings to the PMB's ten (Tim Lovett BBKA at a HBPP PMB on 10/03/2011 had said: *"The SEAG has been in existence for 2 years, but had met infrequently – yet the need for scientific input into the Healthy Bees Plan was as great as ever."*10/01/2011 Management and control of *Varroa* was identified as the most urgent research priority. 27/07/2011 With reference to Fera's data on *'Management and control of Varroa'*, the Chairman said there was an opportunity for the first piece of work to be done at Fera. She invited comments on the specification, and what the outputs should look like. Norman Carreck BBKA had said: *"We need to avoid doing a literature review, which covers both 'good' and 'bad' literature*". The Colony Loss Survey was raised, but the Chairman pointed out that it was not due for discussion until the next meeting. Neither of these Defra/Fera Committees mentioned neonicotinoid pesticides as a possible cause of bee declines, only *Varroa*.

9. **The British Beekeepers' Association (BBKA)** At the Annual Delegates' Meeting 16/01/2011, the BBKA Executive *agreed to cease any commercial relations with the agrochemical companies or associated companies relating to the use of the BBKA logo, for the endorsement of pesticides (for money or any other form of remuneration) as soon as contractually possible.'* On 20/06/2011, Tim Lovett, Chairman of the Public Affairs Committee of the BBKA, appeared as a panellist on a 4-minute Bayer video extracted from an evening event on Bee Care, hosted by Bayer in the European Parliament. Link: http://www.youtube.com/watch?v=8PfabP6ipm4
It also featured Julie Girling MEP and John Stewart Agnew MEP who were endorsing Bayer's products for treating V*arroa.* Tim Lovett said: "*The principal problem in the decline in bees clearly has to be the Varroa mite". *Agnew said: *"it's not just the damage done by the mite, but apparently the viruses, all 20 of them, which it can inject into them."* Lovett said: *"The competence of the beekeeper needs to be maximised…It is not adequate if you don't give them the tools."* Julie Girling, MEP talked about the urgency to get these medicines authorised globally to solve the honey bee crisis. "*We need to get the information out…get them authorised…create a critical mass of use to get enough money into the system to get new products developed."* According to Lykele van der Broek (Bayer scientist) they had been developing medicines to "*prevent bees from getting sick."* Klemens Kreiger said *"we were very lucky to have developed Bayvarol® and Perizin®, which are very efficacious against the Varroa mite and, at the same time, safe for the honey bee."* Dr Julian Little said that Bayer had been making products for bees for well over 20 years. Lovett said: *"whenever I meet a politician or an official… I like to stimulate them to get on with the job."* Tim Lovett was speaking as a representative of the BBKA. He had disregarded the ADM resolution. Not only that, but the video must have been 'set-up'. Some of it must have been recorded afterwards because when Julie Girling is speaking, people are talking in the background. As far as we can ascertain, John Stewart Agnew, the UKIP MEP, who so expertly pronounced on *Varroa* and 20 viruses, knows nothing about bees and was not on the panel. This is Agnew's reply on 15/11/2011 to a constituent who asked him to vote for the alternative Resolution, to ban the neonicotinoids: *"You may be interested to know that we have not merely followed this topic with interest but, with my colleague and policy adviser, Tony Brown, we have privately sought expert scientific testimony* (Presumably Tim Lovett).

10. **The Tabajdi Report** 06/10/2011 **and Alternative Resolution** 15/11/2011
Julie Girling MEP was co-rapporteur of the Tabajdi (Csaba Sándor) own-initiative report on Honeybee health and challenges of the beekeeping sector. This was adopted by the Committee on Agriculture and Rural Development on 06/10/2011. Section (1) contains the perennial calls for research, national surveillance systems, reference hives and support for training. Section (2) Veterinary products: for effective treatments against Varroa mites, was new. End of paragraph: "*It highlights, in particular, the need to offer the pharmaceutical industry incentives for the development of new medicinal products designed to combat bee disease.*" This was almost identical to Julie Girling's statement on the Bayer promotional video in June. "*We need to get them authorised…create a critical mass of use to get enough money into the system to get new products developed.*" According to the expert panel on the Bayer video, the products against the *Varroa* Mite, Bayvarol®, Perizin® are ready and just waiting for authorisation. An Alternative Resolution to the Tabajdi Report was debated on 15/11/2011. There were a significant number of MEPs who were unhappy with the Tabajdi Report which had been adopted on 06/10/2011. So an alternative Resolution was proposed by Jill Evans MEP. *This called for the European Parliament to ban the Neonicotinoid Pesticides and Fipronil under the Precautionary Principle, since the existing committee report does not address the crucial issue of the hyper-toxicity of the Neonicotinoid Pesticides, nor does it address the vast body of peer-reviewed evidence which links the use of Neonicotinoids to the death of over 5 million bee colonies in America, France, Germany, Italy, Slovenia and the UK… Points out that special attention must be paid to the use of pesticides of the neonicotinoid family that could cause digestive, hormonal and neuronal disruption; Calls on the Commission to comply with the precautionary principle and to impose an EU-wide ban on the use of neonicotinoid pesticides until independent scientific studies prove that there is no chronic exposure to toxins for honeybees and no danger to the environment and public health originating from their use; the conclusion is that the new generation of neonicotinoid pesticides and fipronil, have never been properly tested or licensed, and have been used illegally since the early 1990s - because the tests used were simply unable to detect their effect on bees and pollinators.* Debated 15/11/2011.Votes: 170 in favour, 454 against. This defeat was not surprising in view of the presence in the EU of pesticide lobbyist's such as Tim Lovett. But it signified that the global campaign was reaching more people. In 2010, few people had even heard about neonicotinoid insecticides.

11. **The Agrochemical Industry spreads disinformation** via multiple lobbyists, not only in the UK Parliament, but in the EU and US too.
Lord Henley, Under-Secretary of State for Defra**:** in a debate with Nick Mole, UK and European coordinator of Pesticides Action Network (PAN-UK& EU) conducted on Radio 4's Farming Today, 13/12/2010, said that the British had an "*ideological dislike of legislation,*" there were "*dangers of over-legislating.*" He said that all decisions on the EU Directive (2009/128/EC) were based on: "*robust scientific evidence.*"
US EPA website**:** January 2011**:** Advertising the Workshop on Pollinator Protection: Advancing the Science. "*Sound science is the basis for EPA's regulatory decisions. Data used for regulatory purposes must be of the highest quality.*"
Administrator Lisa P Jackson US EPA: Mission statement January 2011: "*The EPA is about human protection. It's about community protection. It's about family protection.*"
Rt. Hon James Paice MP, Minister of State for Agriculture: During the Westminster EDM debate 25/012011: "*The then Government fully reviewed that Report and took advice from the independent Advisory Committee on Pesticides… conclusion drawn at that time*

was that the Buglife Report did not raise new issues…and did not require changes to pesticide approvals." (At that time, the ACP hadn't even seen it).
Dr Julian Little of Bayer CropScience said: *"I am sure there are some very interesting effects Dr Pettis has seen in the laboratory, but in reality, when you get to what's important to everybody, which is what happens in the field, you don't see these things happening."* This was a comment on Dr Pettis' (at that time) unpublished work showing that minute doses of imidacloprid were associated with a weakening of bee immunity, such that they became more susceptible to bee diseases. This was despite the fact that subsequently the levels of the neonicotinoids in the bees were below the limit of detection using the researchers' own equipment. (Quote;The Independent: 20/01/2011, Michael McCarthy).
Pettis managed to get it published a year later. (Pesticide exposure in honey bees results in increased levels of the gut pathogen *Nosema*. *Naturwissenschaften*, 2012 Feb; 99(2): 153-8 Epub 2012 Jan 13). He and his colleagues showed that at a concentration of only 5 ppb, imidacloprid was exposing bees to infestation by *Nosema ceranae* and thus a much greater chance of dying prematurely.
Dr Helen Thompson: Bee scientist, National Bee Unit, York, denied that Colony Collapse Disorder in honey bees was present in the UK. She told Channel 4 News on 04/04/2011: *"the Government has reviewed all the data on a link between insecticides and bees, and concluded they are not the primary cause of the decline… There have been a lot of studies undertaken, across Europe and here in the UK and there's been no strong evidence they are linked to bee losses at all."*
Tim Lovett, BBKA: 20/06/2011: *Bayer promotional video expert panel: "The principal problem in the decline in bees clearly has to be the Varroa mite… The competence of beekeepers needs be maximised... It is not adequate if you don't give them the tools."*
Julie Girling MEP: *"The bees' immune system is based on its social activities, so if that reduces, immunity goes down and they are subject to all kind of other pressures."* Strasbourg. Bee Care Panel Debate. Bayer promotional video for *Varroacides.*
Dr Julian Little, Bayer**:** *"If it is Varroa, well, we are very pleased that we are going the right way when it comes to researching products for bee health because that's what Bayer has been doing for… for well over 20 years now."* Bee Care Panel Debate on a promotional video for Bayvarol® and Perizin®. 20/06/2011.
Norman Carreck BBKA**:** Senior Technician at the University of Sussex Department of Apiculture, Scientific Director of the International Bee Research Association and Senior Editor of the Journal of Apicultural Research. Minutes of meeting: Scientific Evidence Advisory Group to the Defra Healthy Bee Plan, 27/07/2011. With reference to Fera's data on: *'Management and control of Varroa'*, the Chairman said there was an opportunity for the first piece of work to be done at Fera. She invited comments on the specification, and what the outputs should look like. Norman Carreck said: *"We need to avoid doing a literature review, which covers both 'good' and 'bad' literature"*.
Bayer CropScience: *"Australian Bees are the healthiest in the world"*. Comment in Sunday Times: 1/11/2011 Article by Charles Clover. *Bee colonies are diminishing…..*

12. **A Study of Beekeeping Practices**; influences and information sources. Final Report 11/05/2010. 60 pages. This seemed to be a particularly pointless report; one that might appear in a Women's Weekly magazine. There were only 30 telephone interviews with amateur beekeepers and an internet survey of 906. It did not state how they were selected and there was no mention of neonicotinoid pesticides either. Someone must have been paid a lot for analysing and writing about a few cosy chats and opinions. Not the sort of 'sound science' that Defra is always boasting about.

13. **Science Advisory Council to Defra –** remodelled in 2011. Finally, on 26/06/2012 SAC-12-24-neonicotinoids were discussed. The newly constituted Committee, on its third meeting, asked for a briefing from Defra/CRD. "*This paper is in response to SAC's request to be briefed on the effect of neonicotinoids on bees, and Defra's position. The SAC will wish to consider the current Defra position and the thinking and evidence behind that position – and to challenge that position if appropriate*. Bee health para 5. *Honey bee colonies have good years and bad years – honey bee loss is not a new phenomenon. Their health is influenced by a number of factors – particularly pests and pathogens, bee husbandry, nutrition and the weather. The population of each bee colony fluctuates naturally throughout the year from around 50-60,000 at the summer peak to around 10-20,000 in winter when the colony slows down. The whole colony can be lost either over the winter or during the beekeeping season. Recent data for both periods indicate lower losses for honey bees over the last 2-3 years. The figures are outlined at* ***Annex 1****. "Defra takes the success of bee populations very seriously. That is why, despite the tough controls already in place, we are not complacent. We carefully assess new studies as they emerge and consider with an open mind whether they alter the overall picture." "We carried out a comprehensive assessment of the evidence last year, culminating in a challenge session led by the Chief Scientific Adviser in August, and found that the total body of evidence supported the conclusion that neonicotinoids do not threaten honey bee populations."* In 2010, ACP had asked, (as a result of examining the 2009 Buglife Report) for overwintering losses associated with systemic neonicotinoids to be undertaken by Fera. There is no evidence that these have been done. That is why the numbers in Annex 1 are so vague. In one of the Pollinator Initiative projects headed by Dr Chris Connolly from Dundee, in partnership with the Scottish Beekeepers' Association (SBA), a three year survey of the impact of chemicals on colony performance in Scotland would be undertaken. Although the project was 3 months behind time (Dr Connolly's bees were "rustled" from a secure area of Dundee University) preliminary results from the first year have just been published in the Journal of the SBA. He said: "*In summary, the presence of oil seed rape (OSR) correlated with a 2-fold increase in over-wintering failure in Scotland 2011-2012. This finding supports the hypothesis that neonicotinoid-treated OSR may be contributing to the honey bee decline in the UK."* There was an east/west divide, with a clear increase in bee losses in the East (intensive agriculture). In fact Dr Connolly, being an honest scientist, excluded results from one beekeeper whose bees were in the non-OSR group who had no losses from 70 hives. Had he included it, the increase in over-wintering losses would have been 3-fold in the East of Scotland. In addition, they have also found the microsporidian *Nosema ceranae* present in over 80% of Scottish hives, suggesting that pesticides are lowering the immune system of the bees leaving them susceptible to attack from this and other pathogens and parasites such as the *Varroa* mite**.** Defra has been silent about these results.
Graham White is a beekeeper in the intensively-farmed area of the east of Scotland. Since 2006 he has not harvested a single pound of honey, despite the fact that he now has ten hives rather than six; the reason is that his apiary stands in the centre of many square miles of arable crops - oilseed rape mainly - that have been treated with neonicotinoids. He says: "*The result is that, like most British bee-keepers, I have lost from 30-50% of my hives every winter since 2005 - whereas from 1995 to 2005 I rarely, if ever, lost a single hive in winter."* This year (2011-2012) his overwintering losses are close to 80%. The Chief Bee Researcher at Fera, Dr. Helen Thompson, denied the existence of Colony Collapse Disorder on Channel 4 on 04/04/2011. Presumably Fera hasn't been looking;

possibly because it doesn't want to know. The most recent data we have seen by Fera on overwintering bee losses only reached as far 2008; we have no idea of who they surveyed.

Dead queens and workers. This is a photograph of a dead colony taken on 11/12/2010 by beekeeper Graham White, who lives in the eastern half of Scotland. He has kept bees since 1994. He says it is a typical dead colony from an area dominated by intensive arable crops, oilseed rape, wheat and barley, where first imidacloprid, and now clothianidin, is used. He said *"It is clear from the photos that there was plenty of sealed honey and pollen within easy reach of the bees. The reason they died was not from starvation; there were simply not enough bees to generate sufficient heat to keep the colony alive. This phenomenon is what beekeepers in the US had termed in 2006 'Fall Dwindling' - when a colony that appears to have been fine during the summer, suddenly weakens and dies - largely because it stopped rearing brood in the Fall and as such did not have sufficient 'winter bees' to carry it through the winter."*

Page 9 of the briefing for SAC: *"Pesticides that are applied as a seed treatment*: It says *"some pesticides are applied directly to the seed"*. In the UK it is approximately one third of all arable crops (Defra's own statistics) and in addition to the seed being coated with chemicals an area may have up to four additional sprayings during the season. It omitted to include the Bayer Garden domestic market, or any of the other places where they are used.

Thiamethoxam usage in the UK
Between 2009 and 2010, thiamethoxam usage went up more than ten times.

Year	**Region**	**Crop Group**	**Active Substance**	**Total Area Treated (ha)1**	**Total Weight Applied (kg)**
2010	Great Britain	All Crops	Thiamethoxam	298,007	9,105
2009	Great Britain	All Crops	Thiamethoxam	22,567	938
2008	Great Britain	All Crops	Thiamethoxam	21,909	940
2007	Great Britain	All Crops	Thiamethoxam	1,333	5.6
2006	Great Britain	All Crops	Thiamethoxam	1,213	5.4
2005	Great Britain	All Crops	Thiamethoxam	1,213	5.4

CRD budget is paid, in part, by the industry. Is it a safety agency or a service agency?
Instead of employing independent scientists, it is presumably easier and cheaper for the UK Government to allow industry to pay a proportion of the Chemical Regulation Directorate's

costs (about 60%). It is evident that the loyalty of the Defra/Fera staff lies with the industry that pays them, rather than the protection of Human Health and the Environment. (Defra told us that the exact amount each year is based on a formula enshrined in the recent European Legislation on Plant Protection Products. It depends on work done).
Extracts from the CRD Annual Report 2008/2009 will support our point: *"This has been a very busy year in the approvals group. Applications for product approvals were 9% over business estimates with a total of 1,767 applications received and 1,622 applications completed this year, 96% of which were completed within published targets. Importantly 100% of 'fast track' applications identified by industry as high priority to their business needs were completed within published targets. Achieving this demanding target despite the increase in applications has required diligent application and commitment of evaluating staff and their managers and represents a significant achievement. We continue to support growers and we have completed the first stage of the conversion exercise for the 'Long Term Arrangements for Extension of Use' on non-edible crops. Of the 401 uses requested by growers, the 131 products containing active substances that have already been fully reviewed in the EU review programme, and included on Annex I of Council Directive 91/414/EEC have been completed. The remaining product/uses identified by growers will be automatically included in the on-going re-registration process minimising the impact on industry. We also assisted in the evaluation of new products by helping companies work towards the completion of appropriate dossiers through the provision of detailed advice. This advice has covered both chemical pesticides and biopesticides that we continue to support under our biopesticides scheme. We submitted completed evaluation reports for 5 new active substances where the UK was the EU Rapporteur Member State and issued 3 UK provisional authorisations in advance of Annex I inclusion. In addition we completed 8 'partial dossier' submissions*.

14. **Critiques of two of the papers mentioned in the Defra Report** These are two that David Fischer from Bayer Crop Science (and Defra) has put the most weight on. Both state that: **"***they prove that the neonicotinoid insecticides cannot possibly be the cause of honey bee declines.)* In fact, neither is 'sound' science.
'Dietary traces of neonicotinoid pesticides as a cause of population declines in honey bees: an evaluation by Hill's epidemiological criteria' James E. Cresswell, Nicolas Desneux, and Dennis van Engelsdorp. Pest Management Science.
"…we employ Hill's epidemiological 'causality criteria' as a structured process for making an expert judgement about the proposition that trace dietary neonicotinoids in nectar and pollen cause population declines in honey bees. Conclusion: We conclude that dietary neonicotinoids cannot be implicated in honey bee declines, but…"
I had the following correspondence with the Editor of Pest Management Science and James Cresswell to take issue with their use of Hill's criteria.

Sent: 06 March 2012 13:08
To: Pest Management Science
Subject: Re: Gerald T Brooks
Dear Simon
Thanks so much for getting in touch.
Re: 'Dietary traces of neonicotinoid pesticides as a cause of population declines in honey bees: an evaluation by Hill's epidemiological criteria' James E Cresswell, Nicolas Desneux and Dennis vanEngelsdorp. Accepted article in Pest Management Science: doi: 10.1002/ps.3290.

Having served as Assistant Editor to a medical journal in the UK for 10 years, I would challenge the authors' use of Hill's criteria in a non-occupational medicine context. They have used it incorrectly to

support a very contentious conclusion in the honey bee world: that dietary neonicotinoids cannot be implicated in honey bee declines. At the end they state: *'we commend the use of Hill's criteria. Since their inception over 40 years ago and subsequent widespread use, no criterion has been abandoned and none added, which means that they provide a stable and well-established infrastructure in which to process scientific evidence.'*
They omit to say that in 40 years it has always been used in a medical context, not to supply scientific evidence. If they had read the three papers fully they should have observed that Hill's criteria have never been used other than in relation to man and occupational exposure.
Sir Austin Bradford Hill was an eminent medical epidemiologist and statistician. His classic paper '*The Environment and Disease: Association or Causation*' was given to the Section of Occupational Medicine in the Royal Society of Medicine in 1965. These criteria were developed to enable physicians and surgeons to test the relationship between occupational exposure and occupational diseases in man. Following on from this, he and Sir Richard Doll went on to prove the relationship between smoking and lung cancer.
The paper by Cresswell *et al*. quotes two other references to Bradford Hill. *The Bradford Hill considerations on causality: a counterfactual perspective* by Michael Höffler, an epidemiologist and psychologist. This was published in Emerging Themes in Epidemiology. All the references are from medical journals. The third one by Swaen and van Amelsvoort is from the Journal of Clinical Epidemiology, discussing the relationship between toxic agents and human cancers. I am surprised that your reviewer did not spot this error; or perhaps they were misled by the use of the word 'environment' in the title and assumed that these were ecological papers. I think that so far this paper has only appeared on line. In order to maintain the reputation of Pest Management Science and the John Wiley Journals in particular I hope that this will be removed from being accepted on-line (perhaps with a note to say why). I hope that I am not too late to stop it going into print. Kind regards

Personal email to James Cresswell, sent 07/03/2012, with further objections to his selection and interpretation of papers, in addition to challenging the use of Hill's criteria.

Dear James
Did you find and read all these papers yourself and personally interpret them? If you did, I would question your judgement at applying scores or "weighting".
Reference 24: You dismiss this document as claims by French beekeepers; but it was a 108-page document, by the *Comité Scientifique and Technique* in France. It took several years to review all the **independent** scientific evidence on systemic pesticides. Their findings were that "*the treatment of sunflowers is a significant risk to bees in several stages of life*"
Reference 26: Maxim & van Sluijs: *"there was no consensus about the potential impact of trace dietary impact of imidacloprid on honey bees"*. It was obvious why there was no consensus; it was just a questionnaire from different bodies. *"The method makes use of expert elicitation of the perceived strength of evidence regarding each of Bradford Hill's causality criteria, as regards the link between each of eight possible causal factors identified in attempts to explain each of five signs observed in honeybee colonies. These judgments are elicited from stakeholders and experts involved in the debate, i.e., representatives of Bayer Cropscience, of the Ministry of Agriculture, of the French Food Safety Authority, of beekeepers and of public scientists."* It was performed by means of a questionnaire (meeting or telephone) which was then analysed. The concluding remarks were: *Often, in controversial situations (such as the one described here), the political positions and the arguments of the stakeholders involved become polarized and immovable*. Bradford Hill's criteria are mentioned. The paper is complete rubbish.
Reference 31: this is the infamous Cutler and Dupree Study 2007; originally submitted by Bayer as a field study (Cutler paper alone in 2006, was rejected by the Canadian Pesticides Management Authority). The next version had subsequently to be downgraded by the US EPA, (The test area was only 2 ha and bees often forage for miles.) After nine years on the market, there still is no proper field study that shows that clothianidin is safe; yet you mention it on at least three occasions. On one occasion you describe it as *"The largest field trial to date"* and give it a weighting of minus 2. Page 6

"field tests found no detrimental effects on honey bee colonies due to either imidacloprid or another neonicotinoid, clothianidin". You refer to it again on page 13: *"One experimental investigation has investigated the effect of exposure to neonicotinoid-treated crops on colony health under field conditions, and it found no effect on either overwinter survival and its proxy variables (e.g. gain in colony mass) or on mortality rates of individual bees."* Not surprisingly, the recent Purdue Study showed that bee-fed pollen had <u>10 times the amount of clothianidin</u> in it than the Cutler & Dupree study showed.
Reference 38 Girolami *et al*. *"Guttation is a particularly valuable source of water for bees in spring when the plants are small"* (Italy is hot). This paper showed that leaf guttation drops of all the corn plants germinated from neonicotinoid-coated seed contained amounts of insecticide constantly higher than 10 mg/l, with maxima up to 100 mg/l for thiamethoxam and clothianidin, and up to 200 mg/l for imidacloprid. The conclusion of the authors was that *"When bees consume guttation drops, collected from plants grown from neonicotinoid-coated seed, they <u>encounter death within a few minutes</u>"*. Indeed, if you enter "guttation drops" into Google, there are several YouTube videos of these lethal events taking place between the corn seedlings.
You then say: *"The critical question of whether bees commonly consume the fluid under field is currently unresolved."* (Reference 37, is: Recent developments and 'new issues'; in <u>Pest Management Science 2010 and written by Helen Thompson)</u>.
Helen Thompson from Fera/Defra has worked on Defra's SID5A Systemic Pesticide Risk Assessment (2007-2009) with three pesticide scientists from Bayer, Dow and Syngenta.
She was among the group of global 'experts' invited to the SETAC Pesticide Risk Assessment for Pollinators in January 2001: SETAC Pellston Workshop January 2011whilst independent researchers were excluded. http://www.setac.org/sites/default/files/executivesummarypollinators_20sep2011.pdf
So she knew that previous risk assessments had been flawed. On page 12 of the SETAC Executive Summary: Fischer (Bayer CropScience) and Moriarty US EPA OPP) admit that previous risk assessments for the systemic neonicotinoids had been flawed: *"Many who are familiar with pesticide risk assessment recognize that the methodology and testing scheme for foliar application products (where exposure may be primarily through surface contact) is not adapted to assess potential hazard and risk from systemic pesticides."* In particular, the authors of the report also admitted that they still had no suitable standard tests for chronic toxicity to either adult honey bees or their larvae.
On Channel 4 Television in April 2011, she denied that the UK had CCD.
In 2009, The Buglife Report on the: *"Impact of Neonicotinoid Insecticides on Bumblebees, Honey bees and other non-target Invertebrates"* was published. Defra was of the opinion that it contained nothing new.
The Advisory Committee on Pesticides concluded that the *"Buglife report highlighted a need in the risk assessment process for data on the impacts of neonicotinoid pesticides on overwintering of bees."*
In July 2009, Fera set up the Healthy Bees Plan Project Management Board (HBPMB) which included three members of the British Beekeeping Association (which for 10 years had been accepting money from the Agrochemical Industry for *"endorsing safe pesticides"*). **This study has never been done**. In fact in 12 meetings of the HBPMB, neonicotinoid insecticides were never mentioned once, only *Varroa* mites and expediting registration of Bayer's bee medicines for treatment.
The £10 million Pollinator Initiative funded nine projects. None of these were on the systemic neonicotinoid insecticides.
Have you seen the US EPA conditional registration document for clothianidin from 2003?
Fischer and Moriarty will know all about it.
It says on page 13: *Clothianidin is highly toxic to honey bees on an acute contact basis* (LD_{50} > *0.0439 μg/bee). It has the potential for toxic chronic exposure to honey bees, as well as other nontarget pollinators, through the translocation of clothianidin residues in nectar and pollen. In honey bees, the effects of this toxic chronic exposure may include lethal and/or sub-lethal effects in the larvae and reproductive effects in the queen.*
http://www.epa.gov/opprd001/factsheets/clothianidin.pdf
The Technical Sheet for Imidacloprid states that it is highly toxic to honey bees; as does the Australian PVMA.
<u>James, do you have any idea the devastation that these chemicals have caused in the US</u>?

On 13/01/2012, the Guardian Environment reported the crisis in the US: *"We are inching our way toward a critical tipping point,"* said Steve Ellis, secretary of the National Honey Bee Advisory Board (NHBAB) and a beekeeper for 35 years. Last year he had so many abnormal bee die-offs that he'll qualify for disaster relief from the U.S. Department of Agriculture (USDA).
Helen Thompson says there is no CCD in the UK?
Graham White, one of our campaign team, lives on the Scottish Borders. He became a beekeeper in 1994. Since 2006 he has not harvested a single pound of honey, despite the fact that he now has ten hives rather than six; the reason is that his apiary stands in the centre of many square miles of arable crops that have been treated with neonicotinoids. He said: "*It was in 2006 that I became aware that I was living in the centre of a vast area of arable crops - oilseed rape mainly - that were treated wall to wall with Imidacloprid. In 2010 I first became aware that Clothianidin was being used on all of the wheat and barley fields around my apiary - and that the drainage of the entire area was being fed into a large pond in my quarry - 50 feet below the level of the surrounding fields. So I strongly suspect that Clothianidin, Imidacloprid and several different fungicides are all contributing to the decline of my bees*." He said: "*The result is that, like most British bee-keepers, I have lost from 30-50% of my hives every winter since 2005 - whereas from 1995 to 2005 I rarely, if ever, lost a single hive in winter*."
According to Graham, in Scotland in 2010 *clothianidin* was used on all crops in an area of about 25,000 acres, and *thiamethoxam* on an area of about 47,000 acres.
In England, the figures are much higher. In 2010 according to Defra total neonics was well over 3 million acres (some fields would have been sprayed up to 4 times).
I could go through many others of the papers you document, particularly the ones written by Scientists from the pesticides industry. If I were to put in many of the papers you missed out, it would prove they were responsible for bee deaths, which they are.
However, it just seemed simpler to use the medical statistics argument. The papers that have used Bradford Hill on complex environmental issues are talking rubbish. It depends on interpretation and weighting, not on fact, as Hill's criteria connecting smoking and lung cancer do. I think that Sir Austin Bradford Hill and Sir Richard Doll would be turning in their graves, to know that their statistics were being used to maintain the sales of a neurotoxin that is not only poisonous to invertebrates, but to humans as well, for the benefit of the pesticides industry and their shareholders.
Yours sincerely

When I finally heard from the Editor, it was to say that they had no intention of taking it off line! Of course I realise why. Pest Management Science has five industry representatives on their Editorial Board. Helen Thompson had published four papers in PMS, one of which was to refute the findings of Girolami about guttation drops being an important source of water for bees during springtime and from which they were exposed to high doses of pesticides.

We note that James Cresswell and Helen Thompson applied another statistical model on Henry's paper: "*A Common Pesticide Decreases Foraging Success and Survival in Honey Bees"* in a commentary in Science, to cast doubt upon Henry's findings (which Henry adequately pulled apart, also in Science.) It took a French journalist, Stéphane Foucault in Le Monde, in an article: "*Le Chercheur, l'agrochemiste et les abeilles*" (*The researcher, the agrochemical company and the bees*) to discover advertisements for an assistant to Cresswell which were being funded by Syngenta, the manufacturer of Cruiser® (thiamethoxam).

The second paper with which I took issue, and by which the industry and Defra placed great store, was published in Ecotoxicology. In fact Blacquière had published a paper with Mommaerts in 2010 which had shown negative effects of sub-lethal doses of imidacloprid on *Bombus terrestris* worker foraging behaviour. It is therefore extraordinary that he should be induced to partake in a paper (presumably commissioned) that purported to show the reverse.

Neonicotinoids in bees: a review on concentrations, side-effects and risk assessment Tjeerd Blacquie`re • Guy Smagghe • Cornelis A. M. van Gestel • Veerle Mommaerts.
"*This review summarizes, for the first time, 15 years of research on the hazards of neonicotinoids to bees including honey bees, bumble bees and solitary bees.*"
The following letter was sent to the Editor of Ecotoxicology asking for it to be published as a comment.

Editor-in-Chief
Ecotoxicology
Dear Dr Shugart
I find it extraordinary that the paper published in Ecotoxicology by Blacquière *et al*. '*Neonicotinoids in bees: a review on concentrations, side effects and risk assessment'* can refer to the Summary by Fischer (Bayer CropScience) and Moriarty (US EPA) of the Pesticide Risk Assessment for Pollinators: Summary of a SETAC Pellston Workshop January 2011, and not discuss the crucial admissions made in that report.
http://www.setac.org/sites/default/files/executivesummarypollinators_20sep2011.pdf
On page 12 of the SETAC Report, Fischer and Moriarty admit that previous risk assessments for the systemic neonicotinoids had been flawed: *"Many who are familiar with pesticide risk assessment recognize that the methodology and testing scheme for foliar application products (where exposure may be primarily through surface contact) is not adapted to assess potential hazard and risk from systemic pesticides."*
The authors of the report also admitted that they still had no suitable standard tests for chronic toxicity to either adult honey bees or their larvae. Chronic toxicity tests on adult and larval bees *"require further development"*. Delegates (by invitation only) agreed that when these were developed they should be required as part of Tier 1 testing. At the end, there were 12 items for future research. Many of the studies they suggested had already been published in peer-reviewed journals by independent scientists, all of whom confirmed the acute and chronic toxic effects of systemic neonicotinoid pesticides on bees.
The paper by Blacquière *et al*. is deficient and cannot possibly claim to be a comprehensive review of risk assessment of neonicotinoids for honey bees.
Yours sincerely

Dr Shugart
I am grateful to you for forwarding the critique by your Ecotoxicology Assessor on the Editorial Board. I would like to make a few corrections to her "negative comments."
First of all, did Dr Helen Thompson (since I assume it was her) admit to you that she and I have crossed swords before?
She claimed that my comments were: *"very definitely base on an advocacy position and not science."*
I find this accusation extraordinary considering their origins; from US SETAC.
The first three paragraphs were quoted directly from the Executive Summary of the SETAC Pollinator Conference in Florida in January 2011. This was a workshop to which she had the privilege of being invited as an expert on bees, so she can hardly deny the truth of them. The Executive Summary was published on the SETAC website in September 2011.
The fourth paragraph was taken straight from the US EPA conditional registration document for Clothianidin in 2003. Again this is factual, rather than advocacy.
The fifth paragraph was also factual; about the current state of US beekeeping. The US Honey National Bee Advisory Board Secretary said their industry was at a critical tipping point. There is nowhere in the letter that CCD or immune deficiency is mentioned, so I find it rather curious that she says: *"we won't be depriving the journal readership of an important hypothesis about CCD by not publishing the letter."*
The website she quotes is not my website, but that of Bee Culture, the Magazine of American Beekeeping, whose members have experiences devastating losses in the last few years.
When Dr Thompson was appointed to the Editorial Board of Ecotoxicology, did she declare any

competing interests? Her work for the UK government on neonicotinoids (Defra's SID5A Systemic Pesticide Risk Assessment) was done in conjunction with three scientists from BayerCrop Science, Syngenta and Dow Agroscience. Four of her papers about bees and neonicotinoids have been published in Pest Management Science, a pesticide journal, the Editorial Board of which has three members of Syngenta, one from BayerCrop Science and one from Dow Agrosciences.
Her views on the neonicotinoids are well known in the UK. As a Bee Scientist working in Fera, she is one of the government chief advisers on Bees. She told Channel 4 news on 04/04/ 2011 that the UK Government had reviewed all the data on a link between insecticides and bees, and concluded they are not the primary cause of the decline. She added that the UK had no CCD. However, many of our beekeepers are having significant overwintering losses, but the Healthy Bees Plan Management Board (HBPMB), set up by Fera in 2009 to look at honey bee health and causes of bee declines in the UK, does not yet appear to have established a UK database with which to confirm or refute this.
In 2009, after publication of the Buglife Report, (Kindemba, V., 2009, *The impact of neonicotinoid insecticides on bumblebees, Honey bees and other non-target invertebrates*), the UK Advisory Committee on Pesticides asked Defra/Fera to study the effects of neonicotinoids on overwintering bee losses. There is no evidence that this has been done; in twelve meetings of the HBPMB over nearly 3 years, neonicotinoids were never once mentioned as a possible cause of bee declines. The Committee was fixated on the *Varroa* mite and expediting registration on anti-*Varroal* medicines, two of which have already been manufactured by another arm of Bayer. In 2010, a £10 million Insect Pollinator Initiative was announced in the UK to study reasons for devastating declines in pollinators. None of the nine projects involve a study of neonicotinoids on honey bees.
I suggest Dr Thompson's reason for recommending that my letter is rejected is to protect the pesticides industry from the embarrassment of having their deliberations at the SETAC Conference and the truth about the EPA Registration Document for Clothianidin being revealed to the public, for the very first time.
The Blacquière review paper is also biased towards the pesticides industry in its selection of papers, since many of the authors are pesticide scientists. I note that the paper references the Cutler & Dupree study. The granting of conditional registration to clothianidin in 2003 was contingent upon the subsequent submission of an acceptable field study, but nine years later this requirement has still not been met. I am therefore very surprised that the Cutler and Dupree study of 2007: *"Exposure to Clothianidin seed-treated canola has no long term impact on honey bees"* has even been referenced, since it was deemed by the US EPA to be inadequate as a field study.
The Editorial Board of Ecotoxicology will need to discuss my evidence against Dr Helen Thompson. Also, at this critical moment, the wisdom of publishing this controversial Blacquière study (that is so obviously biased towards the Pesticides Industry) should be reconsidered.
Yesterday an urgent legal petition was filed with the U.S. Environmental Protection Agency (EPA) by commercial beekeepers and environmental organizations, to suspend further use of a pesticide the agency knows poses harm to honey bees, and adopt safeguards to ensure similar future pesticides aren't approved by the agency. *"EPA ignored its own requirements and failed to study the impacts of clothianidin on honey bees,"* said Peter Jenkins, an attorney for the Center for Food Safety and co-petitioner. *"The body of evidence against the chemical continues to grow, yet the agency has refused to take action."*
Kind regards

I never received an answer and the letter was never published. It is evident that the industry places advocates on as many journal editorial boards as it can, either to reject, or delay, publications against these insecticides. I received a complaint from Prof Stefano Maini from Italy about a paper that he and Dr Porrini submitted to the Journal of Apiculture. Norman Carreck (BBKA, SEAG) was the assessor; he kept it for six months and then rejected it. This was the same Norman Carreck on SEAG who said: *"We need to avoid doing a literature review, which covers both 'good' and 'bad' literature"*. It demonstrates that being an assessor on a journal doesn't require academic qualifications. He was presumably 'placed' by industry. See page 38 in Human health doc. A Witness to The Permanent Peoples' Tribunal held in Bangalore, December 3rd to 6th 2011. How the industry suppresses information.

http://www.agricorporateaccountability.net/en/page/ppt/167

Evidence to the Environmental Audit Committee Paper 3 Contamination of surface and ground-water by the neonicotinoid insecticides

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1. **No monitoring in the US**. In the US, the neonicotinoid insecticides were authorised at the same time as water quality assessments were introduced for monitoring pesticides (1991). These insecticides did not feature in the 2009 US Geological Survey (USGS) National Water-Quality Assessment Program (NAWQA) Report: *Pesticide Trends in Corn Belt Streams and Rivers (1996-2006).* They were absent from the 2008 US study of pesticides in ground-water. The authors of the studies said: "*The results of this study are encouraging for the future state of the nation's ground-water quality with respect to pesticides…Despite sustained use of many popular pesticides and the introduction of new ones, results did not indicate increasing detection rates or concentrations in shallow drinking water resources over the 10 years studied*" <u>That was simply because they were only measuring the older pesticides that had been phased out. These had been replaced by the systemic neonicotinoid insecticides, which were not present in the lists of pesticides monitored</u>. I wrote to Bob Gilliom, Head of Pesticide Synthesis, USGS NAWQA, in April 2011 to point out this anomaly and sent him the Dutch documents about water contamination. He replied and said he would read them. We never heard any more.

2. **No monitoring in Europe; only in The Netherlands.** The Chairman of the UK Environment Agency was also informed in December 2010 (identical letters went to many politicians and organisations to inform them about the neonicotinoid insecticides, with evidence that they were building up in surface water and having an impact on <u>all</u> invertebrates). Lord Smith said the EA had no authority to ban pesticides. He suggested we wrote to Defra and the Defra Ministers, who did have. He gave me the email address of one of his staff in Bristol. I wrote to ask if they were monitored in the UK. <u>Response to enquiry from X re: neonicotinoid pesticides</u>. <u>*Monitoring of neonicotinoid pesticides by the Environment Agency*</u>. "*The Environment Agency's current monitoring of pesticide products in surface waters is determined largely by the statutory requirements of the EU Dangerous Substances Directive and the Water Framework Directive (together*

with its 'daughter' directive, the Environmental Quality Standards Directive). These Directives list chemical substances to be monitored in the environment, including a number of pesticides. However, none of the five neonicotinoid pesticides licensed for use in the UK is included under the current legislation. Our laboratory service is able to screen environmental samples for two of the neonicotinoid products, imidacloprid and clothianidin, using a chemical scanning technique (the GCMS scan). The limit of detection for these compounds is approximately 0.5µg/l. Although we have not specifically targeted neonicotinoids in our routine monitoring, we have been carrying out monitoring programmes using the GCMS scan technique for a range of projects. A review of results from the scans carried out between July 2009 (when we acquired the capability to detect these compounds) and January 2011 has shown there are no positive results for imidacloprid or clothianidin in surface waters. We have not undertaken any assessment of concentrations in soil. We are currently in discussion with the Chemicals Regulation Directorate (CRD) and Defra on the need for more targeted monitoring for these compounds. We would be happy to keep you informed of progress with this." From the Evidence - Monitoring Strategy Unit 04/02/2011.
Our comments: The GCMS scan would not have been sensitive enough to detect the limits in the previous Regulation on Plant Protection Products 91/414/EEC which was 0.1µg/l. It is unfortunate for us (but lucky for the pesticides industry), that the current one in use, EC/1107/2009, no longer specifies a limit. In actual fact, the chemicals cause immune suppression to bees in such low doses that are subsequently impossible to detect, even with the most sophisticated equipment (Pettis *et al*. 2012). We have just heard from the European Parliament that clothianidin was not registered illegally, despite its length of action and persistence in the soil. It was registered under the old regulations 91/414/EEC, which apparently made no reference to any such limits on registered pesticides.

3. **The European Commissioners.** We wrote on a number of occasions to all three Commissioners in Europe. We only had replies from Commissioner Dalli's staff. Neither Michael Flüh nor Eric Poudelet commented on our point about water contamination. We thought it strange that we never had a reply from Commissioners Ciolos or Potocnik. Vice-President Ashton always sent our documents on to Dalli. We suspect that there is some mechanism in the EC that diverts all correspondence about pesticides and GMOs to a central point. This may be significant. One of Commissioner Dalli's first actions on taking office was to lift a 13-year ban on BASF's GM potato Amflora. However, Dacian Ciolos, the Agriculture Commissioner, had expressed doubts about accepting GMOs into Europe at the Oxford Farming Conference in 2011. Recently, when a friend sent our document to Janez Potocnik, the Commissioner for Water, he was quite bemused. He said he would get back to her. When he got back to her, he said it was a different department.

4. **European Union Committee 33rd Report on Water Policy**. On 25/04/2012 a meeting was held in the EU. 'An indispensable resource: EU Freshwater Policy. The UK Environment Agency Chairman, members of Defra, CEH, and the Defra Minister were present at this meeting. All had been alerted to imidacloprid levels increasing in Dutch surface water and levels being inversely related to insect numbers. Dr Henk Tennekes had also shown that there were declines in insect-dependent birds throughout Holland, Germany, France and the UK.
http://ec.europa.eu/environment/water/water-dangersub/pdf/com_2011_876.pdf
The EC regulations on water quality state: *"Priority substances are those identified as presenting a significant risk to or via the aquatic environment within the EU. These are listed in Annex X to the Water Framework Directive (WFD). Some substances are*

identified as priority hazardous substances, because they have 'ubiquitous, persistent, bio-accumulative and toxic' properties. Bio-accumulation is the progressive increase in the amount of a substance in an organism or part of an organism which occurs because the rate of intake exceeds the organism's ability to remove the substance from the body". This is the EU definition of a priority substance that should be monitored. The chemical and ecological profiles are matched, very accurately, by the neonicotinoid insecticides. The dangerous substances that are being monitored at present include DDT, chlorpyrifos, aldrin and dieldrin; the majority of these should be obsolete. The neonicotinoid insecticides whose sales now dominate the global market are absent from the list. Those present at the meeting from the UK were silent on the matter.

5. **New York State never registered clothianidin**. The New York State Department of Environmental Conservation was demanding monitoring of imidacloprid by Bayer in the late 1990s, because it was protective of the aquifers in Nassau and Suffolk Counties. It did not register clothianidin and severely restricted the use of imidacloprid and thiamethoxam. In 2003, NYS wrote to Bayer CropScience, expressing concern about levels of imidacloprid found in clusters of private wells down gradient of farms (one contained 6 ppb imidacloprid), at a golf course monitoring well and at monitoring wells near trees that had been treated with imidacloprid injection.
   http://pmep.cce.cornell.edu/profiles/insect-mite/fenitrothion-methylpara/imidacloprid/imidac_let_1003.html
   http://pmep.cce.cornell.edu/profiles/insect-mite/fenitrothion-methylpara/imidacloprid/imidac_reg_1004.html

   We are convinced that this is why sparrows have disappeared from London, but not from New York. As stated above, NYS did not register clothianidin and severely restricted the use of imidacloprid and thiamethoxam. On behalf of a charity for funding independent research on pesticides www.smallbluemarble.org we tried to claim The Independent newspaper's Sparrow Prize (unclaimed from 2000) for solving the disappearance of the House Sparrow from London. However, were informed that our application did not fulfil the criteria set out in 2000. It should be for a paper published in a peer-reviewed journal and judged by a panel of three: The Independent, Dr Summers Smith the expert on Sparrows, and the RSPB. The RSPB, a 'science-led' organisation, is using neonicotinoid insecticides on its Hope Farm Reserve. The Senior Scientist had been persuaded by the industry that these chemicals are environmentally-friendly and superior to the older ones.

6. **Clothianidin contamination of the environment**. Field and toxicological studies from independent researchers from Indiana (US) showed widespread clothianidin contamination of the environment and bees close to maize fields: 'Multiple Routes of Exposure for Honey Bees Living Near Agricultural Fields' Christian H Krupke, Greg J. Hunt, Brian D. Eitzer, Gladys Andino, Krispn Given PLoS ONE January 2012, Volume 7: e29268. "*In North America in 2010 maize planting reached 35.7 million hectares and is expected to increase*." Most maize is coated with neonicotinoid insecticides. Most is used for food, animal feed and ethanol. By sampling clothianidin, thiamethoxam and several other agricultural pesticides, bees close to maize fields were found to be exposed throughout the foraging period. Extremely high levels of clothianidin and thiamethoxam were found in planter exhaust material produced during the planting of treated maize seed. They were present in the soil of each field, including unplanted fields; in Dandelions foraged by bees; in dead bees collected near hive entrances; in pollen collected by bees and stored in the hive. Maize pollen with *clothianidin* and other

pesticides were fed to the new queens. The fact that they were found in wildflowers proves that they are being washed into aquatic systems and taken up by vegetation.

7. **EFSA Scientific Opinions**. (EFSA provides the Science for the European Commission, but only the EC can grant authorisation for pesticides and GMOs, after EFSA has given a positive opinion). The European Food Safety Authority (EFSA) Panel on Plant Protection Products and their Residues published a 275-page document: "*Scientific Opinion on the science behind the development of a risk assessment of Plant Protection Products on Bees*." 18/04/2012. Defra followed this with a similar document on 13/09/2012; *Neonicotinoids and bees. The State of the Science and the regulatory response*. In both cases the authors were only calculating exposure from a theoretical point of view, or extrapolating from original data before contamination (or sometimes from data on 'similar' species), rather than measuring actual levels. (For example; risks to bats, which are in dramatic decline, are not measured directly. The shrew is taken as a standard insectivorous species and the data are extrapolated to bats. The fact that shrews don't fly and reproduce rapidly whereas bats forage insects in the air from orchards and are very slow reproducers seems to have been ignored). EFSA hasn't taken into account the gross contamination already present in the environment from years of use/abuse from which all invertebrates, not just bees and bumblebees, are dying. Science is supposed to be about measurement. These Scientific Opinions by EFSA and Defra are a blatant distortion of science for the purpose of misleading the public. EFSA cannot be taken seriously as a scientific organisation when it has no knowledge of the baseline levels in soil, surface and ground-water with such a persistent chemical (half-life in soil up to 1386 days). We know that the toxins have been found in wild flowers foraged by bees, having been taken up from surface water. In addition, what genuine scientific document would have the following paragraph?
The final decision on protection goals needs to be taken by risk managers. There is a trade-off between plant protection and the protection of bees. The effects on pollinators need to be weighted against increase in crop yields due to better protection of crops against pests.

8. **The Austrian Ombudsman challenged the European Commission** in April 2012. They complained that the EC had not taken into account the new research on bees and neonicotinoids. The EC had to reply by 30/06/2012. We decided to follow suite. We also noted that EFSA readily agreed to increase MRLs in neonicotinoids at the request of industry [Syngenta Crop Protection BV for thiamethoxam (clothianidin) asked the EFSA to grant an increase of MRL on carrots (Approved February 2010). Syngenta Agro SA asked for an increase in MRL of thiamethoxam (clothianidin) in strawberries and beans with pods from 0.05 mg/kg to 0.3 mg/kg (i.e. six times). (Approved: June 2010). Monsanto Europe asked the EFSA to set the import tolerance for glyphosate in lentils "*in order to accommodate the authorised desiccation use of glyphosate in lentils in the US and Canada*" from 0.1 mg/kg to 10 mg/kg (i.e. 100 times). (January 2012) The EFSA had granted similarly elevated MRLs for glyphosate on wheat and GM soya.]
We received a 2-page reply from Michael Flüh on behalf of the EC and a 5-page reply from EFSA. Third para out of four of the EC letter: *"The allegation as regards the illegality of the registration of clothianidin is strongly rejected. The assessment of clothianidin, carried out by a Rapporteur Member State (RMS) and peer reviewed by experts from all Member States, concluded that safe uses of this substance exist"*.

9. **The Ombudsman rejected our complaints** on 03/10/2012.

10. **Defra/Fera protects humans from dioxins but not from neonicotinoids**. Defra and Fera continue to protect humans from Persistent Organic Pollutants (POPs), such as aldrin, dieldrin and DDT and dioxins. *"They are a group of chemicals which persist in the environment, may bioaccumulate in food and human tissues and are toxic. The two remaining POPs (known collectively as dioxins) have never been produced intentionally but may be formed as a by-product during combustion or some industrial processes. In the UK, dioxins have been recognised as chemicals requiring action for many years and significant action has already been taken to reduce exposure to them. Overall UK environmental emissions reduced by around 70% between 1990 and 2005. The major route of human exposure to dioxins and dioxin-like PCBs is through the food chain. Over the past 10 years, there has been approximately a 70% reduction in levels of dioxins and dioxin-like PCBs in food. <u>The Food Standards Agency continues to monitor the UK food supply and animal feeds for dioxins and dioxin-like PCBs to further reduce human exposure</u>."* In that case, why did EFSA publish a Scientific Opinion on the herbicide 2,4-D (one half of the infamous *Agent Orange*, a dioxin used as a defoliant during the Vietnam War) in November 2011? Its effects on human health are uncertain, but veterans exposed to this chemical had increased risk of non-Hodgkin's lymphoma and the US EPA had suggested it has endocrine disruption potential in mammals. The answer may be because in the US, Dow has applied for a GMO corn that is tolerant to 2,4-D and glyphosate. The herbicide 2,4-D was re-registered in the EU in 2002 and Greece is in the process of revising the existing MRLs in crops and in meat; many have already been recommended for use.

11. **Japanese field study on CCD, clothianidin and dinotefuran**. A Japanese 4-month field study done on eight colonies of 10,000 bees per colony suggested that dilute solutions of neonicotinoids from paddy fields and in orchards can be carried back to the hive in pollen and over a period leads to collapse or over wintering failure. (Toshiro Yamada, Kazuko Yamada, Naoki Wada. <u>Influence of dinotefuran and clothianidin on a bee colony</u>. *Jpn. J. Clin. Ecol.* Vol.21 No.1 2012.) <u>Conclusions</u>: *A colony rapidly dwindled after the administration of dinotefuran or clothianidin and finally became extinct after taking on an aspect of CCD. That is, a queen bee did not disappear until adult bees became few and brood and foods existed in the colony at the point in time when a queen disappeared. Wax-moth larvae did not exist for some time after the extinction of colony. This means that the CCD is just one of situations where a colony dwindles away to nothing although it may look mysterious. These results strongly suggest that the neonicotinoid pesticides such as dinotefuran and clothianidin can most probably cause CCD whose mechanism is proposed as follows: In supposing that a pesticide is sprayed and diluted in water of a rice paddy or an orchard and its concentration becomes low, the low-concentration pesticide carried by foraging bees continues to affect a colony for a long time and finally leads to a collapse of a colony or the failure in wintering. Even if a colony does not collapse and looks active, it causes an egg-laying impediment of a queen and a decrease in immune strength of bees leading to the infestation of mites in a colony.*

12. **Immune suppression confirmed in medaka fish in rice paddy fields in Japan** Sánchez-Bayo and Goka, while studying Japanese medaka fish in experimental paddy fields, observed physiological stress in juvenile medaka and massive infections of the weaker fish by a *Trichodina* ectoparasite where rice was treated with imidacloprid, compared with medaka in control rice fields. This proved that imidacloprid causes immune suppression in fish as well as in honeybees. (Sánchez-Bayo, F, Goka, K.

Unexpected effects of zinc pyrithione and imidacloprid on Japanese medaka fish (*Oryzias latipes*). *Aquatic.Toxicol.* **74** (4), 285-293 (2005).)

13. **KidsHealthReportOct2012.pdf** A generation in jeopardy. How pesticides are undermining our childrens' health and intelligence. This is a new US Report from Pesticide Action Network North America (PANNA).

Executive Summary

"*Children today are sicker than they were a generation ago. From childhood cancers to autism, birth defects and asthma, a wide range of childhood diseases and disorders are on the rise. Our assessment of the latest science leaves little room for doubt: pesticides are one key driver of this sobering trend. As the recent President's Cancer Panel reports, we have been "grossly underestimating" the contribution of environmental contamination to disease, and the policies meant to protect us have fallen far short. Nearly 20 years ago, scientists at the National Research Council called for swift action to protect young and growing bodies from pesticides. Yet today, U.S. children continue to be exposed to pesticides that are known to be harmful in places they live, learn and play. This report reviews dozens of recent studies that examine the impact of pesticides on children's health. Our analysis reveals the following:*

• **Compelling evidence now links pesticide exposures with harms to the structure and functioning of the brain and nervous system.** Neurotoxic pesticides are clearly implicated as contributors to the rising rates of attention deficit/hyperactivity disorder, autism, widespread declines in IQ and other measures of cognitive function.
• **Pesticide exposure contributes to a number of increasingly common health outcomes for children, including cancer, birth defects and early puberty.** Evidence of links to certain childhood cancers is particularly strong.
• **Emerging science suggests that pesticides may be important contributors to the current epidemic of childhood asthma, obesity and diabetes.**
• **Extremely low levels of pesticide exposure can cause significant health harms,** particularly during pregnancy and early childhood.

Appendix B page 38 Top pesticides used in agriculture and at home.
Table B-1*"Most commonly used pesticide active ingredient in agriculture"* and
Table B-2 *"Most commonly used active ingredient at home"*; listed by volume of use.

The US pesticide figures don't add up

On Table 4 page 27, Pesticide usage (in the US) in all market sectors in 2007 is stated to have been 857 million pounds of active ingredient.
This figure is at odds with the US EPA fact sheet published in January 2012 which says that: "*approximately 5.1 billion pounds of pesticides are used each year in the United States*"…
(The US billion has only nine 'noughts' whereas the UK billion has twelve). Even so, there is a huge difference between the 5.1 (US billion) pounds in 2012 and the 857 million pounds that the EPA claimed were used in the 2007 figures for the Kids Health Report. Presumably by only putting in the weights applied for the older pesticides, they could be exonerated from blame for effects on humans, particularly during fetal life, in infancy and in childhood when their organs are at their most vulnerable to toxins. In that case, where were all the other pesticides (and GMOs) hiding? The US EPA has a second list on which all these pesticides appear; the allegedly "*reduced-risk pesticides*" whose

concentrations in surface or ground-water water are not being monitored by any of the environmental protections agencies.

EPA Fact sheet Jan 2012 goes on to state: *"A challenge for EPA is to ensure that pest control and pesticide use become increasingly safer each year. To meet this challenge, EPA is promoting safer pesticides and reducing risks through the re-registration process. EPA is also expediting approval of safer, reduced-risk pesticides, and assessing more completely the potential risks of pesticide products, with special protections for infants and children."*

Absent from the list of monitored pesticides are the following neonicotinoid insecticides: imidacloprid, thiamethoxam, clothianidin, dinotefuran, thiacloprid, acetamiprid and all the GMO herbicide-tolerant seeds, most of which have insecticides applied to the seed. Only the old pesticides are being monitored. Lethal new insecticides are hidden from US public view. Similar concealment takes place in Europe. These are the silent killers.

Insecticides in homes and gardens in the US *"In 2007, an estimated 78 million pounds of pesticides (measured by active ingredient) were applied in homes and gardens across the country, with the herbicides 2,4-D and glyphosate (RoundUp) topping the list. The household pesticide product industry has an estimated annual net worth of $1.4 billion; according to US EPA, more than 78 million households—roughly 74% of all households in the U.S.—report using pesticides at home. Our current system of industrial agriculture and pest control relies on chemical inputs sold by a handful of corporations. These multinational corporations wield tremendous control over the system, from setting research agendas to financing, crop selection and inputs throughout the production and distribution chain.*
Not surprisingly, these same corporations also hold significant sway in the policy arena, investing millions of dollars every year to influence voters, lawmakers and regulators at both the state and federal level to protect the market for pesticides.
The result is agriculture, food and pest control systems that serve the interests of these corporations well. It does not, however, serve farmers, who have lost day-to-day control of their operations and are putting themselves and their families in harm's way. Farmworker interests are not served, as workers are continuously exposed to chemicals known to harm human health. And the health of children across the country is compromised by exposure to pesticides used to control pests in agriculture and where they live, learn and play. In short, the system is broken."

The top six agrochemical corporations are being protected. Do they have an agreement with NAWQA not to monitor their products in surface and groundwater?
The link shows the distribution of imidacloprid on crops in 2002 from the NAWQA website and the maps are at the end of the document, pages 33 & 34.
http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=02&map=m3004
The second link shows the distribution of thiamethoxam on crops in 2002.
http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=02&map=m248

14. **Commission Dalli resigns; corruption in Europe**. European Commissioner Dalli resigned on 16/10/2012 because of the results of an anti-fraud investigation (by OLAF). It was nothing to do with pesticides or GMOs, even though one of Dalli's first actions on coming into office was to lift a 13-year ban on BASF's GM potato Amflora.

The EU Press statement on 16/10/2012: *"The OLAF report showed clearly that the European Commission's decision-making process and the position of the services concerned has not been affected at all by the matters under investigation."*
In Europe, it is business as usual. With Dalli gone, there will still be other lobbyists left to take his place, all determined to get GMO crops and food into Europe.
Corporate Observatory Europe and many other campaigners have repeatedly complained to the European Ombudsman about European Commission's failure to curb 'revolving doors'. '*A large number of senior staff have moved through revolving doors in industry, or vice versa, including as lobbyists, creating potential conflicts of interest*'. The complaint refers to 10 cases which highlight these concerns.
In October 2012, the European Court of Auditors criticised the Commission's agencies for failing to take adequate action to tackle 'revolving door' type conflicts of interest. (Special Report No 15/2012: Management of conflict of interest in selected EU Agencies). Transparency International has described the "*excessive and undue influence of lobbyists in the European Corridors of power*" as a form of "*legal corruption*".
Dalli's portfolio has temporarily been taken on by Vice-President Maros Sefčovič. When in charge of transparency issues, Commissioner Sefčovič repeatedly rejected concerns from Civil Society Groups urging the Commission to take firmer action against revolving door cases.

29 October 2012

Written evidence submitted by Dr Christopher Connolly, University of Dundee

Summary
1. Pesticides are screened for safety on the basis of their ability to kill individual bees (LD_{50}) but no consideration is given to sub-lethal toxicity.
2. The LD_{50} is determined for individual bees, not whole colonies.
3. Sub-lethal toxicity does not, necessarily, mean the death of the individual bee.
4. Sub-lethal toxicity may induce a vulnerability to other insults such as disease.
5. Many pesticides target the insect brain.
6. Sub-lethal toxicity in bees may lead to a dysfunction in the brain.
7. Many pesticides are used prophylactically by farmers and in combinations that are not reported.
8. Pesticides can act together by disrupting related targets.
9. All chemicals, be they medical therapeutics or pesticides, exert off-target activity. How this works is unpredictable and need to be tested empirically.
10. Lab tests versus 'realistic' field studies.

Detail

1. The level of pesticide required to kill a bee is important, but misses the real toxicity of compounds. Chemicals may cause chronic damage to insect pollinators (possibly even humans!) if exposed acutely (eg. Asbestos exposure in humans) or chronically (eg. Alcohol/smoking or therapeutic drugs like valium in humans). In both human cases, toxicity is only evident after long periods. Delayed toxicity has now been demonstrated in bumblebees (Whitehorn et al 2012, Gill et al 2012), where pesticide effects require many weeks.
2. For the social insect such as the bees, ants and wasps, it is the colony that is the breeding unit and so it is this that is most important. I accept that it is not reasonable to use whole colonies of honeybees for toxicity studies as this would be prohibitively expensive and flawed by their interaction with a complex environment that cannot be controlled.
3. Nevertheless, in the case of the social insects, individual weaknesses (non-lethal) may have a direct impact on the entire colony and poisons may even be taken back to the colony where they are stored (Mullin et al 2010) and fed to their developing young. As the neonicotinoids are based on nicotine, it is possible that the developmental toxic effects, observed in the human foetus of a smoking mother, predicts similar developmental deficits of bee larvae fed neonicotinoid contaminated food. Societal breakdown could occur at multiple levels, such as, learning (to be efficient in sourcing food), communication (sharing information regarding food resource availability/colony condition), navigation (negotiating their way in the environment)(Henry et al 2012), reproduction (queen only) and behaviour (colony dynamics).
4. Bees (or other pollinators) weakened by pesticide exposure may be more vulnerable to other threats such as disease or mite infestation. In fact the combined toxicity of a pesticide along with a disease is a common strategy of "Integrated Pest Management" as recommended by WHO to tackle malaria (using a fungus with Permethrin), cattle ticks (fungus plus deltamethrin) and maize rootworm (nematode plus tefluthrin). So, it is likely that such interactions occur in our pollinators that are facing multiple chemical and disease stresses. In support of this hypothesis, this possibility is starting to be reported (Alaux et al 2010, Aufauvre 2012, Vidau 2011, Pettis et al 2012, Wu 2012). The mechanistic basis for this is unknown.
5. We know that many pesticides target the insect brain, making the social insects more vulnerable to their exposure. The brain is a plastic structure that relies on changes to drive higher cognitive function, mood and social behaviour.

6. Dysfunction of the brain may not cause gross morphological changes. In fact, dysfunction is more likely to result in subtle changes to the structure and function of synapses (sites of information transfer between neurons and the sites of learning). Synapses can learn to become stronger, or weaker, and so directly impact the efficiency of information flow in that particular circuit. Disturbing this 'plasticity' can lead to alterations in their learning ability and/or affect mood/social interactions.
7. Pesticides are now used as preventative measures, in the absence of any threat to the crop (or pets – eg. Worming). Therefore, the risk to the environment and human health is much greater than necessary. We should not be killing all insects (and so the local ecosystem), only those that have become a problem. In fact, the situation is even worse as the information on what pesticides have been applied (and where and when) is not available. Therefore, should particular pesticide combinations be dangerous, we could never learn from such mistakes. Suppose 10% of local inhabitants are exposed to a cancer-causing combination of pesticides. Ten years later we may (or may not) identify a link with the local environment but would not have access to the information required to make that link. However, if the local use of pesticides were available, bioinformaticians/epidemiologists could correlate local bee losses (we saw a 5% overwintering failure in the west of Scotland and a 20% loss in the east, Fife was particularly bad) with local pesticide use. The identity of the farmers could easily be kept confidential as it is the correlation of pesticide use to pollinator losses that is important. Achieving this important policy change would have a major impact and could fast track scientific research by targeting it to potential causes of the pollinator declines. Such information may also inform on the causes of the many idiopathic, chronic human diseases like the neurodegenerative disease and Irritable Bowel Syndrome in humans.
8. Pesticides can work together at target sites to enhance toxicity. We have tested this hypothesis in our ongoing research programme "An investigation into the synergistic impact of sublethal exposure to industrial chemicals on the learning capacity and performance of bees" (funded by the IPI), with respect to the cholinergic synapse that is targeted by pesticides that; A. Alter the release of acetylcholine (eg. λ-cyhalothrin and τ-fluvalinate). B. Inhibit the removal of excess acetylcholine (eg. Chlorpyrifos and coumaphos). C. Directly stimulate the excitatory acetylcholine receptors (neonicotinoids). Together, chemicals targeting these sites are likely to work in concert to increase the neural deficits or lower the dose required to perturb the neural pathway. Our studies have shown interactions between imidacloprid and coumaphos, at both the level of brain activity (Dundee - manuscript under review, Palmer *et al*) and learning (Newcastle - manuscript under review, Williamson *et al*) in the honeybee, or with imidacloprid and λ-cyhalothrin on bumblebee colony performance (Gill *et al* 2012). Similarly, interactions between coumaphos and τ-fluvalinate have been shown to enhance toxicity to honeybees (Johnson et al 2009). Interactions at other synapses are also likely, as well as interaction at other sites (eg. Gut function or chemical detoxification).
9. In addition to the consequences of toxicity due to pesticide effects at target sites, significant off-target activity is also common. This is also true for therapeutic drugs where their use is determined according to their side effects. For pesticides, it is well known that many of the fungicides are much more toxic than anticipated, exhibiting unexpected synergy with other chemicals (Pilling *et al* 1995). We are, using *in vitro* models, researching a particular fungicide that appears to interact with cholinergic therapeutic agents used medicinally to treat Alzheimer's disease patients and women treated for bladder weakness (unpublished data – MRC grant application under review).
10. With respect to the criticism of the validity of all lab studies, past and future, in preference for the more relevant field studies, I consider this claim totally unprofessional and lacking all scientific credibility. Laboratory studies are the cornerstone of all therapeutic drug discovery as they provide a mechanistic description of events that can be controlled and tested experimentally. These studies

identify real and quantified threats. In contrast, field studies are performed in a particular context with an uncontrolled surrounding area. What may be found at one site could be irrelevant to that found at another site. This is especially important given the multiple stresses to which our pollinators are exposed and the likelihood that multiple threats contribute to the pollinator decline. It is true that a laboratory based mechanistic explanation does not confirm that these effects are largely responsible for the pollinator decline. This will require countrywide bioinformatics once we know what pesticides have been used. An isolated field study has limited value.

How do we proceed to put in place more appropriate testing regimes? In the absence of knowledge regarding local pesticide use this will be difficult and should not be permitted. Nevertheless, more interaction of DEFRA with university laboratories is essential to determine these new risks. Key disciplines, such as pharmacology and neuroscience must be included in the assessment process (this is seriously lacking at present). All new compounds should be subjected to these higher standards (sub-lethal and chronic toxicity on both honeybees and bumblebees) before they are released for use. This will require the companies paying (indirectly to avoid any undue influence) for the independent university study.

In summary, we are playing ‘Environmental Ker-Plunk’, using pesticides to remove insect species (possibly also higher species) and we don’t know which species will be lost and how many other species will collapse with them. Eventually, the entire ecosystem will collapse unless we monitor and regulate pesticide use appropriately. With the growing world population, with increasing appetites, we have to learn to live with pesticides, not just ignore them.

26 October 2012

Written evidence submitted by Bee the Change

Submitted on behalf of Bee The Change, Facebook Awareness Campaigners. The campaign has 82,636 members worldwide, including 8,153 new members in the seven days ending on October 29, 2012.

The group is campaigning for effective regulation under the Bees Act 1980 to restrict the import of 'Foul Brood' spore infected honey products and for the immediate ban of neonicotinoid pesticides (acetamiprid, imidacloprid, thiacloprid or thiamethoxam etc).
These pesticides are closely linked to Colony Collapse Disorder and are not only available to farmers but can be purchased from Garden Centres, for entirely unregulated domestic (garden) use.

1. The British Bee Keeper's Association (BBKA) was until recently endorsing the use of neonicotinoid pesticides. The organisation was also receiving payment for this endorsement from Agro-Chemical Companies. (McCarthy, January 12 2011).

(a) It is possible to infer that the BBKA may have given erroneous advice, during the period of this paid relationship.
(b) Varroa (honey bee stock depletion) has become established wisdom, despite evidence that Varroa is manageable.
(c) Advice has been to date that the Varroa Mite is mostly responsible for the depletion of bee stocks. However, Varroa management is possible without chemical control and Memorandum #2 (Flores, Sept 11, 2009) shows honey bee adaptations, mitigating Varroa.

2. The use of Agricultural Pesticides is regulated in purchase and use. However Domestic Use (purchased from Garden Centre) is not regulated. Additionally, bees find diverse (flower) forage in urban environments, arguably better that in a (monocultural) Agricultural Environment.

(a) Does DEFRA have jurisdiction over Domestic Pesticide Regulation?

3. The Bees Act 1980 requires that Secretary of State for Environment, Food and Rural Affairs, the Secretary of State for Scotland and the Secretary of State for Wales to agree and decide jointly that a threat is posed to the health of bees. These are now individual powers and devolved to Assemblies

(a) The spirit of 1980 Act of Parliament is towards the protection of Bees from 'pests'. This does not explicitly exclude chemical pesticides, for instance sprayed on gardens/ agricultural areas and where forager bees are able to visit that area (freely). Foragers will pass (as stomach contents) throughout the colony. Chemical may thus be stored in honey, re-affecting the colony at a later time, reducing the statistical correlation of any colony reduction in relation to spraying.
(b) Paragraph 3 of the 1980 Act covers the revocation of licenses to sell chemicals that are a pest to bees.

4. Apiform Colonies, being an organic system, may recover more slowly than expected under removal of any pest threat. This is due to other factors, such as weather conditions which are not under human control.

(a) £1.8bn spending on human hand-pollination (Carrington, April 2012) indicates a financial saving available to the government in the removal

of detrimental factors to Honey Bee Stock.
(b) Pesticides are not the only potential contributory factor to Honey bee decline but it is a controllable one. Responsible agencies are therefore required to use this control as part of protection required due to the Bees Act 1980.

5. Public interest in the area of honey bee decline is increasing.
The attached petition gives details on the call by signatories for the banning of neonicotinoid pesticides.

(a) The attached petition shows signatures filtered by country.
Additional signatures indicate the worldwide concern over the use of neonicotinoids.
(b) Worldwide pesticide usage demonstrates that there may be no land areas of refuge for pollinator species. (eg. with spraying, seed coating, genetic modification and domestic garden use, many areas of application increases the likelihood of contact with Honey Bee Species, which are irreplaceable.
(c) Please note dangers of 'genetic bottleneck' where reduced numbers of colonies may cause total population crash in the event of colony islandisation, where unmated queens being out of range of male drones from unrelated colonies, if colonies become sporadic and spread out.

6. Petition (as of October 29 2012)

20,362 signatures	(Worldwide)	
940	Australia	(Commonwealth Country)
808	Canada	(Commonwealth Country)
9,436	United Kingdom	

To: Department for Environment - Food and Rural Affairs, Secretary of State for Scotland, and the Secretary of State for Wales

We the undersigned, Demand that neonicotinoid insecticides products be withdrawn from general sale in UK supermarkets, hardware stores, garden centres and farm supply stores according to the Bees Act 1980. Anything that contains acetamiprid, imidacloprid, thiacloprid or thiamethoxam must be banned.

Neonicotinoid is a widely used farm pesticide first introduced in the 1990s that has caused significant changes to bee colonies and removing it could be the key factor in restoring nature's army of pollinators, according to two studies released in March.*

Neonicotinoids are a class of insecticides chemically related to nicotine. Neonicotinoid imidacloprid is currently the most widely used insecticide in the world.* The use of some members of this class has been restricted in some countries due to evidence of a connection to honey-bee colony collapse disorder. The pesticide works as a neurotoxin by interfering with the transmission of stimuli in the insect nervous system.

29 October 2012

Written evidence submitted by Dr Robert Paxton

SUMMARY

• Drs Vincent Doublet and Robert Paxton of Queen's University Belfast/Martin-Luther-University Halle-Wittenberg have undertaken laboratory experiments on interactions between a neonicotinoid insecticide, thiacloprid, and pathogens for juvenile honey bee health.

• Both viruses and pesticides have a detrimental effect on honey bee brood development and survival.

• When viruses and pesticides are experimentally administered simultaneously to honey bee larvae at sub-lethal doses, they interact additively and sometimes synergistically, hindering larval development and enhancing larval/pupal mortality.

Reporting text:

As part of the BBSRC (Insect Pollinators Initiative) project 'Impact and mitigation of emergent diseases on major UK insect pollinators' (BB/l000100/1) and the EU funded research project BeeDoc (Bees in Europe and the Decline of Honeybee Colonies; 244956 CP-FP), Drs Vincent Doublet and Robert Paxton of Queen's University Belfast/Martin-Luther-University Halle-Wittenberg have undertaken laboratory experiments on the interactions between a neonicotinoid insecticide, thiacloprid, and pathogens for honey bee health.

Our aim was to examine experimentally and *in vitro* how viral infection and pesticides affect individual larval and pupal bees, and the interactions between viruses and pesticides, so as to identify the main 'driving processes' that cause honey bee mortality.

This research has become all the more relevant because two recent papers have highlighted the role of neonicotinoid pesticides, systemic plant insecticides of growing importance to agriculture, in bee mortality (Henry *et al.* 2012; Whitehorn *et al.* 2012). Other recent papers have also suggested a major role for pesticides, both neonicotinoids and acaricides commonly used by beekeepers to control *V. destructor* mites inside the hive, in exacerbating the effects of honey bee pathogens (Alaux *et al.* 2010; Vidau *et al.* 2011; Locke *et al.* 2012; Pettis *et al.* 2012).

This report details our research aimed at uncovering if and how two pesticides interact with the commonest viral pathogen of honey bees transmitted by *V. destructor* mites, deformed wing virus (DWV), to cause brood mortality and other developmental aberrations. As pesticides, we employed: (i) t-fluvalinate, a synthetic pyrethroid commonly used by beekeepers inside the hive to kill *V. destructor* mites; and (ii) thiacloprid, a neonicotinoid commonly sprayed on oilseed rape and the commonest of this class of insecticide found as a residue inside European beehives. In addition to DWV, we also extended our analyses to examine the effects of the second most common virus in honey bees, black queen cell virus (BQCV), and its interactions with pesticides for honey bee health.

Experimental Protocol

To examine the interaction between pesticides and pathogens, we inject DWV into white-eyed pupae as our DWV treatment. We also undertook a series of parallel experiments in which we fed DWV to larvae on day 2 of larval age as our means of DWV treatment. This had the advantage that DWV is naturally acquired by feeding and its natural site of infection is likely the alimentary canal (ventriculus) of bees. This treatment therefore adds an extra dimension to our experiments on the interactions between DWV and pesticides for honey bee health.

We additionally investigated the impact of BQCV on honey bee larval/pupal health in a further set of replicate experiments. In this case, we fed BQCV directly to 2-day old larvae. BQCV is relatively stable, compared to DWV, facilitating its experimental manipulation and use.

For all experiments described herein, we employed standard methods for honey bee larval/pupal rearing, as described in Aupinel *et al.* (2007). In short, honey bee eggs in brood combs were transferred to a 34^0C incubator at 95% relative humidity. As they hatched, eggs were transferred to individual wells of a 48 well microtitre plate and kept in the same conditions as described above. For each treatment (including each control treatment), we used 48 larvae/pupae per treatment. We replicated entire experiments 3 times using honey bees derived from 3 colonies i.e. each replicate used bees from one colony (total 154 larvae/pupae per treatment). A statistical power analysis suggested that these sample sizes would allow us to detect more subtle effects of pesticide-viral treatments than would otherwise have been the case. Mortality of larvae was recorded every day.

After entering the prepupal stage one week after hatching from the egg (see Fig. 1), microtitre plates were held at 35^0C and 80% relative humidity till the start of the pupal stage (see Fig. 1). Pupation success and mortality were recorded through to the end of pupal development and emergence of adults.

RESULTS

Experiment 1. Virus (BQCV) + neonicotinoid (thiacloprid) fed to honey bee larvae.

Figure 1 shows the % mortality of larvae/pupae when fed different doses of BQCV two days after hatching and transfer to 48 well microtitre plates. On the upper part of the figure we also give the developmental stage of honey bees to help interpretation. Figure 1 shows that a quantity of 10^9 BQCV causes high mortality. Lower doses of BQCV have no effect on larval/pupal mortality.

In Figure 2, we see the effects of BQCV on development (pupation success). In this case, 10^9 BQCV causes high developmental abnormality (lack of pupation); 10^7 BQCV causes moderate developmental abnormality (reduced pupation success); 10^4 BQCV does not cause developmental abnormality (pupation success is as good as control bees).

Varying doses of t-fluvalinate and thiacloprid were fed directly to larvae across the entire larval period (5 days). In summary, we found sublethal doses of these two pesticides to be:
t-fluvalinate: 1 mg/kg larval food
thiacloprid: 0.1 mg/kg larval food
and we used these concentrations in further experiment, both with BQCV and DWV.

In Figure 3 we show the effect of t-fluvalinate, thiacloprid, 10^9 BQCV and interactions among the three on larval mortality when one or other pesticide is administered with BQCV. There is a clear additive effect of a pesticide with BQCV on larval mortality. If lower doses of BQCV are used in treatments instead of 10^9 BQCV, there is a corresponding drop in larval mortality, as seen in Figure 1, with little additional effect of pesticide + BQCV on larval mortality beyond treatment with either pesticide or BQCV alone (Figure 4).

In Figure 5, we see a similar response of pupae (successful pupation) to treatment with BQCV and pesticides as we saw with respect to larvae and larval survival. In essence, both BQCV and pesticides reduce pupation success, and they seem to act additively. Additivity is particularly marked for the treatment 10^7 BQCV + thiacloprid (Figure 5).

Experiment 2. Virus (DWV) + neonicotinoid (thiacloprid) fed to honey bee larvae.

Figure 6 shows the % mortality of larvae/pupae when fed different doses of DWV two days after hatching and transfer to 48 well microtitre plates. A quantity of 10^9 DWV causes high mortality. Lower doses of DWV have no effect on larval/pupal mortality.

In Figure 7, we see the effects of DWV on development (pupation success). In this case, 10^9 DWV causes high developmental abnormality (lack of pupation); 10^7 DWV causes moderate developmental abnormality (reduced pupation success); 10^4 DWV does not cause developmental abnormality (pupation success is as good as control bees). We note that controls for this experiment exhibited slightly elevated mortality.

As explained above, t-fluvalinate and thiacloprid were fed directly to larvae (t-fluvalinate: 1 mg/kg larval food and thiacloprid: 0.1 mg/kg larval food). In Figure 8 we show the effect of t-fluvalinate, thiacloprid, 10^9 DWV and interactions among the three on larval mortality when one or other pesticide is administered with DWV. There is a clear effect of a pesticide with DWV on larval mortality, and the data suggest the effect is synergistic (more than additive) in relation to DWV + either pesticide. If lower doses of DWV are used in treatments instead of 10^9 DWV, there is a correspondingly lower larval mortality, as seen in Figure 6, with no effect of pesticide + DWV on larval mortality beyond treatment with either pesticide or DWV alone i.e. additive effect, if at all and interactive effect (Figure 9).

In Figure 10, we see a similar response of pupae (successful pupation) to treatment with DWV and pesticides as we saw with respect to the DWV treatment of larvae and larval survival. In essence, both DWV and pesticides reduce pupation success, and they seem to act additively. Additivity is particularly marked for the treatment 10^7 DWV + t-fluvalinate.

Experiment 3. Virus (DWV) injected into + neonicotinoid (thiacloprid) fed to honey bee pupae.

Figure 11 shows the frequency of honey bees with wing deformity after emergence when injected with 10^3 viral particles of DWV and fed with or without pesticides during larval development. Pupae were injected at day 11 post-hatching. Honey bees were considered as emerged when ready to walk out of the experimental chamber (rearing plate). All treatments, including the injection of 10^3 viral particles of DWV, led to a high frequency of honey bees with deformed wings compared to treatments where bees were injected with a control solution. The effect of pesticides on the frequency of wing deformity when bees were injected DWV is low, though beyond that of controls. The interaction between DWV and pesticide is generally additive and never synergistic or multiplicative.

Conclusions with respect to the neonicotinoid: thiaclporid

BQCV and DWV have profound effects on their hosts, developing honey bee larvae, causing developmental abnormalities and mortality with increasing pathogen loads. A neonicotinoid pesticide (thiacloprid), when experimentally administered at sub-lethal doses to larvae or pupae, generally interacted additively with these two viruses, DWV and BQCV, to elevate mortality and developmental abnormalities. There is even a potentially synergistic interaction between DWV and the pesticide when the virus is fed at high but biologically realistic doses to larvae.

30 October 2012

Written evidence submitted by Friends of the Earth

Executive summary

1. Bees and other pollinating insects are essential to the economy, to the effectiveness of farming and the quality of produce and to the nation's ecological function and cultural well-being. The Government's recognition of the value and importance of bees in particular has yet to translate into firm action commensurate to the urgent need to ensure the survival, protection and recovery of bee and insect species.

2. The Government's recent neonicotinoids review has not diminished concern that chemicals containing active 'neonic' agents are, whether individually or in combination with other crop protection applications, harming wild species and compounding the other known causes of bee and insect decline – habitat loss, general farming practice., the way built development takes place and pests and diseases in managed honey bee colonies.

3. The review announced on 13 September 2012 was less thorough than expected. Despite its limitations the review found that recent independent studies which had prompted the Government's review do 'provide evidence of sub-lethal effects of neonicotinoids'. But the review concluded that 'none of the studies give unequivocal evidence that sub-lethal effects with serious implications for colonies are likely to arise from current uses of neonicotinoids.'

4. Another review finding is that the current risk assessment does not include testing for their potential effect on the majority of bee species – the honey bee (*Apis mellifera*) being only one of Britain's 267 bee species. The current testing regime for chemicals and new products is uninformed by robust tests for the effect of chemicals on the majority of pollinating insects. This is a deep flaw in the testing regime and although is not especially revelatory as it was common knowledge before the review was published it is good that this is formally acknowledged in the review.

5. Notwithstanding the sizable holes in the testing regime and the Government's ability to know the safety of products, the review stated that the Government is satisfied that the recent studies 'do not justify changing existing regulations.'

6. Another gap in the review is its focus mainly on honey bees with only limited consideration of other bee species. Of the 15 recent published studies reappraised in the review at least 11 are studies of honey bees.

7. Further flaws in the review are that it does not comprehensively address the compound effect of exposure to chemicals on the other known causes of insect and bee decline such as habitats loss, and that it does not examine the combined effect of individual chemicals on insects.

8. The neonicotinoids review should be considered in the context of the Government's National Pesticides Action Plan currently being drawn up as required by the European Sustainable Use Directive. The draft Action Plan submitted by the Government for public consultation does not comply with the Sustainable Use Directive. Without substantial improvement the draft Plan

would be likely to continue undue threats to wildlife, water systems and public health instead of taking the required direct approach to reducing risk.

9. The issue of chemicals and insects gives the Government every opportunity to act with a sense of urgency and precaution but it is far from clear what its actions and intentions amount to. If bees and other insects are as important to farmers, food security and food prices as evidence and Government statements suggests, their welfare is a prime case for invoking the precautionary principle. Yet at every opportunity, the Government appears to express caution about the precautionary principle. The question arises; under what conditions would the Government invoke the precautionary principle?

10. Suspending use of neonicotinoids could be part of a proper testing regime as well as and a way to start helping farmers and other users to reduce their use of and dependence on chemicals.

Introduction to the submitter

Friends of the Earth has worked for over 40 years to protect our natural environment as part of shifting society and the economy to sustainable development approach

As part of *The Bee Cause*, our campaign to end the plight of British bees, we have commissioned the UK's leading bee experts at the University of Reading to compile all of the latest evidence on the causes of bee decline - habitat loss, farming practice, development pressures, chemical use and pests and diseases - into a single report.

Available at www.foe.co.uk/beesreport the report recommends actions for the Government and others and endorses the need for a comprehensive UK Bees Action Plan to deal with all aspects of bee decline in a coordinated way.

Recommendations

1. **Draw up a British Bee Action Plan** - The drawing up of a National Bee Action Plan addressing all causes of bee decline including exposure to chemicals should be led as a matter of urgency by the Government.
2. **Suspend use of neonicotinoids** - The use of neonicotinoids should be suspended pending further research that they do not cause harm.
3. **Revise Government statements** - The Government's own public statements about chemical and product safety should be revised to reflect the uncertainty which the Government has itself accepted about the current testing regime. Statements by Ministers and their agencies should also be revised.
4. **Improve research** - The remaining work due to be carried out by the Government on the remaining stages of the neonicotinoids review by the end of 2012 and spring 2013 must fully address the combined effect of chemicals on all wild bee species and other insects if it is to improve on the limited approach taken by the review up to 13 September 2012 which looked mainly at honey bees and considered neonicotinoids in isolation from other chemicals and the other main causes of bee decline. Research is also required to monitor the actual presence of neonicotinoid insecticides in nectar crop pollen, nectar, foraging bees (including bumblebees and solitary bees), stored pollen and honey.
5. **Improve pesticide accreditation** – accreditation should be amended to include independent, quantifiable and cross-taxa risk assessments of their impacts, including sub-lethal effects, on a range of bees and other insects in

both laboratory and field conditions, including the residues within the pollen and nectar of mass flowering crops.

6. **Improve product labelling** - Labelling regulations for pesticides should be improved to include more specific recommendations which account for the seasonal activity patterns and nesting habits of on-farm taxa, based on up to date ecological information, and extend these standards to non-agricultural pesticides i.e. use in gardening, domestic and horticultural settings.
7. **Improve the National Pesticides Action Plan** - The National Pesticides Action Plan being produced by the Government by 26 November 2012 should commit to protecting nature and public health through the sustainable, phased reduction in the use of pesticides with quantitative targets for the reductions in the total application of all pesticide active ingredients; the Plan should also encourage, support and incentivise the take up of alternative methods of pest management.

Submission response

1. The use (or abuse) of evidence in this particular case, for setting policy and regulations on pesticides.

Friends of the Earth consider that the September 2012 decision of the Government to delay taking action in response to the mounting evidence of harm to bees and other pollinators from the use of neonicotinoid insecticides does not represent good use of science, sound interpretation of the precautionary principle and adequate action commensurate with public concern about the threat to British bees and other pollinating insects.

Government statements to the effect that products are safe appear premature when considerable gaps exist in its own knowledge about the safety of products containing different chemicals – including neonicotinoids - whether in commercial farming, horticulture or domestic gardening settings. For example, at a 25 January 2011 Westminster Hall debate, Lord Henley, then Defra Minister, stated, "In the UK, neo-nicotinoid insecticides are used primarily in commercial agriculture and horticulture production. Only a very small proportion is used in home garden products so the potential risk to bees, if any, from this type of product is negligible." (Hansard Citation: HC Deb, 25 January 2011, c67WH) It is hard to see how such statements can be sustained when neonicotinoids are prevalent in 20 or so chemical applications intended for use by gardeners as well as being pre-applied to most seeds and also to plant pots. All of these are available over the counter from garden centres.

The Government's neonicotinoids review acknowledged that the recent independent studies present evidence of harm in laboratory conditions and decided that more research is needed in field conditions. The review acknowledged that there are significant gaps in the Government's understanding of the impacts of treatments on solitary and bumble bees - the majority of bee species - and indicated the need for more research is needed.

Friends of the Earth do not dispute the value of more research especially where there are significant gaps in understanding about actual levels of exposure and about the potentially different impacts on different bee species.

But conducting further research is not in itself a reason to delay action. The Government has undertaken a process of scientific evaluation and has concluded that scientific uncertainty remains. This uncertainty should support and prompt, not rule out, a precautionary approach. Gaps in the Government's knowledge were also listed in the FERA paper for EFSA[1] *which suggested that there are other routes of exposure for bees which are not currently considered such as dust during the sowing of seeds pre-coated with neonicotinoids and residues in water sources.*

If harm is being done to bees then the costs of inaction are likely to be considerable, including financially. Pollination by bees has also been shown to be important to the quality of the produce that is sold to consumers. And insect pollinators are also important in wider biodiversity as they pollinate the plants that other species rely on for food and shelter. The University of Reading has calculated that it would cost UK farmers at least £1.8 billion a year to replace the services of bees and other pollinators with hand pollination. The recent review looked mainly at research into chemical effects on managed honey bees. This is in keeping with the Government's tendency to talk mainly about honey bees and to fund research accordingly. Despite receiving far less attention Britain's native wild bees are even more important pollinators of food crops than managed honey bees.

As the negative impact of the continued use of neonicotinoids could be irreversible, the Government should not seek to rely on the lack of full scientific certainty as a reason for delay (Article 15 of the Rio Declaration). A suspension of neonicotinoid products with most evidence of harm while further research is carried out, and regulations amended, would be entirely plausible for the Government in keeping with robust science, proportionate action and the precautionary principle.

Shortly after the publication of the Government review a further study (part funded by Defra) provided more worrying evidence of potential harm to bumblebees at realistic levels of pesticide exposure and exposed another flaw of the approvals system - that the combined effect of pesticides is not taken into account. The authors made the following points about the research:

"Currently pesticide usage is approved based on tests looking at single pesticides. However, our evidence shows the risk of exposure to multiple pesticides needs to be considered, as this can seriously affect colony success," Dr Raine.

"The novelty of this study is we show how the sublethal effects of pesticide exposure affects individual bee behaviour with serious knock-on consequences for the performance of the colony as a whole," Dr Gill.

The Government's response to this new evidence is awaited.

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[1] Thompson, H (2012) **Interaction between pesticides and other factors in effects on bees FERA**1

1.7 A wider failure to set policy for pesticides of concern is apparent in the draft National Action Plan on pesticides – the consultation period for which closed on 22 October. The UK is due to submit a National Acton Plan to the EC by 26 November 2012 as required by the Sustainable Use Directive (SUD). The SUD requires member states to include in their NAPs targets to cover particular areas of concern which could include environmental protection, worker protection, or use in specific crops. The SUD sets out that member states should monitor use of pesticides of particular concern, especially if alternatives are available, and set reduction targets. Currently the draft UK NAP does not do this. We should be pleased to furnish the Committee with a copy of our consultation response to the Government's draft National Pesticides Action Plan.

2. The application of real-world – 'field' – data. What monitoring there is of actual – rather than recommended – levels of pesticide usage, and the extent to which that influences policy on pesticides.

2.1 Research by the University of Reading[2] for Friends of the Earth highlighted the worrying increase of pesticide use on crops which rely especially on bees for their pollination:

"In general, more insecticide treatments are applied per hectare in oilseeds and fruit crops than cereals, increasing the risk of exposure to bees."

For example, FERA's data shows that between 2005 and 2010 rates of insecticide application rates rose by 26% on oilseeds and by 295% on strawberries. Since the testing regime for chemicals excludes the effect on wild bees the effect of these considerable rises in chemical use is unknown.

2.2 Understanding of the exposure of bees and other pollinators would rise significantly if research were carried out to monitor the actual presence of neonicotinoid insecticides in nectar crop pollen, nectar, foraging bees (including bumblebees and solitary bees), stored pollen and honey.

3. Potential impacts of systemic neonicotinoid insecticides on human health.

3.1 It appears that studies into the effects of systemic neonicotinoids on human health are another area where research has been lacking. Studies include those by Barouki et al. Environmental Health 2012, 11:42 and Kimura-Kuroda J, Komuta Y, Kuroda Y, Hayashi M, Kawano H (2012) Nicotine-Like Effects of the Neonicotinoid Insecticides Acetamiprid and Imidacloprid on Cerebellar Neurons from Neonatal Rats. PLoS ONE 7(2): e32432. doi:10.1371/journal.pone.0032432

As with any chemical treatments, there is certainly a need to fully understand the level of human exposure through food residues and use of chemicals in or near to public places such as parks, open spaces, streets and drainage systems. The same concerns apply about understanding how mixtures of

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[2] Breeze, T, D, et al (2012) *The Decline of England's Bees*: Policy Review and Recommendations www.foe.co.uk/beesreport

chemicals could affect human health and the long term impact of low level exposures.

4. What alternative pest-control measures should be used, such as natural predators and plant breeding for insect-resistance, in a bid to make UK farming more insect- and bee-friendly?

4.1 Expanding pollinator habitats and food sources such as flowering margins and hedges could also help to encourage natural predators of pests, reducing the need for insecticides. Crop rotations, especially incorporating legumes which are attractive to bees, would improve the diversity of flowering crops as well as building soil quality and reducing pest pressure.

4.2 Better monitoring of pests and more accurate forecasts of pest attack could also help to reduce the need for pesticide use. Seed treatment with neonicotinoids is now routine practice and it would be hard for farmers to purchase non treated conventional oilseed rape seed if they wanted to. Packets of seeds sold in garden centres are also pre-treated in this way.

4.3 More support for organic farming would help to reduce reliance on pesticides. But all farmers should be supported and encouraged to use Integrated Pest Management (IPM) techniques and the Government should have set out how it would do this in its National Pesticides Action Plan to assist the phased reduction in the reliance on chemical pesticides as part of reducing risks to public health, not to mention the financial cost to farmers.

4.4 The SUD requires that member states should "take all necessary measures to promote low pesticide-input pest management, giving wherever possible priority to non-chemical methods". Objectives, targets and timetables should be put in place. IPM should be at the heart of the plan. The widespread adoption of IPM techniques has the potential to achieve a real shift towards more sustainable farming practices that are insect and bee friendly and could also help farmers to reduce costs and overcome problems of pesticide resistance.

4.5 The draft UK Pesticides Action Plan is very weak in this area and it suggests that many pesticide users already follow the principles of IPM. In fact research in the UK part funded by Defra found that most British arable farmers only use a limited number of IPM techniques[3]. As effective IPM cannot be delivered by adoption of one or two techniques in isolation there is a need for a clear definition of what constitutes IPM and a commitment to supporting farmers to build on and add to the techniques they adopt.

4.6 Avoiding the use of pesticides in parks, school grounds and other public places should also be an aim of the Government in the NAP. Other cities such as Toronto and Paris have managed to go pesticide free or significantly reduce the use of pesticides. In the UK Eastbourne Borough Council[4] recently

[3] Rural Economy and Land Use Programme (RELU) 2009 "Overcoming market and technical obstacles to Alternative Pest Management in Arable Systems" http://www.relu.ac.uk/news/policy%20and%20practice%20notes/Bailey/Bailey%20PPN10.pdf

[4] http://www.eastbourne.gov.uk/leisure/parks/conservation/bees/

committed to reducing pesticide use in its parks and gardens. The UK Government should draw on this experience and offer leadership and guidance on this issue to all local authorities.

5 November 2012

Written evidence submitted by Bayer CropScience Ltd

1. Bayer CropScience

Bayer CropScience is dedicated to the development and production of safe crop production solutions for the food and farming industry. It has a long history in the agricultural world both here in the UK and elsewhere in the world, and has developed to its current position as one of the world's leading life science businesses via such well known names as Boots, Fisons, May & Baker, Schering, Hoechst, Rhône-Poulenc, AgrEvo and Aventis. Bayer CropScience employs 21,000 members of staff worldwide and approximately 170 in the UK. It is the UK's biggest supplier of crop protection products.

Bayer CropScience is a member of the Crop Protection Association (CPA) and fully supports the submission of this association on this subject.

2. Understanding Bee Health

2.1 Bayer has a long history as a bee health company, especially in the provision of products to treat the main threat to honey bee health, namely *Varroa destructor*. The *Varroa* mite is perfectly adapted to the lifecycle of the honey bee feeding on its haemolymph, and acting as the key vector for viral diseases like *Acute Paralysis Virus* (APV) and *Chronic Paralysis Virus* (CPV). The wounds inflicted by mites may also be contaminated with bacterial or fungal organisms.

2.2 Broadly speaking, where the *Varroa* is present, bee health is compromised; where the mite is absent or controlled, bee health is good. In most of the tropical and subtropical regions of the Southern Hemisphere, honey bees are of the African or Africanized sort, and bee health is good, mainly because such bees are more able to deal with *Varroa*. Australia has the European honey bee and despite the use of insecticides in agriculture at a similar level of that found in Europe or North America, has the healthiest bees on the planet; as a result of strict biosafety protocols, the *Varroa* mite has yet to reach its shores.

2.3 Bayer has recently announced the opening of the Bee Care Center at its research campus in Monheim, where its activities in promoting bee health are focused, to include finding new solutions for bee health issues and state-of-the-art stewardship of its crop protection portfolio. A second facility will open in the US in 2013 (http://www.press.bayer.com/baynews/baynews.nsf/0/615EA2E1245E4277C12579AB0049D955).

3. Real field data

3.1 There have been many studies that have attempted to look at what happens away from the artificial environment of the laboratory, using real bee colonies, real beekeepers in real fields. Perhaps the two most frequently referred to, mainly because of the rigour and length of the studies, are the German Bee Monitoring study that started in 2004 and is still on-going, and a French study by AFSSA.

3.2 The German study has involved more than 1200 bee colonies from across the country, which have been monitored for the last eight years and bee health was compared to a number of factors including the presence of the *Varroa* mite, fungi such as *Nosema* and *Ascosphaera*, bacteria such as *Paenibacillus*, a number of viruses including the *Deformed Wing Virus* (DWV) and the *Acute Bee Paralysis Virus* (ABPV), environmental factors, beekeeping practices, and of course pesticides (interim results published by Genersch E, et al. (2010): *The German bee monitoring project: a long term study to understand periodically high winter losses of honey bee colonies*. Apidologie 41 (2010) 332–352). Poor bee health during this time correlated very well with *Varroa* and both the viruses mentioned above, and the age of the queen. No such correlations were observed between poor bee health and *Nosema* or pesticides. During this time, nectar, honey, pollen and bee bread samples were analysed for the presence of insecticides. Whilst it was possible to find trace amounts of pesticide, there was no correlation between pesticide presence and bee colony health. Note that the neonicotinoid clothianidin was not detected and imidacloprid was detected only once in the 215 samples collected from 2005–2007.

3.3 The second multifactorial study comes from France where the government agency, AFSSA, looked at 120 bee colonies from around France between 2002 and 2005. Where colony mortalities occurred, no statistical link was found between poor bee health and the presence of pesticide residues, with the control of *Varroa* being seen as absolutely key (http://www.anses.fr/PM9100V1I0.htm for the English summary and http://www.anses.fr/Documents/SANT-Ra-EnqueteAbeilles2005.pdf for the original study).

4. Impacts of systemic neonicotinoid insecticides on human health.

4.1 The European Union is recognised as having the strictest regulatory system anywhere in the world when it comes to plant protection products such a pesticides. As part of this process, "plant protection products are only approved in the EU if it may be expected that their use will not have any harmful effects on human and animal health or on groundwater or any unacceptable influence on the environment" (http://www.efsa.europa.eu/en/pesticides/pesticidespeerreview.htm)

4.2 The development of neonicotinoid insecticides represented a step change in a farmer's or grower's ability to control destructive pests and the diseases that they spread, using products of very low mammalian toxicity. For example, in the public version of the Draft Assessment Report, "according to the toxicological properties of imidacloprid, harmful effects on the health of operators, bystanders, workers or consumers are not expected when the plant protection product is used in accordance with good plant protection practice" (via http://dar.efsa.europa.eu/dar-web/provision).

4.3 Likewise, the review report for clothianidin, finalised in the Standing Committee on the Food Chain and Animal Health concluded "that plant protection products containing clothianidin will fulfil the safety requirements laid down in Article 5(1)(a) and (b) of Directive 91/414/EEC."

http://ec.europa.eu/food/plant/protection/evaluation/newactive/list_clothianidin.pdf

5. Impact of not having access to seed treatments

5.1 It is important to recognise that farmers use insecticides for a reason; they are expensive to buy and expensive to apply. They are used because farmers need to control damaging insects and the diseases that they spread, if they are to produce the ready supply of safe, high quality affordable food that consumers demand.

5.2 As previously mentioned, the arrival of innovative products such as the neonicotinoid insecticides was a step change in pesticide use in that they are comparatively very safe to mammals. Furthermore, their suitability as seed treatments means that farmers can control damaging insects in cereals, oilseed rape and other crops at the germination and early growth stages when they are at their most vulnerable, without resorting to the application of broad spectrum insecticides, which control not just those insects that are foraging on the crop but also many insects that use the crop as cover.

5.3 The impact of restricting such seed treatments needs therefore to be understood. For example, in years of high pest incidence, farmers may have to apply up to four extra spray applications of pyrethroids or other insecticides.

5.4 A recent survey of oilseed rape farmers in the UK on the consequences of losing such seed treatments suggest that 90% of them would need to apply more foliar sprays, 79% of them felt their yields would decrease, and 72% of them felt that there could be adverse environmental consequences.

5.5 It is also worthy of note that France has restricted the use of neonicotinoid seed treatments for over 10 years; despite this, bee health in France remains similar to, or worse than, that seen here in the UK.

6. What alternative pest-control measures could be used, such as natural predators and plant breeding for insect-resistance, in a bid to make UK farming more insect- and bee-friendly.

6.1 Bayer CropScience believes that integrated pest management (IPM) is a key technique for dealing with insect pests in an environmentally sustainable manner, and has recently completed the acquisition of AgraQuest Inc., a global supplier of innovative biological pest management solutions. IPM does, however, require effective tools to do the job.

6.2 Encouraging predatory insects has been an important facet of improving the farm landscape with the provision of beetle banks and uncut margins demonstrating their usefulness in this area (http://www.gwct.org.uk/education__advice/english_entry_level_stewardship/habitat_issues/337.asp). Such provision should continue to be encouraged.

6.3 Biopesticides are becoming an area of interest although the focus has tended to be on glasshouse and orchard environments. That said, companies such as AgraQuest do supply extracts of fungi such as *Chenopodium* for field crops and *Bacillus thurengensis* has been widely used as an insecticide. This area will continue to flourish, as new opportunities arise.

6.4 The potential of innovative plant breeding in IPM is the subject of intense activity. Indeed, some of the most successful GM crops are insect tolerant varieties of crop plants, with 75 million hectares being planted with such varieties in 2011 (http://www.isaaa.org/resources/publications/briefs/43/pptslides/default.asp). There has also been a recent flurry of activity in the UK in this area with the recent trials of aphid resistant wheat having been successfully harvested at Rothamsted (http://www.rothamsted.ac.uk/Content.php?Section=AphidWheat).

5 November 2012

Written evidence submitted by The Co-operative.

Executive Summary

1. The evidence base on the impacts of neonicotinoid pesticides has grown dramatically in recent years linking long-term, chronic exposure to field realistic levels of the pesticides with problems with bee fecundity, impaired ability to pollinate crops, increased susceptibility to disease and the loss of hives[1].

2. In March 2012, the then Chief Scientific Adviser to DEFRA, Sir Bob Watson, publicly expressed his concern about the current UK position in regard to neonicotinoids and went on to state that he wanted the science reassessed "very, very carefully"[2].

3. The use of neonicotinoid pesticides is very widespread – in 2011 in excess of 1.25 million hectares of British cropland were treated with this class of pesticide[3]. However, the chronic, long-term effects of these systematic chemicals are not adequately addressed by the current pesticide safety assessment process, a situation which should be urgently rectified.

4. In light of the European Food Safety Agency (EFSA) report and other recent research from the UK and Europe, we believe that the weight of evidence upholds our call for an independent review of the science and regulatory assessment of neonicotinoid pesticides.

The Co-operative Group

5. The Co-operative operates significant food, funeral, legal, farming and financial services businesses and has been owned and democratically controlled by its members since 1844, when it was founded on the values and principles of self-help, self-responsibility, democracy, equality and equity. With seven million members, it is one of the largest consumer co-operatives in the world.

6. The Co-operative is in the unique position of being both a food retailer and a farmer. We serve over 14 million customers a week and we farm approximately 35,000 acres in England (and 15,000 in Scotland). It is therefore of vital importance to maintain pollinators to help food production on both the land we

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[1] Whitehorn P.R. *et al*. (2012) Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production
336 (6079): 351-352. Available at: www.sciencemag.org/content/336/6079/351.abstract
Henry M. *et al*. (2012) A common pesticide decreases foraging success and survival in honey bees. Available at: www.sciencemag.org/content/336/6079/348.abstract
European Food Safety Authority (2012) Scientific Opinion on the science behind the development of a risk assessment of Plant Protection Products on bees (*Apis mellifera*, *Bombus* spp. and solitary bees).
(2012) *EFSA Journal 10(5) 2668*.Available at:
www.efsa.europa.eu/en/efsajournal/pub/2668.htm
Gill R.J. *et al* (2012) Combined pesticide exposure severely affects individual- and colony-level traits in bees. Available at http://www.nature.com/nature/journal/vaop/ncurrent/full/nature11585.html

[2] www.independent.co.uk/environment/nature/government-to-reconsider-nerve-agent-pesticides-7604121.html

[3] The Food and Environment Research Agency. Pesticides Usage Surveys. Available online at: http://pusstats.csl.gov.uk/myindex.cfm

farm and in our supply chain. Our successful farming business also demonstrates that prudent use of pesticides and encouragement of pollinators on the land is a viable policy.

7. We have an industry-leading policy to safely manage the use of pesticides in all own-brand fresh, chilled, frozen and canned produce sold in our food stores. The policy contains 32 banned, 90 prohibited and 328 monitored pesticides and led to our top ranking in the most recent Pesticide Action Network Supermarket Survey[4].

8. In 2009, we launched our Plan Bee campaign in response to the worrying decline of honeybees and have since expanded our activity to include support for other at risk pollinators such as bumblebees, butterflies and hoverflies. We have trained 300 new beekeepers, distributed 1.2m packets of pollinator friendly wildflower seeds to our members and customers, and we have installed 1,200 hives on our farms. We have also conducted wildflower seed trials on our farms to determine the mix best suited to sustaining foraging bees in field margins.

9. Through the Plan Bee campaign we have taken specific action on neonicotinoid pesticides including:

   - from early 2009, prohibiting the use of six neonicotinoid pesticides on our own-brand fresh and frozen produce (clothianidin, dinotefuran, imidacloprid, fipronil, nitenpyram and thiamethoxam). This requires growers to seek a derogation for use if they can demonstrate viable alternatives don't exist;
   - funding research into the impact of neonicotinoids on bees, the results of which we expect to be published before the end of the year.
   - calling on the UK Government to carry out a systematic review of the impact of pesticides on our most important pollinators via a petition on our website, which 8,000 people have signed.
   - a key vote at the check outs of our food stores from 5 – 19 April 2010, asking the question 'do we need better pesticide research on bees?', to which nearly 250,000 people (76%) voted yes.

10. For more detail of these and other Plan Bee projects, please see the Plan Bee website: www.co-operative.coop/planbee

Bees in the UK

11. Pollinators are integral to our food system – honeybees alone are responsible for pollinating around 30% of the food we eat[5]. Pollinator populations are in decline. Between 1985 and 2005, there was a 53% drop in the number of managed honeybee colonies in the UK[6], and wild honeybees are thought to be close to extinction throughout the British Isles[7]. A number of bumblebee species are also struggling – 25 species can be found in the British Isles, but three have become

[4] www.pan-uk.org/supermarkets/2011-supermarket-comparison
[5] Klein A.M. *et al*. (2006) Importance of pollinators in changing landscapes for world crops. Proceedings of the Royal Society (2007) **274**, 303–313. Available at: www.ncbi.nlm.nih.gov/pmc/articles/PMC1702377/pdf/rspb20063721.pdf
[6] Potts S.G. *et al*. (2010) Global Pollinator Declines; Trends, Impacts and Drivers; Trends in Ecology and Evolution 25, 345-353. Available at: http://www.sciencedirect.com/science/article/pii/S0169534710000364
[7] Carreck N. (2008) Are Honeybees (Apis mellifera L.) Native to the British Isles?; Journal of Apicultural Research 47, 318-322. Available at: http://cat.inist.fr/?aModele=afficheN&cpsidt=20970698

extinct in the last 150 years and seven have been added to the UK Biodiversity Action Plan list[8] in a bid to safeguard their survival. There are more than 200 species of solitary bee in the UK[9]. These tend to have lower dispersal potential and more specialisation than honey and bumblebee species and as a result, are thought to be more vulnerable[10].

12. There is a large financial cost associated with pollinator declines. It is estimated that the value of honeybee pollination of commercial crops has been estimated at between £120-200 million annually[11]. A publication from the Parliamentary Office of Science and Technology states that the total loss of pollinators could cost up to £440m a year, about 13% of UK income from farming. Insect-dependent crops can be pollinated by hand, but the cost of this would be prohibitive, estimated at around £1,500m a year[12].

13. Pesticides, in particular neonicotinoids, have been cited as one of the major factors leading to declining pollinator populations.

14. The recent Defra report[13] appears to be a significant step forward in acknowledging the problems identified in the growing science base but stops short of taking action on testing and regulation. We look forward to Defra reporting back on the issue by the end of the year and hope that the Environmental Audit Committee will reinforce the urgency of this work.

Growing evidence base on impacts of neonicotinoids

15. The evidence base on the impacts of neonicotinoid pesticides has grown dramatically in recent years. Research from Stirling University[14], the French National Agriculture Research Institute (INRA)[15], Royal Holloway, University of London[16] and the opinion released by the European Food Safety Agency (EFSA)[17] on the pesticide risk assessment for honeybees all highlight that the current risk assessment fails to adequately address certain routes of exposure to

[8] JNCC. UK BAP priority terrestrial invertebrate species. Available at: http://jncc.defra.gov.uk/page-5169
[9] Royal Entomological Society. Solitary Bees. Available at: www.royensoc.co.uk/insect_info/what/solitary_bees.htm
[10] Williams N.M. *et al*. (2010) Ecological and life-history traits predict bee species response to environmental disturbances; Biological Conservation **143**, 2280-2291. Available at: www.sciencedirect.com/science/article/pii/S0006320710001138
[11] www.defra.gov.uk/food-farm/crops/bee-health/
[12] Parliamentary Office of Science and Technology (2010). Postnote 384, Insect Pollination. www.parliament.uk/documents/post/postpn348.pdf
[13] Defra, (2012) Neonicotinoid insecticides and bees, the state of the science and the regulatory response. Available at: www.defra.gov.uk/publications/files/pb13818-neonicotinoid-bees-20120918.pdf
[14] Whitehorn P.R. *et al*. (2012) Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production
336 (6079): 351-352. Available at: www.sciencemag.org/content/336/6079/351.abstract
[15] Henry M. *et al*. (2012) A common pesticide decreases foraging success and survival in honey bees. Available at: www.sciencemag.org/content/336/6079/348.abstract
[16] Gill R.J. *et al* (2012) Combined pesticide exposure severely affects individual- and colony-level traits in bees. Available at
http://www.nature.com/nature/journal/vaop/ncurrent/full/nature11585.html
[17] European Food Safety Authority (2012) Scientific Opinion on the science behind the development of a risk assessment of Plant Protection Products on bees (*Apis mellifera*, *Bombus* spp. and solitary bees). (2012) *EFSA Journal 10(5) 2668*.Available at: www.efsa.europa.eu/en/efsajournal/pub/2668.htm

neonicotinoids for pollinators and raise concerns about the use of products containing these compounds. In addition, in March 2012, the Chief Scientific Adviser to DEFRA, Sir Bob Watson, publicly expressed his concern about the current UK position in regard to neonicotinoids and went on to state that he wanted the science reassessed "very, very carefully"[18].

16. This growing evidence base links long-term, chronic exposure to field realistic levels of the pesticides to problems with bee fecundity, an impaired ability to pollinate crops, an increased susceptibility to disease and the loss of hives.

Inadequate assessment of the sub-lethal effects of pesticides

17. The use of neonicotinoid pesticides is very widespread – in 2011 in excess of 1.25 million hectares of British cropland were treated with this class of pesticide[19]. However, the chronic, long-term effects of these systematic chemicals are not adequately addressed by the current pesticide safety assessment process, a situation which should be urgently rectified.

18. Systemic pesticides behave very differently to conventional applications. As the chemical is taken into each part of the plant including the pollen and nectar, the exposure of bees to the insecticides is prolonged, causing chronic exposure to pollinators. In the case of honey and bumblebees, this exposure continues in the hive. At present, there is no suitable standardised testing procedure for chronic toxicity of pesticides, there are no threshold values with which to identify a chemical which presents a significant risk and the wider environmental impact of their use is not considered appropriately.

19. The European assessment is also inadequate for assessing the sub-lethal effects of pesticides. Sub-lethal effects are not tested as standard – these tests only occur if the Hazard Quotient is triggered. The Hazard Quotient is the application rate of the chemical (g/ha) divided by the dose of the chemical required to kill 50% of the test population (the LD50). Only if the Hazard Quotient exceeds 50 are the higher level tests, such as those assessing the sub-lethal effects of pesticides, applied. There are no internationally agreed, standardised assessment methods for sub-lethal effects, and no validity criteria or toxic standards for them. Additionally, while honeybees undergo acute toxicity tests, the acute effects of pesticides on bumblebees and solitary bees are largely unassessed.

Recommendation

20. In light of the EFSA report and other recent research from the UK and Europe, we believe that the weight of evidence upholds our call for an independent review of the science and regulatory assessment of neonicotinoid pesticides.

31 October.2012

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[18] www.independent.co.uk/environment/nature/government-to-reconsider-nerve-agent-pesticides-7604121.html
[19] The Food and Environment Research Agency. Pesticides Usage Surveys. Available online at: http://pusstats.csl.gov.uk/myindex.cfm

Written evidence submitted by Sussex Beekeepers Association

Areas of concern over the rapidly expanding use of Neonicotinoids for systemic crop protection.

There is a substantial risk of conflicts of interest arising in that DEFRA as it is solely responsible for :-

- Farming economics
- National food security
- Protection of the natural environment
- Pesticide regulation and approval
- Environmental safety of pesticides
- Health and maintenance of Honey bees as pollinators

The only test applied to arrive at a balanced policy is the Balance of Economic Advantage test which is heavily weighted towards the first two items as these are measurable in monetary terms.

The Chemical Regulation Directorate CRD together with the Advisory Committee on Pesticides ACP advises DEFRA on the effects of pesticides but carries out no research on an independent basis on the effects of these, relying instead on the crop protection industry to both fund, frame and execute such research as is done.

As Neonicotinoids are highly water soluble and have a relatively long residual half life, more than 1.5 years in the field of use, there is a strong risk that in crops like maize used for silage which is often planted for two or three successive years without a treatment break that soil residual levels are higher than expected as not only are stalk and root residues containing these substances left in situ but manure and slurry effluents containing them when fed to cattle is spread back onto the land as part of the crop cycle. Grazing pastures are also used to spread potentially contaminated manure and slurry and effluents enabling the unmonitored risk of uptake by non target bee forage plants such as clovers. It appears that such risks have not been considered or assessed by CRD, nor by ACP

There is no system for regularly testing for residues either in soils or in groundwater and standing water, the later being important water sources for honeybees. There is evidence that neonicotinoid levels may often be very high in standing water.

There is a strong risk of re-uptake of these substances by plants in field margins which are not targets of use. No samples/ censuses are taken either of residues or invertebrate populations in field margins and adjacent land to assess collateral damage.

There is strong evidence that when used as a systemic insecticide in maize the substances are present in sap exuded as guttation which is attractive to honeybees and is also present in the pollen of both maize and oil seed rape both of which are collected, frequently in large quantities, by bees and processed into food for their larvae.

There is strong evidence that significant concentrations of neonicotinoids can exist in dust in arable areas which can adhere to bees and other invertebrates.

There is published evidence that sub lethal doses of these very powerful neurotoxins can affect the behaviour of insects, including honeybees. These sub lethal dosage effects have not been assessed, measured or monitored either by the producers of neonictinoids or independently by CRD /ACP who have stated that the risks are acceptable.

These substances are freely available for use by the general public. 36 products are currently licensed for domestic use. The only safeguard against misuse is a label, danger/harmful to bees. This is sufficient to be considered an adequate risk control by CRD/ACP. There is no requirement for point of sale advice to be given to purchasers nor are retailers required to have any training to explain the risks involved. This endangers bees and other non target insects in gardens, a very important source of honeybee forage.

There appears to be a strong correlation between the use or increased use of these substances and recently (5-6 years) observed changes to honeybee behaviour which cannot realistically be attributed to the advent of the varroa mite in UK honeybees (1992-1997)
These include:-

Fatally late swarming activity which is normally over by end June, and has been occurring as late as October and not weather related.

Significantly large numbers of virgin queen not returning to colony after mating flights, suggesting failed navigational abilities.

Failure of mated queen to continue to lay fertilized eggs once laying has been established.

High proportions of queens produce only unfertilized (male) eggs leading to collapse of colony (not colony collapse disorder as seen in US) suggesting either that neural control of spermetheca mechanism has failed (this allows the queen to deposit a sperm fertilising an egg which will become a female, worker or queen) or that the queen is unable to sense the dimension of the cell to be laid in. Worker cells are narrower than drone(male) cells which is sensed by the queen in deciding whether to fertilise that particular egg). This again suggests a neural breakdown

Abnormal supersedure (replacement by the colony) of normally laying young queens suggesting that the young queen is producing insufficient 9 ODA (queen pheromone' controlled by the endocrine/ neural system)

Anecdotal evidence is provided of these occurrences by comparing four apiaries each with similar colony numbers, two near extensive rape fields (East Sussex), one adjacent to maize silage crops West Kent and one more than two miles from any rape or maize crops (East Sussex).

In the first, second and third these events are common affecting 30%+ of colonies each year and becoming increasingly common over the last 3-4 years. In the fourth they are very uncommon despite the bees being more stressed because of the more exposed location.

Whether or not these observations are as a result of the use of neonicotinoids, the important effects should be researched as a matter of urgency. At the very least this would eliminate the increasingly widely used neonicotinoids from suspicion. If neonicotinoids are indeed implicated in these now frequently reported events the future of honeybees in the UK is in extreme peril

31 October 2012

Written evidence submitted by the Scottish Wildlife Trust

The Scottish Wildlife Trust welcomes the opportunity to submit evidence to the Environmental Audit Committee (EAC) regarding insects and insecticides.

Our evidence concentrates on our concerns with regard to the impacts of neonicotinoid insecticides and is summarised below:

- Effects on insect pollinators- honeybees, bumblebees, hoverflies, butterflies and moths
- Half-life in soil; routes of exposure and contamination of non- target vegetation (such as that found along field margins)
- Effects on ecosystems in the agricultural landscape
- Inadequacy of risk assessment for these types of insecticides

Scottish Wildlife Trust's position

1. There is a growing body of evidence that shows that neonicotinoids have a detrimental effect at sub-lethal doses on insect pollinators. For this reason, the Scottish Wildlife Trust believes that the Scottish Government should adopt the precautionary principle and place a moratorium on their use on all outdoor crops in Scotland until there is convincing scientific evidence that pollinator populations, and by extension ecosystem health, are not significantly impacted upon by use of neonicotinoids.

Effects on insect pollinators

2. Pollination[1] has been estimated to be worth c. £430 million p.a. and 20% of UK cropped areas are pollinator dependent.[2]

3. Defra has estimated that the number of UK registered honeybee hives is only sufficient to supply a third of the pollination services required for agricultural crop production; the remainder of the services being supplied by wild pollinators.[3] Some crops such as strawberries, tomatoes and peppers are mainly pollinated by managed bumblebees; honeybees are also not as effective pollinators of field beans, apples and raspberries as wild pollinators.[3]

4. There is an increasing body of research that has shown that sub-lethal doses of the active ingredient in neonicotinoids is damaging to the honeybees and bumblebees. The effect on other pollinators is largely unknown.

Honeybees

5. Research by Mickaël et al[4] examined the sub-lethal effects of neonicotinoids on honeybee behaviour rather than on bee mortality *per se*. It showed that non-lethal exposure of honeybees to thiamethoxam caused high mortality due to homing failure at levels that could put a colony at risk of collapse. The researchers tested the theory that although sub-lethal doses of insecticide (in this case thiamethoxam) may not cause direct mortality, it could cause behavioural difficulties in bees and thereby cause homing failure in foraging honeybees. The conclusions of the study were that*: exposure of foragers to non-lethal but commonly encountered doses of thiamethoxam can affect forager survival, with potential contributions to collapse risk. Furthermore, the extent to which exposures affect forager survival appears dependent on the landscape context and the prior knowledge of foragers about this landscape. Higher risks are observed when the homing task is more challenging.*

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[1] This includes all pollinators such as honeybee, bumblebee, hoverfly and to a lesser extent butterflies and moths
[2] UK National Ecosystem Assessment (2011). The UK National Ecosystem Assessment Technical Report (UKNEATR). UNEP-WCMC Cambridge.
[3] UK National Ecosystem Assessment (2011). The UK National Ecosystem Assessment Technical Report (UKNEATR). UNEP-WCMC Cambridge
[4] Mickaël Henry et al (2012) A Common Pesticide Decreases Foraging Success and Survival in Honeybees. Science Vol 336 :348-350

6. Defra's response has been that although the results are interesting, they believe the artificiality of the experiment calls it in to question. We can appreciate that the 'perfect' experiment would be conducted totally in the 'wild' to mimic field conditions, but this assumes that it is easy to ensure that a 'control' group of bees have not been exposed to the insecticide (given the fact that research has also shown the long half-life of the active ingredient and contamination of field margins - see below).

7. **We would like the EAC to ascertain how unintended contamination of control bees would be dealt with in a field trial**.

8. With regard to Defra's observation of the potential artificiality of the dosing regime compared to exposure under field conditions - where is the evidence of this? The researchers claim that: *To simulate daily intoxication events, foragers received a field-realistic, sub lethal dose of thiamethoxam (a real dose of 1.34 ng in a 20-ml sucrose solution) and were released away from their colony with a microchip glued on their thorax.*

9. Their methods are explained in Supplementary Material[5] and the dosage has been verified and it is stated that: *The real content was measured to be 67µg/l, i.e. slightly above the expected 50µg/l, leading to an effective dose of 1.34 ng per honeybee.*

10. This dosage is in accordance with that which honeybees would be exposed in the wild i.e. in the order of parts per billion.

11. One of the subtleties of the French experiment was investigating the 'homing challenge'. It was found that the homing failure effects of exposure to neonicotinoids was exacerbated when honeybees were inexperienced or faced a more complex landscape.

12. In refuting Henry et al's research, Defra state: *Existing studies submitted in support of the present regulatory approvals fully meet current standards. They do not explicitly address all the sub-lethal effects suggested by the academic research. However, they do cover a wide range of important endpoints and, in these studies, hives exposed to treated crops did not show any gross effects when compared to control hives exposed to untreated crops.*

13. We would call on the EAC to scrutinize these studies that Defra refers to because we do wonder if the foraging bees faced the complex landscape challenges that were introduced into Henry et al's research. If not, can they be thought of as reliable and do they mimic the field conditions that Defra so clearly want to see?

Bumblebees

14. Research published earlier this year by Whitehorn et al.[6] has found that bumblebees suffer decline when exposed to neonicotinoids. Researchers at Stirling University exposed colonies of bumblebees to miniscule doses (mimicking field realistic conditions) of the neonicotinoid, imidacloprid. They found that treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with control colonies. They conclude that: *there is an urgent need to develop alternatives to the widespread use of neonicotinoid pesticides on flowering crops wherever possible.*

15. Defra's response to this research is that because bumblebees are not covered in the current EU Authorisations Regulation *it is more difficult to assess the significance of the findings of this study*. **We do not see why this is the case, and the point regarding 'assessing the significance of these findings' needs further clarification by the EAC.**

16. We note that Defra commissioned a further study (PS 2371) to examine the potential effects of imidacloprid on bumblebees foraging on oilseed rape grown from imidacloprid treated seed under field

[5] Mickaël Henry et al (2012). Supplementary Material for A Common Pesticide Decreases Foraging Success and Survival in Honeybees. Published on 29 March 2012 on *Science* Express DOI: 10.1126/science.1215039
[6] Penelope R. Whitehorn et al.(2012). Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production. , Science Vol 336: 351 - 352

conditions. The recently published research by Gill et al[7] confirms the findings of Whitehorn et al's[6] work in that they showed:
imidacloprid exposure at concentrations that can be found in the pollen and nectar of flowering crops causes impairment to pollen foraging efficiency, leading to increased colony demand for food as shown by increased worker recruitment to forage.

17. They also found that a 'cocktail' of insecticides was even more damaging. In addition, they found that effects were seen when there was prolonged exposure (not over the 96 hour test) i.e. 2- 4 weeks - which mimics the crop blooming period.

18. The researchers concluded that:
Our findings have clear implications for the conservation of insect pollinators in areas of agricultural intensification, particularly social bees with their complex social organization and dependence on a critical threshold of workers performing efficiently to ensure colony success.

Other insect pollinators

19. We are not aware of any research being conducted on the effects of neonicotinoids on other insect pollinators. As pollination has been estimated to be worth c. £430 million p.a. and 20% of UK cropped areas are pollinator dependent,[8] we do find it surprising that the risk to other pollinators has been ignored (see also paragraph 3 above). However, we are aware of the ongoing research investigating which insects pollinate UK crops.[9] This may throw new light on the importance of other pollinators in the agricultural landscape but the research will not ascertain what impacts neonicotinoids have on all pollinators.

20. **In light of the fact that wild pollinators (i.e. not honeybees) make up a significant proportion of pollination services in UK crop production (see paragraph 3 above), we would like the EAC to scrutinize why Defra does not consider the risk to wild pollinators an important consideration in assessing the safety or otherwise, of neonicotinoids.**

Half-life in soil and routes of exposure

21. Krupke et al[10] have found that neonicotinoid compounds are persistent in soils and are also found in untreated fields. In their research they conclude that:
These results demonstrate that honeybees living and foraging near agricultural fields are exposed to neonicotinoids and other pesticides through multiple mechanisms throughout the spring and summer. The potential for greatest exposure (and the period when mortality was noted), occurs during planting time when there is potential for exposure to extremely high concentrations of neonicotinoids in waste talc that is exhausted to the environment during and after planting.

22. They go on to state:
Our results also demonstrate that clothianidin is present in the surface soil of agricultural fields long after treated seed has been planted in that field. All soil samples we collected contained clothianidin, even in cases where no treated seed had been planted for 2 growing seasons. During the spring planting period, dust that arises from this soil may land on flowers frequented by bees, or possibly on the insects themselves. Of potentially greater concern are the very high levels of neonicotinoids (and fungicides) found in the talc that has been exposed to treated seed, since part of this highly mobile material is exhausted to the outside environment during planting and after planting. The large areas being planted with neonicotinoid treated seeds, combined with the high persistence of these materials and the mobility of disturbed soil and talc dust, carry potential for effects over an area that may exceed the boundaries of the production fields themselves.

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[7] Richard J. Gill, Oscar Ramos-Rodriguez & Nigel E. Raine (2012). Combined pesticide exposure severely affects individual- and colony-level traits in bees, *Nature*, published 21 October 2012
[8] UK National Ecosystem Assessment (2011). The UK National Ecosystem Assessment Technical Report (UKNEATR). UNEP-WCMC Cambridge.
[9] The £10 million Insect Pollinators Initiative
[10] Krupke CH, Hunt GJ, Eitzer BD, Andino G, Given K (2012). Multiple Routes of Pesticide Exposure for Honeybees Living Near Agricultural Fields. PLoS ONE 7(1): e29268. doi:10.1371/journal.pone.0029268

23. This exposure to waste talc has also been found by Tapparo et al[11]. They investigated environmental exposure of honeybees to particulate matter containing neonicotinoid insecticides coming from corn coated seeds which have been drilled into soil. They found that:
particulate matter released by the drilling machine during the sowing of corn seeds coated with neonicotinoid insecticides represents a significant mechanism of environmental diffusion of these insecticides. Bees flying over the sowing field and approaching the emission cloud of the drilling machine can efficiently intercept the suspended particles being directly contaminated with elevated dose of insecticide, significantly higher than the LD50 values estimated for contact, with the cuticle, administration (18, 22, and 30 ng/ bee for imidacloprid, clothianidin, and thiamethoxam, respectively).

24. **As both experiments were conducted on maize/corn it is unknown whether the seed coating on OSR would present similar problem. We would like to know if this route of exposure has been investigated by Defra**.

25. Other routes of exposure include through guttation drops. Guttation is a natural plant phenomenon causing the excretion of xylem fluid at leaf margins Girolami et al[12] found that*:*
leaf guttation drops of all the corn plants germinated from neonicotinoid-coated seeds contained amounts of insecticide constantly higher than 10 mg/l, with maxima up to 100 mg/l for thiamethoxam and clothianidin, and up to 200 mg/l for imidacloprid. The concentration of neonicotinoids in guttation drops can be near those of active ingredients commonly applied in field sprays for pest control, or even higher. When bees consume guttation drops, collected from plants grown from neonicotinoid-coated seeds, they encounter death within few minutes.

26. **We would like the EAC to determine if this route of exposure is being investigated by Defra.**

Effects on ecosystems in agricultural landscapes

27. Most of UK's plant communities rely on pollinating insects to reproduce and therefore spread (apart from species such as grasses which are wind pollinated). Although the loss of semi- natural habitat is thought to be a major driver of wild bee declines (and most likely other insect pollinators), the fact that there are less pollinators present will affect the composition of plant communities themselves because of limited reproductive capacity, genetic diversity and plant dispersal.

28. Pollinating insects also form a vital part of the food chain for other species such as birds, reptiles and amphibians. It follows that any insecticide that drastically reduces pollinator numbers and causes pollen limitation within wildflower populations[13] will reduce biodiversity and have effects beyond the agricultural sector which will ultimately affect the health and function of entire ecosystems.

29. Wildflower communities make up semi-natural grasslands, woodlands, agricultural field margins, hedgerows and have a recreational, aesthetic and cultural value which is difficult to quantify. Wildflower strips along crop margins have also been shown to harbour natural 'enemies' which can help control crop pests. [14]

30. Cardinali et al[15] reviewed two decades of research that has examined how biodiversity loss influences ecosystem functions, and the impacts that this can have on the goods and services ecosystems provide. They have made a number of concluding statements from their research including:
There is now sufficient evidence that biodiversity per se either directly influences or is strongly correlated with certain provisioning and regulating services – these included the regulating service of biocontrol.

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[11] Tapparo et al (2012). Assessment of the Environmental Exposure of Honeybees to Particulate Matter Containing Neonicotinoid Insecticides Coming from Corn Coated SeedsEnviron. Sci. Technol. 2012, 46, 2592−2599
[12] Girolami et al (2009). Translocation of Neonicotinoid Insecticides From Coated Seeds to Seedling Guttation Drops: A Novel Way of Intoxication for Bees. Journal of Econ Entomol. 102(5): 1808Ð1815
[13] See: Ashman et al (2004). Pollen limitation of plant reproduction: ecological and evolutionary causes and consequences. Ecology **85** 2408-2421
[14] Haenke, S., Scheid, B., Schaefer, M., Tscharntke, T. and Thies, C. (2009). Increasing syrphid fly diversity and density in sown flower strips within simple vs. complex landscapes. Journal of Applied Ecology, 46: 1106–1114
[15] Cardinali et al (2012). Biodiversity loss and its impact on humanity. Nature 486

31. Other researchers have also stated that conservation of biodiversity in the agricultural landscapes can be considered an insurance policy - providing ecosystem resilience in the face of perturbation.[16] Using aphids as an example Tscharntke et al stated:
The identity of naturally occurring enemies as cereal aphid antagonists greatly differs among regions and years. Around the city of Göttingen, Germany, there are years in which parasitoids are key mortality agents and others where ladybird beetles or syrphid flies[17] cause most of the mortality. Hence, cereal aphids suffer from a large number of enemies, but the effectiveness of each enemy seems to vary with landscape, region and. This spatio-temporal variation in effectiveness of each enemy species emphasizes the need of biodiversity preservation as insurance and to take large spatial scales into account. The long-term sustainability of ecosystems may depend on substitutable insurance species within each functional group. As environmental constrains change with time and space, it is hardly predictable which life history traits of aphid enemies is best adapted. Hence, only a diverse species pool for one ecological function may provide the best chance to include at least one well adapted, efficient species in a given environmental situation.

32. **We would like the EAC to ask Defra how they assess the impacts of neonicotinoids on biodiversity, ecosystem function and provision of ecosystem services.**

Inadequacy of risk assessment for these types of insecticides

33. The risk assessment process used to evaluate the risks of neonicotinoids (and indeed other insecticides) is outdated and designed for the older generation of insecticides which were sprayed on crops. Unlike systemic insecticides, the earlier foliage sprayed crops degraded quickly and so the risks to honeybees were only during the period of spraying or contact with recently treated foliage.

34. Neonicotinoids pose risks to insect pollinators, which are not currently accounted for, because:
    - they are persistent in soils,
    - they are transported to all parts of the plant including pollen and nectar (and guttation);
    - minute quantities found in pollen and nectar have sub-lethal effects
    - effects can vary depending on landscape complexity, timescales over which contaminated food stuff is ingested, cocktail effect of other insecticide;
    - they are not confined to crops but can contaminate wildflower field margins.

35. **In light of the risk assessment review currently underway by the European Food Safety Agency[18] we would like the EAC to determine why Defra continues to consent to the use of these neurotoxic chemicals even though the risk assessment of their effects on non-target species is acknowledged to be not fit for purpose.**

36. **Furthermore will a new risk assessment mean that there will be a moratorium placed on neonicotinoid use until it can be convincingly shown that pollinator populations are not significantly impacted upon by use of neonicotinoids?**

1 November 2012

[16] Tscharntke, T., Klein, A. M., Kruess, A., Steffan-Dewenter, I. and Thies, C. (2005). Landscape perspectives on agricultural intensification and biodiversity – ecosystem service management. Ecology Letters 8: 857–874.
[17] This includes hoverflies
[18] EFSA is currently revising the European Guidance Document on terrestrial ecotoxicology elaborated by the Commission and experts from Member States. In the context of this revision, the bees risk assessment will also be addressed.

Written evidence submitted by Bedfordshire Beekeepers Association

1. **Summary**

- Our deep concern for the plight of honeybees and other pollinating insects
- Loss and improvement of habitat
- Possible serious dangers of insecticides: research claims and controversy
- Need for decisive evidence and robust scientific research to clarify the situation
- The threat of varroa
- Recap of the history and nature of varroa
- Attempts to contain varroa and their limitations
- Alternative treatments: a call for research into a biological control.

2. **Bee Health - the Situation Overall**

2.1 Media accounts of the imminent death of the honey bee as a species are probably exaggerated, but nevertheless we are right to be very concerned about the health and wellbeing of honey bees, even if this has not reached the proportions of the phenomenon of sudden, mysterious loss of many hives in the United States that has been termed Colony Collapse Disorder. Over the last forty years our experience "on the ground" is that beekeeping has become far more difficult and uncertain, certainly requiring ever higher levels of skills and attention.

2.2 From our contacts with members of our association and others, we estimate that winter colony losses in our county now run at around 20% or higher whereas historically they were typically 5-10%. This is higher than some other estimates quoted by Defra in a recent letter.

2.3 We should also be extremely concerned about the state of other pollinating insects, which are in serious, long-term decline, and the resultant threat to agricultural production and to the well-being of the countryside that we rightly treasure.

2.4 Loss of a varied natural habitat – both the flowers and nesting sites - is certainly one cause of the problems with all types of bee. It is very important that farmers do all that is possible to restore a varied landscape, rich in trees and flowering plants, and possible nesting locations, such as through higher level environmental stewardship schemes. Copious and varied sources of pollen, including early and late in the annual cycle, are now recognised to be very important for the health of bees. Urban landscapes are clearly also very important as islands of plenty for bees and other wildlife, and the public seems very receptive to messages about planting flowers that provide nectar and pollen – something to encourage as strongly as possible in promoting biodiversity.

2.5 Another source of problems is likely to be chemical sprays, perhaps in "cocktail" combinations. There is now a considerable body of research that suggests that there might be cause for great concern, even though it is contested by the giant agro-chemical firms and perhaps by scientific advisers in the UK. The anxiety is that bees may be adversely affected at sub-lethal levels, particularly by neonicotinoids used as pesticides since the early 1990s which interfere with the nervous system of insects.

2.6 An important recent study by a team led by Professor Dave Goulson at Stirling University has rightly received much attention. It shows that neonicotinoids at quite low levels can seriously harm the development of bumblebees: “Treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with control colonies” (Abstract in *Science* 20 April 2012. The speculation that neonicotinoids “may be having a considerable negative impact on wild bumble bee populations across the developed world” could obviously be extended to honeybees, as well as a wide spectrum of other pollinators. Other research in France has suggested that the homing systems of honey bees can be disrupted so that they fail to return to the hive.

2.7 Some other European countries, notably France, have suspended forms of neonicotinoids. We sense from our contacts that scientists believe that there may be a very serious issue to be addressed. As an Association that actively supports scientific research we certainly argue that it is important to press ahead with further detailed, in-depth studies to cast much-needed light on the matter. The issues are potentially huge in their implications for environment and agriculture in general, as well as for specifically honeybees and other key pollinators.

2.8 We very much welcome the inquiry instigated by the Parliamentary Environmental Audit Committee in its attempts to establish the truth of the situation.

3. **The story of varroa and our attempts to contain it**

3.1 For honey bees, varroa remains a huge threat, and we ask the committee also to bear this in mind, assessing the situation holistically.

3.2 The varroa mite has spread round almost the whole world. It is a massively destructive parasite that moved, though human intervention, from another species of bee in the Far East to our honey bees. It lives by sucking out the life blood, the hemolymph, of the bee, introducing viruses in the process - much like human drug addicts become infected by sharing contaminated needles. Varroa was first located in the south west of England in 1992, and since that time has spread throughout the mainland.

3.3 Beekeepers initially used pyrethroid strips to control the mite with a knock down rate of 99%. However, the surviving one percent managed to breed, and over the years the knockdown rate dropped off. The strips are no longer used as the mite has developed immunity to them. We are left with products that have a far lower mite kill. Apiguard, related to the oil extracted from the thyme plant, is applied after the honey has been taken off. It is only effective in warmer weather and so its application window is quite small, with a knockdown of probably only about 80%. Some beekeepers use oxalic acid in sugar syrup in midwinter but this is not licensed for use by the VMD. An effective but controversial treatment available on the continent (Apivar, organophosphate-based) is not licensed for use in the UK and therefore not available to us. Beekeepers can also manipulate their colonies using so-called bio-technical methods, but these are very labour-intensive, often with a cost to the bees. Whether bees can come to develop natural immunity to varroa remains very uncertain, though there is great interest in this possibility.

3.4 **Where we are with varroa now**

Varroa is the number one problem that beekeepers face these days, as recent but as yet unpublished scientific research has help to confirm. Within the last few months Dr Stephen Martin at Sheffield University has published research showing that the combination of varroa and deformed wing virus (DWV) can cause a colony to die out quickly. There are many known bee viruses but DWV has the ability to replicate within the mite thereby making it more lethal than other viruses.

3.5 As noted earlier, keeping our bees alive has become much more difficult. These losses can be made up during the following season but at the expense of honey production and pollination. A threat of more catastrophic losses, perhaps triggered by harsh weather conditions such as we have experienced in much of the UK this spring and summer, still hangs over us.

3.6 **Possible Fungal treatments**

Several years ago scientists at Rothamsted Research in Harpenden identified two fungi, from around 80, that kill the mite in laboratory conditions but not bees. Unfortunately this project was cancelled before field trials could take place and the world-class lead researcher was made redundant. The project probably needed another two to three years to complete with the hope that it would be effective in working hives.

3.7 Another project is due to start this autumn with Dr Alan Bowman at Aberdeen University using RNA interference. This will take several years to complete and there is no guarantee that it will work. Past experience has shown that using a single treatment for varroa is a risky strategy. Just as the mite has already developed resistance to pyrethroids, so there is the potential for it develop resistance to further specific treatments. If beekeepers have at least two effective treatments they could be alternated and thereby reduce the resistance risk.

3.8 Research councils are not interested in funding the fungi trials because the basic research has already been carried out. So beekeepers are in the position of trying to keep their bees alive with treatments that are not sufficiently effective or legal.

3.9 **Our proposal**

Finding other more effective ways to combat varroa remains a huge challenge, with the answers most likely to come from scientific research, as with the vexed question of neonicotinoids. The UK has a hugely impressive track record of research into honey bees, notably at Rothamsted, the oldest agricultural research station in the world. Our proposal is that ways should be found to pursue new solutions, including the possibility of fungal treatments. This could be done through public funding, or possibly by grants from industry, or through a combination of these or other sources.

1 November 2012

Written evidence submitted by Pesticide Action Network UK

The Pesticide Action Network UK (PAN UK) is the only charity in the UK that works on all aspects of global pesticide issues. PAN UK has been operating for over 25 years and is part of a global network of like minded organisations concerned about the effects pesticide are having on human health and the environment. The network as a whole and PAN UK in particular is noted for its scientific robustness and attention to detail in all aspects related to the use and / or abuse of pesticides. PAN UK is actively involved in a range of different fora in the UK including the Pesticide Forum and its sub groups and we have on many occasions submitted information to other bodies including the Advisory Committee on Pesticides and government Ministers over the years. PAN UK works closely with PAN Europe on regulatory and policy issues at EU level.

Please note that PAN UK has already submitted a series of fact sheets to the inquiry that cover the complete range of issues related to the effects of pesticides on bees and other pollinators. Much of the scientific evidence that we use to back our approach is contained with or referenced in those documents. This submission complements those fact sheets and should be read in conjunction with them.

This submission will look specifically at two areas;

- The current Defra position in regard to neonicotinoid pesticides and the effect that they are or might be having on bees and other pollinator species in the UK and
- The draft UK National Action Plan on pesticides that could help to mitigate threats to bees and other pollinators in the UK.

PAN UK comments on Defra statement *Neonicotinoid insecticides and bees: the state of the science and the regulatory response*, 13th September 2012

(http://www.defra.gov.uk/publications/files/pb13818-neonicotinoid-bees-20120918.pdf)

There are a number of key points that PAN UK would like to highlight in this response. Our overarching concern is that given the growing weight of independent evidence of the potential for harm from neonicotinoid pesticides, Defra and the UK regulatory authorities are not taking a sufficiently precautionary approach. This is particularly worrying given the serious economic and biodiversity consequences that a severe loss in pollinators would bring to the UK as a whole. We are also concerned that Defra is not prepared to implement measures within its new National Action Plan on pesticides to deliver overall reductions in the use of pesticides in the agriculture and amenity sectors and to ensure that biodiversity in the UK is adequately protected from the threats posed by pesticide use.

Methodological shortcomings in current testing by pesticide companies

PAN UK questions Defra’s assurances that industry testing of neonicotinoids is sufficient and satisfactory in addressing all the potential threats posed by neonicotinoid insecticides. We believe, as does the European Food Safety Authority (EFSA) in its Opinion of May 2012, that there are serious methodological shortcomings in this type of study. For example, the tests focus on short term, acute toxicity to adult worker bees and mainly ignore chronic toxicity and sub-lethal effects on bee behaviour, on larvae and on hive overwintering. We are also concerned that there is a lack of transparency and availability for independent review of factors such as study design, methods and statistical analysis as much of the data submitted by pesticide companies for regulatory purposes is not in the public domain. This approach makes it impossible for concerned stakeholders to see and critique study methods, assumptions, results and the criteria used by decision makers to interpret studies’ data and conclusions. These issues are important because of the many difficulties in designing robust and realistic studies to understand how regular, low dose exposure to pesticide traces in nectar and pollen may affect the highly complex structure of honey and other social bees at colony level. PAN UK's factsheets nos. 2 and 3 discuss these scientific and risk assessment difficulties in detail. Aspects of independent science and the undue influence of industry experts on risk assessment methodology are discussed in factsheet no.8

Implications for neonicotinoid products currently approved

PAN UK is concerned about the approach that Defra is taking to address the problems. On the one hand it now admits that there are several areas in the current risk assessment procedures which need to be revised, yet on the other hand states that current UK regulatory studies are adequate to reach a conclusion of 'no gross effects' in exposed hives. The wording in the Defra response indicates that action on changes to the risk assessment is imminent. This would be welcome, however, even if any changes are instituted, it is not clear whether the new risk assessment process will apply to currently approved products, including those containing the controversial neonicotinoids clothianidin, imidacloprid and thiamethoxam or only to new products seeking future approval. It is absolutely essential that all neonicotinoid products currently approved must be re-tested as the top priority as soon as the new EU testing regime is finalised (scheduled for early 2013). We suggest that they be removed from sale until they have been reassessed and shown to be safe. Without such a commitment we could see products that may well fail the new risk assessment requirements continue in use until their UK approvals are due for renewal, which in some cases could be as late as 2021!

Different regulatory conclusions drawn in other EU countries

PAN UK would draw the EAC's attention to the different conclusions drawn by different national regulatory authorities across Europe following review of the same evidence from the scientific literature. Whilst Defra have clearly decided that no action needs to be taken in the short term, the French regulatory authorities have taken a different view and have, for some years, instituted further controls and restrictions on some neonicotinoids. Following the publication of the Henry *et al.* and Whitehorn *et al.* studies, in March this year, the French suspended the approval for the use of thiamethoxam for oilseed rape (OSR) seed treatments in June 2012. We do not understand why Defra came to a different conclusion, particularly as the cropping systems for OSR are similar in both countries. The Italian authorities, and to some extent, the German authorities have also adopted different approaches to the UK in regard to suspensions. At the very least, this is a clear indication of the scientific uncertainties that exist about the impacts of neonicotinoids and PAN UK believes that this uncertainty justifies a far more precautionary approach from the UK.

This sense that the UK has a far too complacent approach is further highlighted by the different stance of the European Commission. DG Sanco, responsible for pesticide regulation, has acknowledged that there is a growing body of evidence suggesting a link between bee diseases and pesticides. The European parliament has also been very vocal in calling for a timeframe for the withdrawal in the longer term of all neurotoxic pesticides. In 2011 they called for an immediate review of all approved neonicotinoids once improved risk assessment protocols have been developed.

Need for a more open assessment of independent scientific findings

A common response from Defra to new studies that indicate problems is to single out shortcomings in the studies or dismiss them because they do not address "real life" scenarios. We do agree that there are uncertainties inherent in some studies (see factsheets 2 and 3) however, we do not believe that this is a valid reason for simply discarding the findings from independent studies, especially as the current regulatory studies required are widely acknowledged to be deeply flawed. In our view, important findings from independent scientists should rather be a spur for further research and prompt greater precaution.

Defra's caveats about the level of "real-life" and "field realistic" exposure of several independent studies are of great concern to PAN UK. A basic element of the precautionary principle is that “Regulatory controls should incorporate a margin of safety; activities should be limited below the level at which no adverse effect has been observed or *predicted*”[1](emphasis added).Most of the studies rather dismissed by Defra clearly show that harm to pollinators could occur at field-relevant levels of exposure. Over the last 18 months, more scientists are now voicing concerns about the role of pesticides in pollinator declines, especially in relation to increased susceptibility to bee diseases and parasites. These subtle interactions and the ‘cocktail’ effect of exposure to many different pesticide residues in the foraging environment are very poorly understood, yet Defra seems not to factor them into their conclusions.

PAN UK would like to see a broader, open and more participatory evaluation process to see where consensus lies on what the different studies contribute and to identify the pros and cons of each study in its design, analysis and interpretation of the results.

We agree with many of the comments raised by CRD/Defra over recent independent studies, for example, about the weak design and irrelevance of one widely publicised US study by Lu *et al* (2012) on replication of Colony Collapse Disorder. However, we totally disagree with the Defra conclusion that overall the four most publicised studies published this year (Henry *et al*, 2012; Whitehorn *et al*, 2012; Pettis *et al*, 2012; Lu *et al* 2012) do not provide enough new evidence to warrant any change to the regulatory system. Since Defra and CRD’s response, another extremely relevant and robust study has been published by Gill *et al* (2012, in *Nature*) from British universities on bumblebees exposed to a combination of a neonicotinoid and a commonly used pyrethroid insecticide, documenting harmful effects on individual bees and on colony level performance. A useful commentary on this paper and the regulatory questions it raises was published in the News & Views section of *Nature* (Osborne, 2012).

Dealing with scientific uncertainties: Late lessons from early warnings

While no single study alone is likely to deliver the ‘killer facts’ in such a complex issue, many of the more recent and well-designed studies are contributing important pieces to the jigsaw puzzle of pollinator declines. PAN UK agrees that we need more research, especially on exposure patterns in the UK context, but we mustn’t let this become an excuse for avoiding or delaying tough regulatory decisions. The agrochemical industry always play the ‘more research’ card but we know from analyses of earlier environmental policy cases involving scientific uncertainty and high stakes, that earlier decisive action should have been taken- see the European Environment Agency’s illuminating *Late Lessons from Early Warnings* report (http://www.eea.europa.eu/publications/environmental_issue_report_2001_22). Volume 2 of Late Lessons is now published and includes a useful chapter on the controversial debates in France over the neonicotinoid insecticide imidacloprid and impacts on bees, illustrating the problems that arise when vested interests and incorrect value judgements cloud the risk assessment process. See http://www.eea.europa.eu/publications/false-positives-2013-late-lessons-volume2

It is not just the position of Defra that PAN UK takes issue with but also that of the Advisory Committee on Pesticides (ACP), particularly their statements that “*the current risk assessments are secure*” and that “*there is no evidence as yet of neonicotinoid impacts on bees in the UK*”. Again this displays a very complacent attitude: are we to wait for there to be an impact on bees in the UK before we take action? We are not aware of any relevant field studies that have been undertaken in the UK that have appropriate methodology and adequate statistical power and look at long term exposure and colony health which would allow them to draw that conclusion. The only data that we do have to our knowledge is in the studies undertaken by the manufacturers which, as already mentioned, have been called into question by EFSA. Our conclusion is that the ACP are confusing ‘absence of evidence’ with ‘evidence of absence of impact’!

Supporting farmers to shift to safer and more sustainable pest management

If, as PAN UK urges, the UK does decide to restrict neonicotinoid use, then action is needed now to support farmers and other users to shift to safer, effective and more sustainable methods of managing the pests targeted by current neonicotinoid product use. Lessons from the US and Italy show that farmers have become increasingly dependent on use of neonicotinoid seed treatments as 'insurance' against possible pest attack. Entomologists in both countries have warned that 'insurance' applications run counter to one of the fundamental principles of Integrated Pest Management- pesticide interventions should only be made on the basis of field monitoring and when the level of pest incidence is likely to cause economic damage to the crop, on a particular field in a particular season. In the Italian case in maize, researchers found that maize pests were not problematic in fields sown with untreated seed and yields were not effected, showing that most, if not all of the time, these treatments are simply not needed. More details of the US and Italian cases and discussion of pest management alternatives are in our factsheets nos. 5 and 6.

Defra, the Pesticides Forum and the farming sector should take a much more proactive approach to looking at current levels of dependency on neonicotinoids, the actual, rather than perceived, need for treatment as 'insurance' and ways to promote more effective and comprehensive Integrated Pest Management (IPM). PAN UK has outlined a concept note for a pilot scoping study to explore what a British oilseed rape IPM strategy without neonicotinoids might look like.

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In regard to the draft UK National Action Plan on pesticides

Implementation of the new EU Directive on the Sustainable Use of Pesticides and the development of the new National Action Plan (NAP) on pesticides could be a real opportunity to develop a range of measures that would reduce the use of pesticides throughout the UK and consequently reduce negative effects on biodiversity from pesticides.

However, it is the opinion of PAN UK that Defra in drawing up the draft NAP has failed to include measures that would help protect the UK's biodiversity in any meaningful sense. Measures that PAN UK has urged Defra for some years to introduce, but which have been ignored, include:

- restrictions on the use of pesticides in certain areas such as parks, schools and hospitals
- a targeted phase out or reduction in use of certain pesticides
- a fully developed plan for the promotion of Integrated Pest Management
- measures to adequately protect water sources from pollution by pesticides.

Included as an annex to this document is the submission by a group of NGOs, including PAN UK, to the recent public consultation on the development of the NAP that was undertaken by Defra. In it you will see a range of concerns outlined and suggestions for ways in which the NAP could be strengthened to provide better protection for biodiversity to the from the multiple threats associated with pesticide use in the UK.

Annex 1

Biodiversity and Pesticides Group: National Action Plan consultation response

This consultation response is co-authored by a group of environmental NGOs working together to ensure that plant protection products have minimal impacts on biodiversity in the UK. This document, therefore, addresses measures required for the adequate protection of biodiversity and the environment only. However, many of the measures set out here would also contribute to the aim of reducing risks to human health. This response sets out those areas of strong mutual concern to these organisations. Some organisation will also submit their own response as different organisations do have different areas of focus and expertise.

The NGOs that support this document are:

- Buglife – The Invertebrate Conservation Trust
- Bumblebee Conservation Trust
- Butterfly Conservation
- ClientEarth
- ChemTrust
- Friends of the Earth
- Pesticide Action Network UK
- The Royal Society for the Protection of Birds

Overarching comments

The Sustainable Use Directive (SUD)[1] requires the UK to adopt a National Action Plan (NAP). The overall intention[2] is that NAPs should be used to "facilitate the implementation" of the SUD. Article 4 of the SUD sets out in some detail the purpose and required scope of a NAP. The draft UK National Action Plan (NAP) is useful in that it summarises measures currently in place to facilitate sustainable pesticide use. Many of these measures have had some success in meeting their specific aims and providing some environmental protection. However, the SUD is designed to move beyond the *status quo.* It establishes a framework to achieve a sustainable use of pesticides and specifies two key features underpinning the operation of that framework: one of these is the reduction of the risks AND impacts of pesticide use on human health and the environment; the other is promoting the use of integrated pest management AND of alternative approaches or techniques, such as non-chemical approaches to pesticides[3]. **It is our view that the draft NAP as it currently stands is wholly inadequate to achieve the sustainable use of pesticides in the UK.**

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[1] Directive 2009/128/EC of the European Parliament and the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides; OJ L309, 24.11.2009, Article 4.
[2] As commented in Recital (5)
[3] Article 1

This is backed up by current evidence, which shows that current pesticide use is not sustainable and that current measures are insufficient to move the industry in a truly sustainable direction. For example, the Pesticides Forum reports that pesticides remain a significant pollutant of waterways, and that populations of birds known to be indirectly affected by pesticides continue to decline[4]. The draft NAP also fails to clearly articulate how the UK intends to use the mechanisms and procedures required by the SUD in order to meet its stated objectives. Existing measures need to be built upon and improved, and, where necessary, replaced by new approaches, *via* effective and ambitious action, which is both targeted and measured, that will lead to more sustainable pest control systems with less pesticide reliance in UK.

Quantitative objectives, targets, measures and timetables

The setting of quantitative objectives, targets, measures and timetables is a requirement of the NAP in the SUD[5]; however, currently these components are not included in the draft UK NAP. These components are essential to facilitate effective delivery as well as understanding of benefits and impacts of different measures, to allow these measures to be improved upon in the future. Without them, the plan will be ineffective and very weak and not compliant with the SUD. Furthermore, the draft NAP heavily relies on voluntary initiatives. Clear targets are crucial to the success of such initiatives, so that all parties know what they are working towards and so that success can be evaluated. Voluntary initiatives require close monitoring along with consequences of non-compliance, to reduce the risk of free-riding and failure to reach environmental targets. Experience and research[6] shows such initiatives are only really successful when they are backed up by the possibility of regulation. Neither the Campaign for the Farmed Environment nor the Voluntary Initiative on pesticides would have got off the ground in the absence of the real possibility of stricter alternatives (regulation on set-aside and a tax on pesticide use respectively).
Addition to NAP: quantitative objectives, targets, measures and timetables added to all sections of the draft NAP.

Active substances of particular concern
The SUD [7] requires Member States to act in relation to active substances of particular concern. A NAP is to include indicators for monitoring use, especially if alternatives are available, and to set reduction targets and timetables. The SUD also requires identification[8] of trends in use of certain active substances and identification of priority items which require particular attention. The SUD specifically notes the position of active substances which, whilst currently approved, will not meet relevant criteria when renewal is sought.[9] However, this area has not been addressed by the draft UK NAP. The NAP should establish a system for monitoring and instigating research on plant protection products containing active substances of particular concern, establishing timetables and targets for the reduction of their use and a shift to alternatives; and so take a precautionary approach to potential impacts. This is key to NGOs, the public and other stakeholders having confidence in the UK government's ability to respond where increasing scientific evidence of environmental impact accrues. For example, in the case of neonicotinoid pesticides, despite a growing body of robust science indicating cause for concern, the government does not have a clear plan to mitigate the impacts of these pesticides and promote the use of suitable alternatives. As a

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[4] Pesticides Forum annual report (2011) pp 35 – 46 and pp 47 – 49. http://www.pesticides.gov.uk/Resources/CRD/Migrated-Resources/Documents/P/Pesticides-Forum-AR-2011-revSep12.pdf
[5] Article 4(1)
[6] See for example Voluntary approaches for environmental protection in the European union. OECD ENV/EPOC/GEEI(98)29/FINAL, Paris, OECD, 1998
[7] Recital (5), Article 4 (1) paras 2 and 3,,
[8] Article 15(2)(b) and (c)
[9] Article 4(1) para 2

result, many see the government as dragging their feet on the issue and risking damage to our fragile environment.
Addition to NAP: set up a system based on collating existing evidence, or the gathering of new evidence where necessary, to identify products containing active substances of particular concern, monitor their use, and establish timetables and targets for the reduction of their use and a shift to alternatives.

Indicators
Currently, the amount of pesticide applied in terms of weight of active substance is used as an indicator of pesticide use. However, weight applied is not a meaningful indicator because it does not reflect the different characteristics (e.g. toxicity) of different active substances. The Bichel Committee[10] states that the treatment frequency index is considered the best indicator of the environmental burden. The treatment frequency index expresses the average number of times per year agricultural land can be treated with the quantity of pesticides sold, assuming that they are used in the prescribed normal dosages.
Addition to NAP: tonnes of active substance should be replaced as an indicator by the 'treatment frequency index' to more accurately demonstrate environmental burden.
As noted in the draft NAP, the Wildlife Incident Investigation Scheme (WIIS) gives information about acute poisoning incidents, usually resulting from irresponsible use of pesticides. It is important to gather and act upon this information to enforce the correct use of pesticides. However, more relevant to the overall impact of pesticides on wildlife are sub-lethal, chronic effects that may occur even when pesticides are being used according to good practice. The Farmland Bird Index, reported by the Pesticides Forum as a headline indicator, is the best currently available dataset for this purpose. However, the impact of pesticides on these birds is indirect (by removing food sources), and bird populations are also affected by many other factors. There is a need for additional indicators that more directly reflect the impact of pesticides on wildlife, for example on pollinating insects or arable weeds.
The recent evidence showing the vulnerability of pollinator species to pesticides, particularly systemic pesticides, would make them ideal to assess chronic and sub lethal impacts. The importance of pollinators to food security and the agricultural economy are further reasons for their inclusion. Insects pollinate many high value food crops and it would cost UK farmers at least £1.8 billion a year to replace pollination services provided by insects with hand pollination[11]. There are a number of insect pollinator surveys that could be adapted e.g. the UK Butterfly Monitoring Scheme and the Bumblebee Walk.
Addition to NAP: the development of an indicator of direct impacts on wildlife is needed. A working group should be formed to look at how existing pollinator monitoring schemes and arable weeds could be used to provide a new indicator.
The development of resistance in pest populations is an indication that pesticide use is not sustainable, since it means that future control of a particular pest will require higher application rates or new active substances. Integrated Pest Management (IPM), by using a range of pest control strategies and resorting to chemicals only when necessary, should minimise the emergence of resistance. Therefore, an indicator or indicators that reflected the prevalence of resistance to certain chemicals in pest populations would provide useful information about the successful roll-out of IPM approaches. These datasets are already available and being collected: the Resistance Action Groups[12] actively monitor resistance in fungi, insects, rodents and weeds and maintain resistance matrices of known problems. These datasets could be used to generate a suitable indicator or indicators.
Addition to NAP: the development of a resistance indicator to help assess the effectiveness of IPM.

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[10] http://www2.mst.dk/udgiv/publications/2001/87-7944-622-1/pdf/87-7944-624-8.pdf
[11] Breeze T. D. 2011 Valuing UK Pollination Services
http://centaur.reading.ac.uk/25072/2/Insect_pollination_in_UK_agriculture_Final.pdf
[12] Resistance Action Groups http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/Resistance-Action-Groups

Integrated Pest Management (IPM)

IPM is at the heart of the SUD. It requires that Member States *"take all necessary measures to promote low pesticide-input pest management, giving wherever possible priority to non-chemical methods"* [13]. It has the potential to simultaneously improve pest control while helping farming to become more sustainable and resilient overall. From the point of view of individual farmers, it may help them to reduce their costs and avoid or overcome problems of pesticide resistance.

The SUD also provides[14] that the NAP must also set up objectives, targets, measures and timetables to "encourage the development and introduction of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides". The draft UK NAP is very weak in this area; it asserts that many users adopt practices which are in line with the principles of IPM. However, IPM is a complete system for pest and disease management made up of a suite of different techniques. Whilst it is acknowledged that UK farmers do adopt some IPM techniques, it is also fair to say that, as a whole, effective IPM implementation is generally low. Pesticide use is on the rise on some crops and it is clear that IPM is not being used widely enough. For example, according to FERA data insecticide application rates rose 26% on oilseeds and 295% on strawberries between 2005 and 2010.

Research in the UK by the Rural Economy and Land Use Programme[15] and funded by DEFRA clearly shows that farmers will adopt some, but not the complete range of, techniques that would deliver really effective IPM. As effective IPM cannot be delivered by uptake of one or two techniques in isolation. There is a need for a clear definition of what constitutes IPM and recognition that it is a stepwise approach with a need for farmers to build on and add to the techniques that they adopt. Also, without a clear definition of IPM and a means of measuring to what extent IPM is being adopted, it will be difficult to assess compliance with the requirements of the SUD. Adoption of both of these things would enable progress and achievements to be clearly demonstrated at both national scale and on individual farms.

Successful IPM example - Demark

The Danish experience offers a clear vision of what is required by farmers to develop their IPM approach and also shows the benefits of IPM in reducing use of and reliance on pesticides. Pesticide use reduction was introduced in Denmark in 1986 by the first governmental Pesticide Action Plan as a response to a major increase in the use of pesticides and a serious decline in farmland wildlife in the beginning of the 1980's. The wild plant diversity in farmland, for example, decreased by 60% from 1970 to 1990, and the number of partridges fell by 70% from 1970 to 1985.

One of the key measures of the Danish plan was the development of advisory services for farmers. These advisory services offered farmers information on the correct use of pesticides, the feasibility of limiting use through changes in crop rotation, choice of seed varieties, mechanical and biological control, assessment of needs and improved spraying techniques. Importance was placed on financial as well as environmental considerations so it was clear where the benefits of reductions on pesticide use were being felt.

A weekly newsletter was sent out to 20,000 farmers discussing issues such as pesticide products, preventive measures against insects, damage thresholds and the use of reduced doses. Information was also provided to farmers on field trips. The Danish Agricultural Advisory Service estimated in 1997 that the average dose of fungicides applied by their members was about 35% of the pesticide label recommended dose, in contrast to 90% in 1987 – a very clear reduction in use and fully in line with the goals of the SUD.

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[13] Article 14

[14] Article 4 (1) para 1

[15] Rural Economy and Land Use Programme (RELU) 2009 "Overcoming market and technical obstacles to Alternative Pest Management in Arable Systems" http://www.relu.ac.uk/news/policy%20and%20practice%20notes/Bailey/Bailey%20PPN10.pdf

The IPM plan currently under development represents an opportunity to meet many of the Directive's requirements for IPM. To achieve this, the plan should offer farmers a clear benchmark for their current performance, along with recommendations to improve and links to the resources available to help with this. A requirement to achieve a certain standard of IPM could be incorporated into existing assurance schemes as an incentive for farmers to complete the plan and implement improvements in their pest management strategies. Organic farming makes minimal use of pesticides and has clear benefits for biodiversity. Techniques used in organic farming, for example, measures to develop fertile soils and encourage natural enemies of pest species, should be incorporated into the IPM toolkit used by conventional farmers.

Addition to NAP:

- **Provide a clear definition of IPM that builds on the principles set out in Annex 3 of the SUD**
- **Develop crop and sector-specific IPM protocols**
- **Provide extension and outreach services to assist farmers in implementing IPM, this could be done through the existing Voluntary Initiative (VI)**
- **Integrate IPM options into agri-environment schemes e.g.: beneficial insect package**
- **Based on the above incorporate mandatory training in IPM for all sectors into assurance schemes**

Water Protection

As previously highlighted, pesticides are a significant water pollutant; for example, causing a risk of non-compliance in 15% of all surface water DrWPAs in England and Wales and 1.4% in Scotland[16]. A wide range of voluntary measures are currently being implemented to safeguard waters from pesticide pollution. Many initiatives, such as Catchment Sensitive Farming, focus only on areas which have existing problems and may neglect areas which are vulnerable, e.g. where a key species or habitat of conservation importance is present. Also, there seems to be limited integration of different initiatives. We, therefore, propose 'voluntary safeguard zones' as a method of bringing together measures in our most vulnerable water areas and ensuring better integration of measures specific to the water issue. This method could be applied to lakes, ditches, wetlands, ponds etc as well as rivers.

Voluntary safeguard zones would protect pesticide vulnerable waterbodies, particularly catchments designated under the Water Framework Directive ("WFD") or the EU Birds and Habitats Directives. This measure should be backed by a proposal for regulation should a voluntary approach prove unsuccessful. Each safeguard zone would have a series of requirements dependent on the specific vulnerability of that catchment, the species and habitats present and the specific problem in that catchment (e.g. a particular pesticide causing WFD non-compliance). These safeguard zones could be incorporated into River Basin Management Plans as part of the WFD, as well as other plans, such as regional biodiversity plans or locally-determined Nature Improvement Areas. They could include a range of measures such as Catchment Sensitive Farming and agri-environment as well as situation specific measures. Voluntary safeguard zones should be well supported by advice, training and assessments through integration with existing schemes and initiatives.

Species example – The Depressed River Mussel (*Pseudanodonta complanata*)

The Depressed river mussel is on the UK Biodiversity Action Plan list and has declined rapidly in the UK. It has a global threatened status of Vulnerable (IUCN), meaning it is at risk of extinction globally. High levels of Metaldehyde were found in Hurleston Water Treatment

[16] Pesticides Forum annual report (2011) http://www.pesticides.gov.uk/Resources/CRD/Migrated-Resources/Documents/P/Pesticides-Forum-AR-2011-revSep12.pdf

Works. Water is taken from a canal where the Depressed river mussel is found. There were worries that if no action was taken, this would result in a loss of the population completely. The Environment Agency responded by producing an information sheet explaining to local farmers about the mussel and reminding them of best practice when using Metaldehyde. This is one example of an area that would be suitable for a 'Voluntary Safeguard Zone'. A series of measures using a range of initiatives could be used to protect this watercourse and its population of Depressed river mussel in the long term.

Addition to NAP: Establishment of 'voluntary safeguard zones', which would combine a range of initiatives in our most vulnerable water areas

Specific areas

The SUD requires that Member States give special attention to the use of pesticides in specific areas, including protected areas as defined under the Birds and Habitats Directives (SPAs and SACs) and areas used by the general public. This is not satisfactorily addressed in the NAP.

Areas designated for biodiversity

The PPP (Sustainable Use) Regulations 2012 specify only that when pesticides are used in protected areas, the amount used and frequency of use must be as low as practically possible. This does not offer any protection above and beyond what should be universally practiced under an IPM approach. Protection also needs to go beyond the protected areas themselves: e.g. aquatic sites are affected by activities in the whole catchment. We believe that voluntary safeguard zones (see water protection section for detail) should be implemented for SPAs and SACs and other biodiverse areas that may be vulnerable to impacts of pesticides, backed by a proposal for regulation should a voluntary approach prove unsuccessful.

Addition to NAP: Establishment of 'Voluntary safeguard zones', which would combine a range of initiatives in our most vulnerable SPAs and SACs and other biodiverse areas

An appropriate mechanism exists to monitor and control the impacts of pesticides on SPAs and SACs in the UK in the form of the SSSI system (ASSI in Northern Ireland). Information available on the condition of English SSSIs[17] indicates that pest control practices may be a contributory factor in the adverse condition of some sites: water pollution from agriculture/ run off is cited as a factor for 281 sites, inappropriate weed control for 163, inappropriate pest control for 14, and pesticide/herbicide use is specified in 2 cases. The condition of SSSIs is monitored and assessed according to the individual management requirements and features of each site, so to more accurately assess the impacts of pest control on SSSIs would require examining the individual records for each site.

If the SSSI system is to be relied upon to meet the SUD requirements additional action needs to be taken.

Addition to NAP:

1. **Ensure all SPAs/SACs are underpinned by a SSSI. Where this is not the case, it will be essential that they are protected from inappropriate pesticide use via an alternative mechanism**
2. **Ensure all SSSI notifications coincident with SPA/SAC sites are checked and where necessary amended through re-notification to ensure that all SPA/SAC features are also SSSI features**
3. **Check all SSSI notifications coincident with SPA/SAC are checked to ensure that all potentially damaging activities are listed, and that for each, the relevant operations list covers all relevant operations which may result in**

[17] http://www.sssi.naturalengland.org.uk/Special/sssi/reportAction.cfm?Report=sdrt17&Category=N&Reference=0

damage to the features of the site, rather than just 'changes' to those operations.

In situations where the conditions above are not met, and, therefore, where there is no existing formal mechanism via which the effects of pesticide use on an SPA/SAC can be assessed, the obligation on Government, devolved administrations and competent authorities to ensure that SPAs and SACs are not damaged remains. For further discussion of this issue see the RSPB's response to the consultation in 2010[18].

An effective strategy for increasing and improving uptake of IPM (see IPM section above), would be the best means of delivering reduced risk to biodiversity on a landscape scale, ensuring protection beyond designated sites. Therefore, we suggest that the Government could use its 12 new Nature Improvement Areas (NIAs) to trial improved IPM delivery methods for farmers (such as farmer groups/farmer extension schemes mentioned above), which would provide useful case studies for improving IPM schemes nationally to better protect biodiversity.

Addition to NAP: NIAs used as pilot areas for increasing and improving the uptake of IPM to protect biodiversity.

Public spaces

It is surprising that the UK NAP contains no commitment to phase out or minimize use of pesticides in public spaces such as parks and school grounds. Although the 2012 Regulations (see above) include a requirement for use to be "as low as reasonably practicable" in these areas, the Government says that it will not further define this or issue guidance to pesticide users. This response falls far short of the requirement in the SUD[19] which requires Member States to "ensure that the use of pesticides is minimised or prohibited in certain specific areas" and further that specific alternative options [20] be considered in the first place.

Urban areas have a role to play in delivering the Government's aim of more and better places for nature. Cities are increasingly thought to provide important habitat for a range of biodiversity, which improves the quality of areas for living and provides health benefits. A plan to phase out the use of pesticides in parks and school grounds would not rule out exemptions being put in place to control particular incidents of pest or disease. Cities such as Toronto and Paris have managed to eliminate or significantly reduce the use of amenity pesticides - the UK Government should draw on this experience and offer leadership and guidance on this issue to local authorities. This could be delivered by changing the objectives of the existing Amenity Forum.

In the previous consultation carried out by Defra on implementation of the SUD, it was very clear that the majority of responses from the public and NGOs were supportive of complete bans in such areas[21]. There is no reason to suspect that it will be any different this time around. Stopping the use of pesticides in such areas is much less complicated than doing so in the agricultural setting. We, therefore, urge the government to listen to the public on this issue.

Addition to NAP: set out a plan to phase out pesticide use in parks and school grounds.

Sales and Information & Awareness raising

Members of the public want to know what the risks are to non-target organisms of using pesticides in gardens. They are particularly worried about bees: for example Buglife receives

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[18] http://www.rspb.org.uk/Images/RSPB%20response%20on%20SUD_tcm9-251411.pdf

[19] Article 12

[20] *Ibid;* "appropriate risk management measures shall be taken and the use of low risk plant protection products …. And biological control measures shall be considered in the first place"

[21] (see page 33) http://webarchive.nationalarchives.gov.uk/20110318131226/http://defra.gov.uk/corporate/consult/pesticides/101215-pesticides-condoc-response.pdf

frequent requests for information about the effects of pesticides on bees and other insects, and what gardeners can do to protect them. Pan UK also receives many calls each year from the public asking about products they intend to use on their lawns or in their gardens and patios etc. Their main area of concern is whether the products they intend to use will harm birds, bees or other wildlife and whether non- or less toxic alternatives are available. This information is not readily available to the public when purchasing chemicals: it is only if they search the internet they can eventually find information. The Sales section of the draft NAP (section 10.2) requires “distributors selling products for non-professional use to provide general information on risks, good practice **and** low-risk alternatives”. The non-regulatory arrangements described relate to shopkeeper training but this does not guarantee that the information will be passed on to the consumer. Although, as stated in the draft NAP, some information is provided on the label, labels can easily be misread or ignored. A reminder on risks and good practice would be very beneficial to ensure pesticides are used properly, along with information on low-risk alternatives.

Therefore, we would recommend an industry-led leaflet, developed in collaboration with stakeholders, to raise awareness of risks to non-target organisms, encourage correct use and suggest low risk alternatives; and to guide consumers to other sources of information. This would be a short leaflet offered to the consumer at the point of sale and would be a much more effective way of delivering this information. This would also be an easy way of ensuring that the regulation is being applied, particularly in relation to low-risk alternatives. This would also help deliver the National Action Plan section 11 Information and Awareness Raising as the leaflet would guide people to the HSE’s pesticides information webpages; we would hope that the ‘alternatives’ section of the website would improve as it only provide links to the homepages of other organisations at the moment.

Addition to NAP: An industry-led information leaflet at point of sale to raise awareness of risks to non-target organisms, encourage correct use and suggest low risk alternatives; and to guide consumers to other sources of information.

2 November 2012

Written evidence submitted by John Hoar

1. Summary

The UK pesticide regulatory bodies have failed to protect the honey bee and other pollinators from the hazards and risks associated with the use of neonicotinoid insecticides. Whereas in respect of neonicotinoid insecticides:

- The existing pesticide risk assessment for honey bees is inadequate;
- Neonicotinoids fail to meet the requirements of EC 1107/2009;
- There is no risk mitigation for seed treated with pesticides.

If neonicotinoids are not to be suspended under the precautionary principle, then there is an urgent need for a reporting system that mandates farmers to report the sowing of treated seed and which information is available to beekeepers to take into account in the management of their colonies.

2. Introduction

I am a beekeeper with four years' experience and the author of two articles for the British Beekeepers Association News (BBKA News)[1,2]

As you are aware, about one-third of UK arable land was sown with seed treated with systemic pesticides in 2010. Neonicotinoids are the active substance most widely used in systemic insecticides for seed treatment, e.g. clothianidin, thiamethoxam and imidacloprid. They are a neurotoxin to insects, the effect of which is virtually irreversible and cumulative. Neonicotinoids are at least 5 000 times more toxic to bees than DDT and a lethal oral or contact dose for a honey bee is in the order of nanograms (billionths of a gram).

I estimate that a single seed, treated with Bayer product 'Poncho', for example, contains the equivalent of 100 000 lethal oral doses for a honey bee. Of course, it is not expected that bees will have direct contact with the seed but they will be exposed to pesticide residues in pollen, nectar and guttation water, as well as in soil and water. Foraging bees will also take back pesticide residues to the hive. There is considerable scientific evidence that the use of neonicotinoids are harmful to honey bees and other wildlife, see for example: Tennekes[3] and Pesticide Action Network[4].

It is not the purpose of this submission to present scientific evidence against the use of neonicotinoids, but to ask the Environmental Audit Committee why DEFRA will not establish a reporting scheme that mandates farmers, who sow seed treated with systemic insecticides, to submit a report to a central collection point, accessible by beekeepers, so they may take this information into account in the management of their colonies. I wrote to the DEFRA Minister, Richard Benyon MP, on 13th May 2012 with this proposal, but it was refused.

3. The existing pesticide risk assessment for honey bees is inadequate.

In 2011, a *Pesticide Risk Assessment for Pollinators* workshop was held in the USA[5]. Two-thirds of the (48) participants were from the environmental protection agencies and agrochemical industry, including representatives from the UK Chemicals Regulation Directorate (CRD) and the Food and Environment Agency (FERA). The aim of the workshop was "to explore the state of the science on pesticide risk assessment for pollinators."

The workshop summary states:

- "no globally harmonised, tiered testing system exists for honey bees" nor a test that "addresses chronic toxicity to adult bees and larvae."
- "the methodology and testing scheme employed for foliar applications … is not adopted to assess potential hazard and risk from systemic pesticides."

The workshop summary concluded with a list of research recommendations, including:

- Compiling pesticide residue data in pollen and nectar compared with pesticide applications on seeds.
- To determine if plant guttation drops are a pesticide exposure route for bees.
- The need for a standard procedure for a chronic feeding study with adult bees.
- Further research on methods to evaluate potential pesticide effects on bee foraging behaviour.

At the Annual Open Meeting of the Advisory Committee on Pesticides (ACP) 2011, it was said that "It is therefore not expected that a standardised chronic bee toxicity guideline will be quick to develop (perhaps 5 years)."[6]

In June 2012 the European Food Safety Authority (EFSA) published a *Scientific Opinion on the science behind the development of a risk assessment of Plant Protection Products on bees*.[7] Here are some of the statements from the Summary:

- "The current methods of field testing would need major improvements in order to detect for example an increase in daily mortality of foragers by 10% with high statistical power."
- "Further research is recommended on the testing of the presence and fate of residues…and on the developments of reliable exposure models."
- "The overview of the available studies on sub-lethal doses and long-term effects of pesticides on bees highlighted gaps in knowledge and research needs in the following areas: more toxicological studies to be performed in bees for a wider range of pesticides on both adults and larvae including sub-lethal endpoint, also contact and inhalation routes of exposure."
- "It is therefore concluded that the conventional regulatory tests based on acute toxicity (48 to 96 h) are likely to be unsuited to assess the risks of long-term exposures to pesticides."
- "The working group identified the need for improvement of existing laboratory, semi-field and field testing and areas for further research."

Imidacloprid and Clothianidin were approved for use in 1993 and 2003 respectively, over 10 years ago. These statements confirm that there are major deficiencies in the existing pesticide risk assessment methodology and absence of proper research into the effects of neonicotinoids on honey bees in the field. It is clear that neonicotinoids were approved after inadequate tests designed for foliar (sprayed) products.

Thus the evidence above does not support the claim by DEFRA that "The risk assessment process, set out in European legislation, looks in detail at the risk to honey bees, considering a range of factors including methods of application and examining both lethal and sub-lethal effects."[8]

4. Neonicotinoids fail to meet the requirements of EC 1107/2009

European Regulation (EC) No. 1107/2009 lays down rules governing plant protection products and the active substances contained in these products.[9]

Persistence in the environment is an important criterion and an active substance is defined as 'very persistent' if the half-life in soil exceeds 180 days, yet Clothianidin has a half-life in soil of 545 days. It is surprising therefore that the UK Environment Agency does not routinely test soil and water for neonicotinoids, especially in locations where treated seed is sown in succession.

The Regulation also states that an active substance shall only be approved if it "will result in negligible exposure of honey bees, or has no unacceptable acute or chronic effects on colony survival and development, taking into account honeybee larvae and honeybee behaviour." (Annex 3, s3.8.3). As noted above, there are no internationally agreed test guidelines and the European Union risk–assessment methodology is incomplete in several respects, then it can be reasonably concluded that neonicotinoids have failed to meet this test.

5. There is no risk mitigation for seed treated with pesticides.

The EFSA states that the final decision on protection goals needs to be taken by 'risk managers'. EFSA also says "There is a trade-off between plant protection and protecting the ecosystem services, pollination, hive products and biodiversity. From a farmer's point of view, plant protection may be more important than hive products." In other words, there is a let-out clause in favour of economic factors.

The SETAC Workshop summary also says that if "the use of that [pesticide] product is considered efficacious and necessary [for plant protection], then the regulating authority may seek to manage the potential risk through mitigation." Risk mitigation is often in the form of label instructions.

For example, Bayer Provado© Ultimate Bug Killer (400ml aerosol spray can) contains 0.1 g Imidacloprid (0.25 g/l). The environmental protection label states "HIGH RISK TO BEES. Do not apply when blooms are open. APPLY AWAY FROM BEES." The term 'high risk' is worse than 'extremely dangerous'. This product is also systemic, i.e. it is absorbed into the plant, to provide up to four weeks plant protection. This aerosol can contains enough active substance to kill two million bees, based on a lethal dose of 50ng/bee (LD50 24h). It is shocking that that the risk manager decided in favour of ornamental plant protection and then passed responsibility for the protection of bees to the general public.

Risk mitigation is also undermined when agrochemical companies promote their neonicotinoid pesticide products as being more or less “bee-friendly”. Beekeepers rely on the users of insecticides to exercise caution and to liaise with local beekeepers before using pesticides that may harm bees. The term ‘bee-friendly’ serves to undermine this caution and encourage non-compliance.[10]

In respect of treated seed there is NO risk mitigation, e.g. there is no requirement for farmers to report when sowing seed. Unlike spray pesticides, which are applied at the first sign of a pest attack, i.e. reactively, pesticides applied to the seed are used constantly, whether they are needed or not, i.e. prophylacticly. There are many implications to wildlife and the environment by this approach to pest management. Yet the DEFRA publication *Pesticides: Code of practice using plant protection products* contains nothing precautionary about systemic products.[11]

6. Recommendations

If, as a result of this Inquiry, neonicotinoids are not going to be suspended under the precautionary principle, then there is an urgent need for a reporting system that mandates farmers to report the sowing of treated seed and which information is available to beekeepers to take into account in the management of their colonies.

Farmers derive economic benefit from the use of pesticides. The Rural Payments Agency has a Rural Land Register (RLR) which holds details of all registered land parcels in a digital format. All land must be registered on the RLR for a farmer to be eligible to receive payments from, say, the Single Payment Scheme. Each field has a unique reference number. Such a reporting scheme might be included in the current agri-environmental schemes administered by Natural England.

Farmers who sow treated seed would make an online report with relevant information to DEFRA, who could pass this information to the National Bee Unit (NBU). The NBU could then compare this information with ‘Beebase’ registered beekeepers and notify them by email accordingly. Alternatively, this information could be presented in the form of a map which beekeepers could access online. Beekeepers could then take this information into account in the management of their bee colonies. This would also allow further research into the effect of neonicotinoids on bees, by correlations between seed treated crops and colony losses nationally.

2 November 2012

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[1] Hoar, J. 2012a. ‘Pesticide Risk Assessment for Pollinators Workshop: A Beekeepers view.’ *BBKA News* May 2012.
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[5] Fischer D. & Moriarty, T. 2011. *Pesticide Risk Assessment for Pollinators: Summary of a SETAC Pellston Workshop*. Society of Environmental Toxicology and Chemistry (SETAC)
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[8] DEFRA. 2012. Statement on 'Neonicotinoid insecticides and bees'. DEFRA September 2012.
[9] European Parliament . Regulation (EC) No 1107/2009 concerning the placing of plant protection products on the market. *Official Journal of the European Union*. 24.11.2009
[10] Houlton, S. 2012. 'Feeding a growing world.' *Chemistry World* July 2012.
[11] DEFRA. 2006. *Pesticides: Code of practice using plant protection products*. DEFRA.

Written evidence submitted by Dr Nigel Raine

Summary

1. Defra state they will keep regulation of neonicotinoids under review in light of new evidence on effects of these pesticides to bees as it emerges.

2. Defra's commitment to update the risk assessment for bees and pesticides by the end of 2012 is highly desirable. This revised risk assessment should include:

i. sublethal effects of pesticide exposure.
ii. exposure to multiple pesticides.
iii. chronic exposure (as well as acute tests).
iv. larval exposure.
v. bumblebees and solitary bees (as well as honeybees).

3. A new study (Gill *et al.* 2012) provides evidence that field-level exposures of pyrethroid and neonicotinoid pesticides change the behaviour and survival of an important insect pollinator – the bumblebee (*Bombus terrestris*). All detrimental effects were most severe when colonies were exposed to both pesticides. This suggests the combined effects of pesticides could be more harmful to bees than exposure to single chemicals, something not assessed under the current risk assessment framework.

Detail

1. There is widespread interest in the possible impacts exposure to pesticides could be having on bees from a range of stakeholders, including farmers, beekeepers, the public, researchers, pesticide companies, policy makers, etc. Publication of the document 'Neonicotinoid insecticides and bees: the state of the science and the regulatory response' in September shows Defra are reacting to new scientific findings as relevant studies are published. They have also committed to continue this watching brief stating that: "As our knowledge develops, we (Defra) will continue to consider the need for further research and for any changes to the regulation of neonicotinoids."

2. At any point in time Defra will be making a decision on the regulatory status of any pesticide with partial evidence (i.e. the body of research and related information available at that time). It is for the committee to judge whether the evidence reviewed by Defra fully supports the conclusions drawn in the September report (pb13818). The proposed course of action "to update the process for assessing the risks of pesticides to bees in the light of developments in the science - including the latest research" seems a reasonable response given the speed with which the evidence base is growing and the importance of neonicotinoids to agriculture. It would be unfortunate if a putative neonicotinoid ban resulted in an increased usage of other pesticide classes which might have worse consequences for bees. However, the speed with which the risk assessment for bees and pesticides is updated is completed should be closely monitored. At present this document states the aim to complete this task by the end of 2012 – it would be highly desirable to see a firmer commitment to completion of this process by a specific date in print.

3. Looking forward a common criticism of the studies reviewed in this report is the lack of field-realism. A recently published study by Gill *et al.* (2012), investigated whether exposure to two of the most commonly used pesticides on flowering crops in the UK, at field-level concentrations, detrimentally affects bee behaviour and colony survival. This study, unlike any other, directly investigated whether sublethal effects on multiple individuals might be amplified to affect overall colony success. Understanding this is crucial given that the most important insect pollinators, honeybees and bumblebees, are eusocial so colony function relies on the efficient collective behaviours of numerous individuals. Specifically, we studied the effects that exposure to

sublethal doses of the pyrethroid lambda-cyhalothrin (LC) and the neonicotinoid Imidacloprid (IMD) had on bumblebee (*Bombus terrestris*) colonies over a 4-week (chronic) exposure period.

4. Gill *et al.* (2012) found that whilst IMD had only subtle effects on individual worker foraging behaviour this culminated in a significant reduction in overall colony performance and survival potential. Moreover, simultaneous exposure of colonies to both IMD and LC caused a significant increase in overall worker losses in comparison to independent exposure of each pesticide, and higher levels of colony failure (collapse). These findings are of particular concern given that the methods of exposure used are typical of those bees encounter in the environment in the UK.

5. Previous empirical studies on the effects of pesticides have focused primarily on honeybees which, due to their large colony, size present a challenge when studying colony effects. Consequently, the vast majority of studies to date have investigated single pesticide effects on specific behavioural traits of individuals under relatively artificial scenarios (reviewed in Cresswell 2011). Moreover, many of these studies have looked at an acute period of exposure (i.e. a comparatively high dose over a short period) rather than a more realistic chronic response (low level exposure over a longer time period). Honeybees are important pollinators, but there are also a wide variety of other bee species and other insect pollinators that play a major role in pollinating crops and wild plants. However we know much less about the possible effects of pesticides on insect pollinators other than honeybees.

6. One of the few studies to date on pesticide effects on bumblebees (Whitehorn et al. 2012) recently reported that colony queen production can be affected by IMD exposure (although it was unclear from this work what mechanism underpinned this observed effect). The study by Gill *et al*. (2012) is highly novel because it reports that chronic exposure to field-realistic levels of two pesticides both produce detrimental effects on individual bee behaviour with knock-on consequences for colony growth, success and survivorship. These results indicate there is a significant need to determine the effects of combined exposure to multiple pesticides during the risk assessment process for use of these chemicals (i.e. the situation bees typically face when foraging in the UK).

7. The Gill *et al*. (2012) study adds much needed information about the effects pesticides can have on bumblebees.

8. As an active researcher investigating pesticide effects on bees, I am very keen to support and work with the policy/decision making community to make the best decisions with robust evidence bases to allow our farmers to continue to provide food at the same time as allowing our bees to thrive (and continue to provide their vital role as pollinators of crops and wild plants).

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2 November 2012

Written evidence submitted by the National Farmers Union

The NFU represents more than 55,000 farming members in England and Wales. In addition we have 40,000 countryside members with an interest in farming and the country. The NFU welcomes the opportunity to make a submission to the Environmental Audit Committee's inquiry into Insects and Insecticides.

Executive summary

- The NFU aims to base its policy on sound scientific evidence and supports a risk-based approach to regulation.

- With respect to honey bee health, the NFU position follows the general consensus of the scientific community, which is that there is no single cause of honey bee colony losses, but pests and diseases, particularly the parasitic mite Varroa, are the most important factor at play.

- Farmers and growers use pesticides to control damaging pests and diseases, and thereby enable the reliable production of the safe high quality and affordable food and plants demanded by consumers.

- The decision to use a pesticide is not taken lightly - pesticides are expensive to buy and to apply and this cost has to be balanced against the cost of crop losses arising from pest or disease outbreaks.

- Wildlife Incident Investigation Scheme (WIIS) data shows that the number of pesticide incidents with bees in the UK is around its lowest since records began in 1981.

- If neonicotinoid insecticides were not available, farmers and growers would use less-effective insecticides that pose a greater risk to bees and other insects, and would compromise the production of many agricultural and horticultural crops.

- As the science moves on our understanding improves and this enables us to identify gaps in current regulatory processes and develop ways to improve them accordingly. This process is already well underway in respect of pesticides and bees.

Introductory comments

1. The NFU has a significant interest in the impact of insecticides on bees and other pollinating insects. The issue is very important to our industry in terms of agricultural pollination and the availability of crop protection products (pesticides), both of which are important elements of sustainable food production. We also have an interest in the insect pollination of wild plants within the wider countryside, as the majority of this land falls under the management of farmers and growers.

2. The NFU also represents the interests of commercial bee farmers, and has the Bee Farmers' Association (BFA) as a member. Through our membership of COPA-COGECA

(the EU level organisation representing farmers), the NFU works closely with the BFA to represent the interests of UK beekeepers at a European level.

3. At a national level, the NFU sits on the Bee Health Advisory Forum, which among other roles acts as the project board guiding implementation of Defra's Healthy Bees Plan.

4. Negative impacts of pesticides on non-target organisms are always an issue of concern and it is right that measures are taken to minimise and mitigate any risks. It is also important that any actual risks are looked at alongside the benefits of pesticide use. Earlier this year, the European Food Safety Authority (EFSA) published a lengthy review of the pesticide risk assessment process for bees[1], which stated that 'there is a trade-off between plant protection and the protection of bees. The effects on pollinators need to be weighed against increase in crop yields due to better protection of crops against pests.'

The use of scientific evidence

5. Concern has been raised by a number of organisations about the impact of insecticides on insects, in particular the impacts of neonicotinoid insecticides on bees and other pollinating insects. As a result there have been calls for changes to the regulatory assessments of the impacts of neonicotinoids on bees, and some organisations are calling for precautionary bans on the use of neonicotinoid insecticides until their safety is re-examined under new assessment processes.

6. There are a number of scientific studies showing that if you feed insects with neonicotinoid insecticides you see negative effects on their behaviour and life cycles. This is the evidence that sits behind calls by organisations for changes to regulatory assessments and precautionary bans, and this is the research that attracts plenty of media attention. However, there are also a number of equally valid scientific studies that have looked for these negative effects and not found them, and in particular not found them under full field conditions.

7. The NFU finds the way in which the issue is dealt with by the media particularly frustrating. Stories about pesticides and bees generally appear in response to the publication of a particular scientific study or handful of studies. The reporting does not assess how well the studies reflect the real-word field situation, or assess the relevance of the studies in the context of all the other known science in this area. As a result the science is reported, without any context of how significant the new findings are to the debate around pesticides and bees. The health of bees and other pollinating insects (including the impacts of pesticides on that health) is a science-based issue. Science works on the principle of testing and re-testing an idea to build a consensus – a weight of evidence.

8. The NFU aims to base its policy on fact and sound scientific evidence. With respect to honey bee health our position follows the general consensus of the scientific community, which is that there is no single cause of bee colony losses, but pests and diseases, particularly the parasitic mite Varroa, are the most important factor. There is no compelling weight of evidence showing conclusively that neonicotinoid insecticides are responsible for the widespread declines in bee and other pollinator populations. The NFU agrees that the

[1] EFSA Scientific Opinion on the science behind the development of a risk assessment of Plant Protection Products on bees (Apis mellifera [honey bees], Bombus spp. [bumble bees] and solitary bees), http://www.efsa.europa.eu/en/efsajournal/pub/2668.htm.

impact of insecticides on bees and other pollinating insects is a factor that should be investigated. There is no room for complacency, but equally this factor needs to be kept in perspective. The NFU is concerned that a disproportionate focus on the issue of bees and pesticides actually diverts attention away from the key threats of pests and disease, to the detriment of bee health in the UK. This concern is shared by organisations representing beekeepers.

9. In the interest of taking a balanced and appropriate approach to the evidence on this issue, the NFU has welcomed the assessments of recent research in the EFSA Statement (on the findings in recent studies investigating sub-lethal effects in bees of some neonicotinoids)[2] and the Defra report (Neonicotinoid insecticides and bees: The state of the science and the regulatory response)[3]. These balanced reviews have found the recent research to be inconclusive in terms of the sub-lethal effects that are likely to arise from current uses of neonicotinoids.

10. The NFU fully supports a risk-based approach to regulation. In the absence of a weight of evidence to support restrictions on the use of neonicotinoid products, changes (bans) would be made on the basis of a precautionary hazard-based approach, which we do not support. The NFU believes that taking a hazard-based approach, when the hazard of concern is impact on non-target insects, would undermine the EU regulatory process that is anchored in a science-based approach.

11. The long running Wildlife Incident Investigation Scheme (WIIS)[4] provides one of the few pieces of available evidence monitoring the ‘real-world’ unwanted effects of pesticides on wildlife in the UK. WIIS data shows that the number of pesticide incidents with bees in the UK is around its lowest since records began in 1981. In the last ten years there have only been five confirmed honey bee poisoning incidents as a result of the approved use of crop protection pesticides in the UK. It is widely believed that the decline in the number of honey bee poisoning incidents in the UK has been the result of the introduction of less persistent and less toxic chemicals (such as the neonicotinoids), and improved liaison between those applying pesticides and those keeping bees. The NFU believes this evidence suggests that in the context of pesticides and honey bees, the UK agricultural landscape is around the safest it has been for more than 25 years. This view is commonly echoed back by beekeepers themselves when the NFU meets with beekeeping groups around the country.

Does the EU regulatory system governing the placing of pesticides on the market adequately assess impacts on bees and pollinators?

12. There are concerns that there are inadequacies in the way regulatory authorities assess the long-term and sub-lethal effects of systemic pesticides (such as neonicotinoids) on insects. It is very well known that the current pesticide risk assessment systems for bees were not developed to assess systemic pesticides and this is being addressed by the International Commission on Plant Bee Relationships Bee Protection Group and the European Plant Protection Organisation (EPPO). EPPO guidelines were revised accordingly in 2010, based on detailed consideration of the available scientific evidence. Even before revision, the principles underlying the changes had already being widely applied by regulators both in the UK and at the EU level for many years in assessing the

[2] http://www.efsa.europa.eu/en/efsajournal/pub/2752.htm
[3] http://www.defra.gov.uk/publications/2012/09/18/pb13818-pesticides-bees/
[4] http://www.pesticides.gov.uk/guidance/industries/pesticides/topics/reducing-environmental-impact/wildlife

risks posed by systemic pesticides, to ensure their risk assessment procedures are appropriate.

13. Further changes to the regulation governing the placing of plant protection products on the market have meant that since June 2011 pesticides have been subject to stricter requirements regarding risks to honeybees.

14. The NFU has welcomed the EFSA Scientific Opinion[5] published earlier this year, which identified gaps in knowledge and made recommendations to improve the current risk assessment. As the science moves on our understanding improves and this enables us to identify gaps in current regulatory processes and develop ways to improve them accordingly. It is right that this is done and that this is done at the EU level. Changes are already happening and the NFU is also looking forward to seeing the outcome of EFSA's current work to review the current risk assessments for neonicotinoids, due to be published in December 2012.

Pesticide use and stewardship in the UK

15. All pesticides undergo rigorous assessment and there are strict regulations implemented at both an EU and UK level governing their development and use. As a result, the NFU considers that farmers and growers should be able to use all products approved through this process.

16. Farmers and growers use pesticides to control damaging pests and diseases, and thereby enable the reliable production of the safe high quality and affordable food and plants demanded by consumers. The decision to use a pesticide is not taken lightly - pesticides are expensive to buy and to apply and this cost has to be balanced against the cost of crop losses arising from pest or disease outbreaks. Having taken the decision that the risk of losses warrants the application of a pesticide, farmers and growers will use the most cost-effective product that is available to them.

17. The rate at which a pesticide can be applied is strictly controlled. All pesticides used in the UK are controlled under strict criteria as part of EU regulations 91/414 or 1107/2009. These controls set approved application rates for each product that ensure environmental protection requirements are met and that the pesticide will work effectively. These application rates include a maximum dose rate and it is a legal requirement that this must not be exceeded. This is an independently verified process and acts a regulatory control.

18. Because pesticides are expensive to buy and apply, farmers and growers will avoid higher application rates where possible to reduce costs. However they must apply products at suitable levels to achieve control, particularly as too low a dose rate would increase the risk of pests developing resistance to pesticides. Thus, actual application rates are determined by the economic need to control pests effectively and to avoid unnecessary wastage of expensive chemicals. The use of lower application rates can also be useful in enabling the option of additional subsequent applications, if these were to become necessary.

19. Application rates above recommended rates could also result in pesticide residues that exceed the permitted Maximum Residue Limits. This would result in the rejection of

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[5] http://www.efsa.europa.eu/en/efsajournal/pub/2668.htm

produce. Farmers and growers work to prevent such occurrences because the potential business impacts, such as loss of business, loss of assured status and prosecution, are huge.

20. The NFU believes that the standards of agricultural practice in the use of pesticides in the UK are among the highest in Europe, as evidenced by the high professional standards identified in the recent DEFRA Pesticide Forum report[6] and identified by ministerial comments concerning the achievement of the industry Voluntary Initiative since its inception in 2001 in raising pesticide stewardship standards[7].

21. The basis of this achievement is the Voluntary Initiative on pesticides, which has looked to improve the standards of operators, agronomists and application equipment on an on-going voluntary basis with schemes that in all cases continue to exceed the requirements of the newly implemented EU Sustainable Use Directive. The Voluntary Initiative reports progress to Defra ministers annually. On a voluntary basis 20,359 spray operators are involved in on-going Continuing Professional Development via the National Register of Spray Operators, run by City and Guilds. Of the total sprayed area in the UK, 86.8% was sprayed using spray equipment tested annually under the National Sprayer Testing Scheme. The inclusion of these measurers in assured produce schemes, like the Red Tractor, which have very high levels of uptake by farmers and growers, have further improved standards of pesticide stewardship in the UK.

22. Growers in the fresh produce and arable sectors are supported by experts in the agronomic advice industry, many of whom have received additional training beyond expected industry standards; 847 agronomists hold the Biodiversity Environmental Training Award (BETA), designed to improve the standards of environmental stewardship and encourage best practice.

23. Following the success of the Voluntary Initiative, improved pesticide stewardship has been encouraged by a range of chemical company initiatives and also by fresh produce and arable assurance schemes. Key industry initiatives relevant to insecticide usage have focused on use of buffer zones and low drift nozzles to reduce risk of drift, while careful stewardship of all pesticide-treated seed is undertaken by the industry. This includes improving seed applications to reduce risks of pesticide dusts, and by encouraging operator care to avoid seed spills and ensure seeds are properly buried when drilled.

24. The UK 2011 pesticide survey[8] indicates that the total area treated with pesticides in 2011 (5,974,142 ha) is similar to the area treated in 1991 (5,990,717 ha). However, during the same period the total weight of pesticide applied has halved (falling from *c*. 1,023,668 kg in 1991 to 437,399 kg in 2011). This indicates that the total usage of insecticide has more than halved in the last twenty years, as a result of improvements in active ingredient effectiveness and precision application technology. These improvements are also associated with a significant decrease in the use of pesticide sprays (965,324 kg in 1991, 356,233 kg in 2011) and an increase in use of seed treatments (*c*. 58,344 kg in 1991, *c*. 81,166 kg in 2011). More targeted applications that more precisely deal with the risk (such as seed treatments) enable insecticide usage to be reduced. Foliar sprays have always been associated with higher risk to non-target insects.

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[6] http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/pesticides-forum
[7] http://www.voluntaryinitiative.org.uk/
[8] http://pusstats.csl.gov.uk/myindex.cfm

The importance of neonicotinoid insecticides to UK horticulture and agriculture

25. The neonicotinoid class of chemicals includes a range of systemic insecticides, with different spectrums of activity, used in many different ways. This includes neonicotinoids considered a high risk to bees, and appropriately their use is governed by strict management practices to mitigate this risk, e.g. not applying when crops are in flower or when bees are actively foraging in the crop. But it also includes neonicotinoids that are considered such low toxicity to bees that they can be applied when crops are in flower and are vital components of Integrated Pest Management (IPM) strategies where populations of beneficial insects need to be conserved.

26. Neonicotinoids are used very widely in the UK. For example, more or less all oilseed rape would be seed treated with a neonicotinoid. There are five neonicotinoids approved for professional use in the UK; acetamiprid, clothianidin, imidacloprid, thiacloprid and thiamethoxam. Some of these are also approved for amateur use in bug killers. Clothianidin and imidacloprid are mainly used as seed treatments for crops including cereals, maize, oilseed rape, sugar beet and some horticultural crops. Thiacloprid is an IPM compatible neonicotinoid of low toxicity to bees, which is approved for use in the UK on a huge range of horticultural crops.

27. Neonicotinoids are particularly important in controlling sucking insect pests like aphids, thrips and capsids, because they are used
    a. to replace less effective older chemicals, such as the organophosphate, carbamate, pyrethrum and pyrethroid insecticides, which are generally more persistent and more toxic to bees and other beneficials. E.g. thiacloprid has replaced more persistent and more ‘bee toxic’ insecticides, like the pyrethroid deltamethrin, as a treatment for raspberry beetle.
    b. to control pests already resistant to the OP, carbamate, pyrethrum and pyrethroid insecticides, and as part of resistance management strategies. E.g. thiacloprid is the only effective ‘bee-friendly’ friendly’ insecticide available to control aphid pests on Brussels sprout. If thiacloprid was unavailable, growers would become dependent on just a few alternatives. This dependence would increase the risk of resistance developing to these insecticides. Moreover, these alternatives present a higher risk to bees than thiacloprid itself.
    c. as effective seed treatments, negating the need for more hazardous and frequent spray applications, e.g. thiamethoxam, clothianidin and imidacloprid are the only insecticide seed treatments for oilseed rape and sugar beet. Without them the option would be more frequent sprays, using pyrethroids that are a higher risk to bees and other insects. On cereals, no neonicotinoid seed treatments would result in the need for multiple insecticide sprays against aphids.
    d. as part of IPM strategies, e.g. selective neonicotinoids like thiacloprid are increasingly important on tree fruit crops such as apples. The alternative approved actives, such as cypermethrin, deltamethrin, chlorpyrifos, and bifenthrin, are more persistent and toxic to bees and other beneficial insects.

What would farmers and growers do if neonicotinoids were not available?

28. The number and range of pesticide active ingredients available to farmers and growers has already decreased significantly in recent years, following the adoption of EU Directive

91/414 in 1993 and the subsequent Directive 1107/2009, which were designed to bring an improved regulatory framework to pesticide registration. With wide ranging evaluations of toxicological effects on human health and the environment, the number of active ingredients available for use in the EU has fallen from *c.* 900 actives in 2001 to *c.* 230 actives in 2009. This has two main implications; firstly the more toxic substances are generally no longer available, and secondly the range of pesticides available to control each pest or disease has reduced significantly, such that in many cases only one or two pesticide control options may be available. This situation can be further compounded by high levels of pest resistance seen to many existing products.

29. Neonicotinoid insecticides are relatively new products compared with the alternative insecticides available and offer an alternative mode of action. Farmers and growers use these pesticides because they are the most effective products available. As indicated in point 27 above, neonicotinoids are used to replace less effective older chemicals, which would often have to be used in higher volumes and are generally more persistent and more toxic to bees and other invertebrates. Having no neonicotinoids would leave farmers and growers no option but to use insecticides that actually pose far greater risk to bees and other insects. Assuming of course that alternative pesticides are available at all. The use of these less effective pesticides would also seriously compromise production of many crops.

30. A recent survey by Bayer of oilseed rape farmers in the UK on the consequences of losing neonicotinoid seed treatments suggested that 90% of them would need to apply more insecticide sprays, 79% of them felt their yields would decrease, and 72% of them felt that there could be adverse environmental consequences.

31. Approximately 92% of sugar beet seed sown by UK growers was treated with neonicotinoid insecticides in 2012. The neonicotinoids are used to control aphid pests and in particular the virus diseases spread by these aphid pests. Research has shown that in the absence of adequate crop protection, 8 of the last 12 years would have resulted in virus epidemics that would have proved devastating to the industry. The loss of neonicotinoids would result in significant yield reductions that would render the sugar-beet industry uneconomic in the UK. Growers have no real control alternatives to neonicotinoids as the main aphid pest concerned has developed resistance to the single alternative insecticide spray currently approved for use.

Reducing pesticide use and alternative pest-control measures

32. The NFU believes that farmers and growers support the opportunities for including integrated pest management (IPM) strategies in their production systems. Many farmers already undertake integrated management strategies[9] when these strategies can reliably reduce the need for expensive pesticide applications. A well-rounded IPM strategy will encourage the use of seed technologies through variety selection and seed treatments. Improving application technology to reduce the overall quantities of pesticide applied, and the use of cultural control techniques such as crop rotation and changing cropping cycles, are all measurers undertaken commonly in field crop production today.

33. The NFU and other industry groups are actively involved in promoting the uptake of IPM strategies. For example, we are supporters of the Defra and industry co-funded SCEPTRE

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[9] http://www.defra.gov.uk/consult/files/consult-nap-pesticides-document-20120730.pdf

project[10] that aims to deliver applied research to help secure approvals for new and safer pesticides and biopesticides, and develop sustainable IPM programmes for use on edible crops. These IPM programmes would be compliant with the new EU Sustainable Use Directive.

2 November 2012

[10] http://sceptre.hdc.org.uk/

Written evidence submitted by The Wildlife Trusts

The Wildlife Trusts welcome the opportunity to submit evidence to the Environment Audit Committee (EAC) regarding insects and insecticides.

Our evidence focuses on neonicotinoid insecticides, in particular:

- The impacts of neonicotinoids on insect pollinators (honeybees, bumblebees, hoverflies, butterflies and moths)
- Half-life in soil; routes of exposure and contamination of non- target vegetation (such as that found along field margins)
- Impacts on ecosystems in the agricultural landscape
- Inadequacy of risk assessment for these types of insecticides

The Wildlife Trusts' position

1. There is a growing body of evidence that shows that neonicotinoids have a detrimental effect at sub-lethal doses on insect pollinators. For this reason, The Wildlife Trusts believe that until it can be categorically proven that neonicotinoids are not adversely impacting pollinator populations, and by extension ecosystem health, Government should adopt the precautionary principle and place a moratorium on their use on all outdoor crops.

Background

2. Since their introduction in 1991, there has been a growing concern that neonicotinoid insecticides could be harmful to insect pollinators at sub-lethal doses. Neonicotinoids have been cited as a contributory factor in Colony Collapse Disorder and recent research regarding their effects on bee foraging behaviour appears to substantiate this.

3. Insect pollinators provide a vital ecosystem service to the UK's farmers and fruit growers. It is estimated a collapse in pollinators would cost the UK economy *c*. £1.8 billion per year[1]

4. Most plant communities rely on pollinating insects to reproduce and therefore spread (apart from species such as grasses which are wind pollinated). They also form a vital part of the food chain for other species such as birds, reptiles and amphibians. It follows that any insecticide that drastically reduces pollinator numbers will have effects beyond the agricultural sector and will ultimately affect the health and function of entire ecosystems.

5. The registration documents/fact sheets for the individual neonicotinoids state that they are toxic or highly toxic to bees; either acutely, or chronically via pollen and nectar[2].

6. However, the manufacturers of the insecticides claim that neonicotinoids do not cause direct bee mortality at small doses. Defra is of the view that the body of evidence assessed so far supports the conclusion that neonicotinoids do not threaten honey bee populations if properly used.

7. The Wildlife Trusts are frustrated that in a number of areas of Defra activity, not least neonicotinoids and tree diseases such as ash dieback, the burden of proof lies in the wrong place. Instead of taking a precautionary approach and insisting that, before chemicals are allowed into the natural environment, companies prove that they do not pose a significant risk, we are in an absurd position where these chemicals are already widely used and the burden of proof is on everyone else to prove that they do, with the consequent delay in action causing potentially devastating impacts on parts of our wildlife.

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[1] UK National Ecosystem Assessment (2011) UNEP-WCMC, Cambridge

[2] See www.npic.orst.edu/factsheets/imidacloprid.pdf ; www.epa.gov/opp00001/about/intheworks/clothianidin-registration-status.html

8. In light of the risk assessment review currently underway by the European Food Safety Agency[3] we would like the EAC to determine why Defra continues to consent to the use of these neurotoxic chemicals even though the risk assessment of their effects on non-target species is acknowledged to be not fit for purpose.

Effects on insect pollinators

9. Pollination[4] has been estimated to be worth c. £430 million p.a. and 20% of UK cropped areas are pollinator dependent.[5]

10. Defra has estimated that the number of UK registered honeybee hives is only sufficient to supply a third of the pollination services required for agricultural crop production; the remainder of the services being supplied by wild pollinators.[6] Some crops such as strawberries, tomatoes and peppers are mainly pollinated by managed bumblebees; honeybees are also not as effective pollinators of field beans, apples and raspberries as wild pollinators.[3]

11. There is an increasing body of research that shows that sub-lethal doses of the active ingredient in neonicotinoids is damaging to honeybees and bumblebees. The effect on other pollinators is largely unknown.

Honeybees

12. Research by Mickaël *et al*[7] examined the sub-lethal effects of neonicotinoids on honeybee behaviour rather than on bee mortality *per se*. It showed that non-lethal exposure of honeybees to thiamethoxam caused high mortality due to homing failure at levels that could put a colony at risk of collapse. The researchers tested the theory that although sub-lethal doses of insecticide (in this case thiamethoxam) may not cause direct mortality, it could cause behavioural difficulties in bees and thereby cause homing failure in foraging honeybees. The conclusions of the study were that*: exposure of foragers to non-lethal but commonly encountered doses of thiamethoxam can affect forager survival, with potential contributions to collapse risk. Furthermore, the extent to which exposures affect forager survival appears dependent on the landscape context and the prior knowledge of foragers about this landscape. Higher risks are observed when the homing task is more challenging.*

13. Defra's response has been that although the results are interesting, they believe the artificiality of the experiment calls it in to question. We can appreciate that the 'perfect' experiment would be conducted totally in the 'wild' to mimic field conditions, but this assumes that it is easy to ensure that a 'control' group of bees have not been exposed to the insecticide (given the fact that research has also shown the long half-life of the active ingredient and contamination of field margins - see below).

14. **We would like the EAC to ascertain how unintended contamination of control bees would be dealt with in a field trial**.

15. With regard to Defra's observation of the potential artificiality of the dosing regime compared to exposure under field conditions - where is the evidence of this? The researchers claim that: *To simulate daily intoxication events, foragers received a field-realistic, sub lethal dose of thiamethoxam (a real dose of 1.34 ng in a 20-ml sucrose solution) and were released away from their colony with a microchip glued on their thorax.*

16. Their methods are explained in Supplementary Material[8] and the dosage has been verified and it is stated that: *The real content was measured to be 67µg/l, i.e. slightly above the expected 50µg/l, leading to an effective dose of 1.34 ng per honeybee.*

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[3] EFSA is currently revising the European Guidance Document on terrestrial ecotoxicology elaborated by the Commission and experts from Member States. In the context of this revision, the bees risk assessment will also be addressed.
[4] This includes all pollinators such as honeybee, bumblebee, hoverfly and to a lesser extent butterflies and moths
[5] UK National Ecosystem Assessment (2011). The UK National Ecosystem Assessment Technical Report (UKNEATR). UNEP-WCMC Cambridge.
[6] UK National Ecosystem Assessment (2011). The UK National Ecosystem Assessment Technical Report (UKNEATR). UNEP-WCMC Cambridge
[7] Mickaël Henry *et al* (2012) A Common Pesticide Decreases Foraging Success and Survival in Honeybees. Science Vol 336 :348-350
[8] Mickaël Henry *et al* (2012). Supplementary Material for A Common Pesticide Decreases Foraging Success and Survival in Honeybees. Published on 29 March 2012 on *Science* Express DOI: 10.1126/science.1215039

17. This dosage is in accordance with that which honeybees would be exposed in the wild i.e. in the order of parts per billion.

18. We would call on the ECA to scrutinize the studies that Defra refer to. Did the foraging bees face the complex landscape challenges that were introduced into Henry *et al's* research? If not, can they be thought of as reliable and do they mimic the field conditions that Defra so clearly want to see?

Bumblebees

19. Research published earlier this year by Whitehorn *et al.*[9] has found that bumblebees suffer decline when exposed to neonicotinoids. Researchers at Stirling University exposed colonies of bumblebees to miniscule doses (mimicking field realistic conditions) of the neonicotinoid, imidacloprid. They found that treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with control colonies. They conclude that: *there is an urgent need to develop alternatives to the widespread use of neonicotinoid pesticides on flowering crops wherever possible.*

20. Defra's response to this research is that because bumblebees are not covered in the current EU Authorisations Regulation *it is more difficult to assess the significance of the findings of this study*. **We do not see why this is the case, and the point regarding 'assessing the significance of these findings' needs further clarification by the EAC.**

21. We note that Defra commissioned a further study (PS 2371) to examine the potential effects of imidacloprid on bumblebees foraging on oilseed rape grown from imidacloprid treated seed under field conditions. The recently published research by Gill *et al*[10] confirms the findings of Whitehorn *et al*'s[6] work in that they showed:
imidacloprid exposure at concentrations that can be found in the pollen and nectar of flowering crops causes impairment to pollen foraging efficiency, leading to increased colony demand for food as shown by increased worker recruitment to forage.

22. They also found that a 'cocktail' of insecticides was even more damaging. In addition, they found that effects were seen when there was prolonged exposure (not over the 96 hour test) i.e. 2- 4 weeks - which mimics the crop blooming period.

23. The researchers concluded that:
Our findings have clear implications for the conservation of insect pollinators in areas of agricultural intensification, particularly social bees with their complex social organization and dependence on a critical threshold of workers performing efficiently to ensure colony success.

Other insect pollinators

24. We are not aware of any research being conducted on the effects of neonicotinoids on other insect pollinators. As pollination has been estimated to be worth c. £430 million p.a. and 20% of UK cropped areas are pollinator dependent,[11] we do find it surprising that the risk to other pollinators has been ignored (see also paragraph 3 above). However, we are aware of the ongoing research investigating which insects pollinate UK crops.[12] This may throw new light on the importance of other pollinators in the agricultural landscape but the research will not ascertain what impacts neonicotinoids have on all pollinators.

25. **In light of the fact that wild pollinators (i.e. not honeybees) make up a significant proportion of pollination services in UK crop production (see paragraph 3 above), we would like the EAC to**

[9] Penelope R. Whitehorn *et al.*(2012). Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production. , Science Vol 336: 351 - 352

[10] Richard J. Gill, Oscar Ramos-Rodriguez & Nigel E. Raine (2012). Combined pesticide exposure severely affects individual- and colony-level traits in bees, *Nature*, published 21 October 2012

[11] UK National Ecosystem Assessment (2011). The UK National Ecosystem Assessment Technical Report (UKNEATR). UNEP-WCMC Cambridge.

[12] The £10 million Insect Pollinators Initiative

scrutinize why Defra does not consider the risk to wild pollinators an important consideration in assessing the safety or otherwise, of neonicotinoids.

Half-life in soil and routes of exposure

26. Krupke *et al*[13] have found that neonicotinoid compounds are persistent in soils and are also found in untreated fields. In their research they conclude that:
These results demonstrate that honeybees living and foraging near agricultural fields are exposed to neonicotinoids and other pesticides through multiple mechanisms throughout the spring and summer. The potential for greatest exposure (and the period when mortality was noted), occurs during planting time when there is potential for exposure to extremely high concentrations of neonicotinoids in waste talc that is exhausted to the environment during and after planting.

27. They go on to state:
Our results also demonstrate that clothianidin is present in the surface soil of agricultural fields long after treated seed has been planted in that field. All soil samples we collected contained clothianidin, even in cases where no treated seed had been planted for 2 growing seasons. During the spring planting period, dust that arises from this soil may land on flowers frequented by bees, or possibly on the insects themselves. Of potentially greater concern are the very high levels of neonicotinoids (and fungicides) found in the talc that has been exposed to treated seed, since part of this highly mobile material is exhausted to the outside environment during planting and after planting. The large areas being planted with neonicotinoid treated seeds, combined with the high persistence of these materials and the mobility of disturbed soil and talc dust, carry potential for effects over an area that may exceed the boundaries of the production fields themselves.

28. This exposure to waste talc has also been found by Tapparo *et al*[14]. They investigated environmental exposure of honeybees to particulate matter containing neonicotinoid insecticides coming from corn coated seeds which have been drilled into soil. They found that:
particulate matter released by the drilling machine during the sowing of corn seeds coated with neonicotinoid insecticides represents a significant mechanism of environmental diffusion of these insecticides. Bees flying over the sowing field and approaching the emission cloud of the drilling machine can efficiently intercept the suspended particles being directly contaminated with elevated dose of insecticide, significantly higher than the LD50 values estimated for contact, with the cuticle, administration (18, 22, and 30 ng/ bee for imidacloprid, clothianidin, and thiamethoxam, respectively).

29. **As both experiments were conducted on maize/corn it is unknown whether the seed coating on OSR would present similar problem. We would like to know if this route of exposure has been investigated by Defra**.

30. Other routes of exposure include through guttation drops. Guttation is a natural plant phenomenon causing the excretion of xylem fluid at leaf margins Girolami *et al*[15] found that*:*
leaf guttation drops of all the corn plants germinated from neonicotinoid-coated seeds contained amounts of insecticide constantly higher than 10 mg/l, with maxima up to 100 mg/l for thiamethoxam and clothianidin, and up to 200 mg/l for imidacloprid. The concentration of neonicotinoids in guttation drops can be near those of active ingredients commonly applied in field sprays for pest control, or even higher. When bees consume guttation drops, collected from plants grown from neonicotinoid-coated seeds, they encounter death within few minutes.

31. **We would like the EAC to determine if this route of exposure is being investigated by Defra.**

Effects on ecosystems in agricultural landscapes

[13] Krupke CH, Hunt GJ, Eitzer BD, Andino G, Given K (2012). Multiple Routes of Pesticide Exposure for Honeybees Living Near Agricultural Fields. PLoS ONE 7(1): e29268. doi:10.1371/journal.pone.0029268
[14] Tapparo *et al* (2012). Assessment of the Environmental Exposure of Honeybees to Particulate Matter Containing Neonicotinoid Insecticides Coming from Corn Coated SeedsEnviron. Sci. Technol. 2012, 46, 2592−2599
[15] Girolami *et al* (2009). Translocation of Neonicotinoid Insecticides From Coated Seeds to Seedling Guttation Drops: A Novel Way of Intoxication for Bees. Journal of Econ Entomol. 102(5): 1808Ð1815

32. Most of the UK's plant communities rely on pollinating insects to reproduce and therefore spread (apart from species such as grasses which are wind pollinated). Although the loss of semi- natural habitat is thought to be a major driver of wild bee declines (and most likely other insect pollinators), the fact that there are fewer pollinators present will affect the composition of plant communities themselves because of limited reproductive capacity, genetic diversity and plant dispersal.

33. Pollinating insects also form a vital part of the food chain for other species such as birds, reptiles and amphibians. It follows that any insecticide that drastically reduces pollinator numbers and causes pollen limitation within wildflower populations[16] will reduce biodiversity and have effects beyond the agricultural sector which will ultimately affect the health and function of entire ecosystems.

34. Wildflower communities make up semi-natural grasslands, woodlands, agricultural field margins, hedgerows and have a recreational, aesthetic and cultural value which is difficult to quantify. Wildflower strips along crop margins have also been shown to harbour natural 'enemies' which can help control crop pests. [17]

35. Cardinali *et al*[18] reviewed two decades of research that has examined how biodiversity loss influences ecosystem functions, and the impacts that this can have on the goods and services ecosystems provide. They have made a number of concluding statements from their research including:
There is now sufficient evidence that biodiversity per se either directly influences or is strongly correlated with certain provisioning and regulating services – these included the regulating service of biocontrol.

36. Other researchers have also stated that conservation of biodiversity in the agricultural landscapes can be considered an insurance policy - providing ecosystem resilience in the face of perturbation.[19] Using aphids as an example Tscharntke *et al* stated:
The identity of naturally occurring enemies as cereal aphid antagonists greatly differs among regions and years. Around the city of Göttingen, Germany, there are years in which parasitoids are key mortality agents and others where ladybird beetles or syrphid flies[20] cause most of the mortality. Hence, cereal aphids suffer from a large number of enemies, but the effectiveness of each enemy seems to vary with landscape, region and. This spatio-temporal variation in effectiveness of each enemy species emphasizes the need of biodiversity preservation as insurance and to take large spatial scales into account. The long-term sustainability of ecosystems may depend on substitutable insurance species within each functional group. As environmental constrains change with time and space, it is hardly predictable which life history traits of aphid enemies is best adapted. Hence, only a diverse species pool for one ecological function may provide the best chance to include at least one well adapted, efficient species in a given environmental situation.

37. **We would like the EAC to ask Defra how they assess the impacts of neonicotinoids on biodiversity, ecosystem function and provision of ecosystem services.**

Inadequacy of risk assessment for these types of insecticides

38. The risk assessment process used to evaluate the risks of neonicotinoids (and indeed other insecticides) is outdated and designed for the older generation of insecticides which were sprayed on crops. Unlike systemic insecticides, the earlier foliage sprayed crops degraded quickly and so the risks to honeybees were only during the period of spraying or contact with recently treated foliage.

39. Neonicotinoids pose risks to insect pollinators, which are not currently accounted for, because:
    - they are persistent in soils,
    - they are transported to all parts of the plant including pollen and nectar (and guttation);
    - minute quantities found in pollen and nectar have sub-lethal effects

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[16] See: Ashman *et al* (2004). Pollen limitation of plant reproduction: ecological and evolutionary causes and consequences. Ecology **85** 2408-2421

[17] Haenke, S., Scheid, B., Schaefer, M., Tscharntke, T. and Thies, C. (2009). Increasing syrphid fly diversity and density in sown flower strips within simple vs. complex landscapes. Journal of Applied Ecology, 46: 1106–1114

[18] Cardinali *et al* (2012). Biodiversity loss and its impact on humanity. Nature 486

[19] Tscharntke, T., Klein, A. M., Kruess, A., Steffan-Dewenter, I. and Thies, C. (2005). Landscape perspectives on agricultural intensification and biodiversity – ecosystem service management. Ecology Letters 8: 857–874.

[20] This includes hoverflies

- effects can vary depending on landscape complexity, timescales over which contaminated food stuff is ingested, cocktail effect of other insecticide;
- they are not confined to crops but can contaminate wildflower field margins.

40. **In light of the risk assessment review currently underway by the European Food Safety Agency[21] we would like the EAC to determine why Defra continues to consent to the use of these neurotoxic chemicals even though the risk assessment of their effects on non-target species is acknowledged to be not fit for purpose.**

41. **Furthermore will a new risk assessment mean that there will be a moratorium placed on neonicotinoid use until it can be convincingly shown that pollinator populations are not significantly impacted upon by use of neonicotinoids?**

2 November 2012

[21] EFSA is currently revising the European Guidance Document on terrestrial ecotoxicology elaborated by the Commission and experts from Member States. In the context of this revision, the bees risk assessment will also be addressed.

Written evidence submitted by the Crop Protection Association

SUMMARY

- Plant protection products are thoroughly tested and can only be approved if there are no unacceptable effects on people or wildlife when they are used according to the conditions of approval.
- It is a legal requirement for users to follow the label which will include instructions for reducing any risks associated with the product.
- Actual pesticide use is monitored and shows that insecticide use has reduced.
- The Crop Protection Association (CPA) and other industry bodies are involved in stewardship activities to promote high standards of application and further reduce risk.

1. The Crop Protection Association

1.1 The Crop Protection Association (CPA) is a key voice of the plant science industry in the UK representing 23 member companies (see www.cropprotection.org.uk)

1.2 CPA members are involved in the development and manufacture of a wide range of plant science technologies which are of crucial importance to the cultivation and protection of food crops, protecting our gardens, woodlands, infrastructure and public places. These include the formulation and manufacture of synthetic and bio pesticides, seed and plant breeding, agricultural biotechnology and the breeding of bees.

2. Plant Protection Products testing and authorisation

2.1 Plant protection products or pesticides are developed to protect plants against specific pests. They are essential to ensure the production of healthy, safe, affordable food in sufficient quantity to feed our growing population. Insecticides are pesticides that control insect pests; herbicides control weeds and fungicides control fungal diseases. Because they contain biologically active compounds and people and non-target organisms can be exposed to them, pesticides have to be thoroughly tested and evaluated to ensure that they can be used without causing unacceptable effects.

2.2 There is detailed European legislation (Regulation 1107/2009) governing the testing, evaluation and authorisation of pesticide active substances and products. Pesticide substances have to be put through a comprehensive series of tests including acute and chronic toxicity in humans and animals, metabolism studies, residues in food, environmental and ecotoxicological studies and efficacy. The results of these tests are evaluated by the regulatory authorities in Member States. Only if the regulators are satisfied is the substance authorised for use in pesticide products which themselves must be tested and approved for specific uses. Approvals can be reviewed at any time.

2.3 Amongst other considerations, Regulation 1107/2009 requires that a plant protection product, when used according to good practice and under realistic conditions of use, must not have any unacceptable effects on the environment. This includes “impact on non-target species, including the ongoing behaviour of those species” and “impact on biodiversity and the ecosystem” (Article 4: 3(e) (ii) and (iii)).

2.4 The honey bee has been selected as a representative pollinator species in the authorisation process. The Regulation states that “An active substance, safener or synergist shall be approved only if it is established, following an appropriate risk assessment on the basis of Community or internationally agreed test guidelines, that the use under the proposed conditions of use of plant protection products containing this active substance, safener or synergist will result in negligible exposure of honeybees or has no unacceptable acute or chronic effects on colony survival and development, taking into account effects on honeybee larvae and honeybee behaviour.” (Annex II: 3.8.3)

2.5 In order to ensure that this is the case, a series of tests is undertaken ranging from laboratory oral and contact toxicity tests to field trials exposing bee colonies under realistic conditions. Metabolites are also tested if they have pesticidal activity. The likelihood of negative effects is assessed and if necessary mitigation measures can be stipulated on the product label to further reduce any risks. These might include:

a. Application in the evening or early morning when honey bees are not flying
b. Reduced application rates
c. Agronomic practices such as removing flowering weeds within the crop before spraying
d. Use of seed drilling equipment which reduces the escape of seed treatment dust to the air.

2.6 Pesticide users are legally required to follow these label instructions.

2.7 Research continues after a pesticide has gained approval. Many studies have been done looking at the possible causes of bee decline some of which are referenced in submissions from Bayer CropScience and Syngenta. Those studies that have used realistic field conditions have not shown any link between poor bee health and pesticides. The general consensus is that causes of poor bee health are multifaceted and include parasites such as the Varroa mite and Nosema, viruses and diseases, a lack of genetic diversity, a lack of suitable forage and nesting habitats, and stress-induced impacts, such as the transport of managed colonies.

3. Levels of pesticide use in the UK

3.1 Pesticide use varies from year to year depending on what crops are planted and on the levels of pests, weeds and diseases. This in turn varies according to the weather conditions. Insecticide use is relatively low when compared with herbicides and fungicides.

3.2 The Pesticide Usage Survey Teams of the Food & Environment Research Agency, an executive agency of the Department for Environment, Food & Rural Affairs conduct surveys of pesticide usage. Their report for arable crops harvested in 2010 is available at the following link:
http://www.fera.defra.gov.uk/scienceResearch/science/lus/documents/arable2010.pdf

3.3 Data on actual pesticide usage on various arable crops are collected and then extrapolated to give national usage estimates of the area of pesticide treatments and the amount of active substances applied.

3.4 The Pesticides Forum Report, Pesticides in the UK 2011, shows that there has been a decrease in the amount of insecticide used in winter wheat between 2004 and 2010 (see Pesticides in the UK, page 56, figure 22a).

4. Industry Stewardship

4.1 Some insecticides can kill bees **if they are misapplied and not used according to the instructions**. For this reason it is essential that users follow the label instructions carefully.

4.2 Instead of being applied as a spray, some insecticides can be applied to the seed so that both the seed and the emerging plant are protected from pest attack. Seed treatments are applied by specialist contractors. The European Seed Association (ESA) and seed treatment manufacturers have developed the European Seed Treatment Assurance scheme (ESTA) to set and audit standards in the seed treatment industry. The standard covers areas such as calibration of equipment and use of a HACCP (Hazard, Analysis, Critical Control Point), a form of risk assessment.

4.3 In addition to the label, all insecticides have an Environmental Information Sheet (EIS) which contains specific information on how to protect wildlife including bees when using that product. These are produced by Members of the Crop Protection Association (CPA) as part of the crop protection industry's commitment to the Voluntary Initiative (VI) (an industry-led initiative to promote the responsible use of pesticides) and can be found on the VI website at: www.voluntaryinitiative.org.uk

4.4 The Crop Protection Association has also published advisory leaflets for farmers and growers and for gardeners.

4.5 "Bee safe, bee careful…when using insecticides" was published in 2011 and contains general stewardship advice for farmers using professional insecticide products. Nearly 180,000 copies have been distributed through the National Farmers'

Union and British Beekeepers' Association (BBKA) to their members. It is also accessible through the CPA website:
http://www.cropprotection.org.uk/media/1948/bee_safe_bee_careful.pdf

4.6 The leaflet describes general stewardship advice which should be followed when applying insecticides in flowering crops including top and soft fruit, oilseed rape, beans, cereals maize and pea crops, and where there are neighbouring flowering crops or flowering wildflowers. This includes:

• Avoid spraying when bees are actively foraging. Spray in the evening or in the early morning when fewer bees forage.

• Take care to minimise drift to nearby flowering plants or hives in and around the treated field. Check the wind speed is less than 5 mph, that nozzles are as close to the crop as possible and that appropriate nozzles are being used.

• Check with beekeepers for locations of local hives and repeat this process annually as beekeepers may change locations of hives.

• Keep local beekeepers contact details in the tractor/sprayer cab and on your mobile. Give at least 24 hours' notice of spraying and identify the product(s) being used.

• If using with a triazole fungicide use only approved tank-mixes.

4.7 The leaflet also gives advice for the use of seed treated with insecticide. This should be planted strictly in accordance with the seed bag recommendations and in addition care should be taken to:

- Avoid leaving treated seed on the surface after planting;
- Ensure that there is no leaching of the seed treatment into puddles and watercourses as pollinators may drink these;
- Limit agitation and abrasion of seed which could lead to "dust" containing insecticide being released into the air.

4.8 Farmers are also encouraged to help bee populations by creating habitats such as tussocky grass field margins and providing nectar and pollen sources by sowing flowering plants on field headlands and managing hedgerows.

4.9 The leaflet for gardeners "Bee informed…when using insecticides in your garden" was published earlier this year and over 100,000 copies have already been distributed to consumers in conjunction with the Horticultural Trades Association. It is also available online:
http://www.cropprotection.org.uk/media/31346/bee_safe_leaflet_v13_final_final_jan_12.pdf

4.10 Although the amount of insecticides used in gardens by the general public is much lower than on farms, it is still important for them to be applied according to the label instructions and following some simple rules such as: spray when bees are less active such as early morning or in the evening; do not spray directly onto open flowers; mow the lawn to remove flowers from weeds before spraying.

4.11 These leaflets, together with discussions with the British Beekeepers' Association, have triggered dialogue at a local level between the industry and beekeepers which is helping to develop a better understanding of the use of insecticides.

4.12 CPA encourages all pesticide users to be aware of the locations of bee hives and supports the notification of beekeepers prior to spraying insecticides.

6 November 2012

Written evidence submitted by Buglife

1. Buglife considers that conserving invertebrates, and particularly those that may be affected by pesticides, is important because they provide a significant proportion of the ecosystem services that humans require, including pollination which is worth £510 million per year to UK agriculture. In addition we believe that negligently causing the extinction of a species is wrong.

2. Buglife has been involved with the issue of neonicotinoid pesticide use since 2008 and in 2009 we produced a report (Kindemba 2009[1]) that summarised all the publically available scientific evidence relating to neonicotinoid pesticides and invertebrates. What we found concerned us, a high proportion of independent studies showed serious sub-lethal impacts on non-target invertebrates. Buglife had no position on the subject before undertaking the science review (we believe that pest control measures should each be judged on need and environmental safety), but after reviewing the science our report recommended:-

    - A review of the inclusion of imidacloprid, other neonicotinoids and fipronil on the positive list of authorised substances in Annex I of Directive 91/414.
    - A review of existing neonicotinoid and fipronil products authorised for outdoor use in the UK.
    - Until the reviews are completed a precautionary suspension of all existing approvals for products containing neonicotinoids and fipronil where these products have been authorised for outdoor use in the UK.
    - The development of international methodologies for assessing the effects of systemic pesticides and sub-lethal impacts on invertebrates.

3. Since 2009 we have seen no compelling evidence that would lead us to change this position, indeed several studies have reinforced very significantly the concerns that we developed at that time (Fipronil is no longer licenced for use in the UK).

4. The evidence we would like to present to the EAC is primarily contained in the attached letter titled *"Neonicotinoid insecticides and bees: the state of the science and the regulatory response, Defra, 13 September 2012 - And re. a proposed claim for judicial review by Buglife – The Invertebrate Conservation Trust"* that we have sent to Defra and that is intended to constitute a letter before claim for the purpose of the Judicial Review Pre-Action Protocol.

Our View in Summary

5. The Defra statement dated 13 September 2012 consisted of a review of some recent neonicotinoid studies and a conclusion that although some of the new studies provided evidence of sub-lethal effects of neonicotinoids, they did not give 'unequivocal evidence that sub-lethal effects with serious implications for colonies are likely to arise from current uses of neonicotinoids'; accordingly, Defra considered that no change to the existing regulation of neonicotinoids is justified.

6. We consider that this decision is an administrative law decision which is susceptible to challenge by way of judicial review.

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[1] Kindemba V. 2009. The Impact of Neonicotinoid Insecticides on Bumblebees, Honey Bees and Other Non-target Invertebrates. Buglife - The Invertebrate Conservation Trust, Peterborough, UK.

7. What we consider to be the appropriate legal framework for the decision and the issues that need to be considered are detailed in the attached letter presented as evidence and we won't repeat them in this letter. There two broad areas of concern in relation to this inquiry 1) were the principles that should have been applied in making the decision applied; 2) were the factors that should have been considered included in the review and considered adequately.

8. Principles that should have been applied include 1) the precautionary principle, we believe that the relevant legislation is clear on this point, and 2) the principle of public participation in environmental decision making that is enshrined in the Aarhus Convention.

9. Factors associated with the use of neonicotinoid pesticides that should have been considered include, the potential:-

   a) impacts on pollinators other than bees;
   b) impacts on aquatic and soil wildlife;
   c) impacts from the dust clouds released every time neonicotinoid seed is drilled (sown);
   d) impacts on species listed for protection under the Natural Environment and Rural Communities Act;
   e) impacts on the UK's ability to meet the ecological and groundwater targets under the Water Framework Directive;
   f) impacts on sites protected by the Birds and Habitats Directives;
   g) impacts from garden and amenity use as well as agricultural use;
   h) plant protection benefit of neonicotinoid use;
   i) and an economic cost/benefit analysis that accounts for effects on ecosystem services.

Recommendations

10. We encourage the EAC to:-

   a) consider the increasing weight of evidence of serious sub-lethal effects;

   b) bear in mind that there is very little funding for, or research undertaken, looking for problems and hence the absence of proof may be more a function of where research funding is allocated than any reflection of the reality of the situation;

   c) examine the small numbers of studies that have suggested that at least domestic honeybee hives are not radically affected by neonicotinoids and to ask if the studies are statistically robust, or would be able to detect a significant sub-lethal effect that would operate over a period of months;

   d) bear in the forefront of their mind that honeybees are artificially sustained domestic animals that are responsible for less then 10% of pollination services and that the environmental safety and economic impact of neonicotinoids must be considered in the context of wild pollinator populations that are responsible for 90% of pollination and are inherently more vulnerable to pesticides than honeybees;

   e) include in this review the impact on freshwater life, particularly bearing in mind that the Blueprint Coalition has just scored the Government E in relation to pesticide pollution of water bodies in its annual review of progress towards a sustainable water policy - http://www.wcl.org.uk/docs/Blueprint_for_Water_Scorecard_6Nov12.pdf;

f) consider what effects the growing popularity of neonicotinoid based garden pesticides are having on the environment and if the impact of garden and amenity use has been adequately considered by Defra;

g) NOT limit its inquiry and recommendations to the important scientific questions that this issue raises, but also to consider the test that should be applied to reach a decision to suspend or ban a pesticide. Should the environment be protected only after there is absolute proof of impacts, or should the importance of preventing damage to the environment mean that in certain instances action of a precautionary nature is needed? What does the law have to say on these questions?

Annex I
Letter from Buglife to Defra Secretary of State

Dear Secretary of State

Re. *Neonicotinoid insecticides and bees: the state of the science and the regulatory response*, Defra, 13 September 2012

And re. a proposed claim for judicial review by Buglife – The Invertebrate Conservation Trust

Introduction

1. I write on behalf of Buglife – The Invertebrate Conservation Trust ("**Buglife**"). The purpose of this letter is to inform you of a proposed judicial review challenge by Buglife to your Department's decision, contained in the above Defra statement dated 13 September 2012 (the "**Statement**"), not to make any changes to the regulation of neonicotinoid insecticides (the "**Decision**").

2. This letter is intended to constitute a letter before claim for the purpose of the Judicial Review Pre-Action Protocol. A summary of the information required by Annex A to that Protocol is set out at the end of this letter.

The Decision

3. In its Statement, Defra considered 15 recent studies examining the effects of neonicotinoid insecticides on bees (summarised at Annex 1 to the Statement), with a view to deciding *inter alia* whether further restrictions on the use of neonicotinoids are required: see §1 of the Statement. Defra's conclusions, as summarised at §2 of the Statement, were that although some of the new studies provide evidence of sub-lethal effects of neonicotinoids, they do not give *'unequivocal evidence that sub-lethal effects with serious implications for colonies are likely to arise from current uses of neonicotinoids'*; accordingly, while it will continue work in this area, Defra considers at present that no change to the existing regulation of neonicotinoids is justified.

4. We consider that Defra's decision not to make any changes to existing regulation (i.e. the Decision) is an administrative law decision which in principle is susceptible to challenge by way of judicial review.

<u>Buglife – The Invertebrate Conservation Trust</u>

5. Buglife is a company limited by guarantee and a registered charity (no. 1092293) that represents invertebrates and their conservation. Invertebrates are all the animals that do not have backbones – 98% of all animal species - and even when plants, fungi and microorganisims are included, 64% of all British species are invertebrates. Buglife considers that conserving invertebrates is important because they provide a significant proportion of the ecosystem services that humans require, including pollination which is worth £510 million per year to UK agriculture. In addition causing the extinction of a species is morally repugnant and Buglife works to prevent this happening.

6. Buglife was founded in 2000 in response to a generally recognised need (brought into sharp focus by the creation of the UK Biodiversity Action Plan in 1994) for an organisation specialising in invertebrate conservation. Its aim is to halt the extinction of invertebrate species and to achieve sustainable populations of invertebrates, and it seeks to do so by practical conservation projects, enhancing education and knowledge, and assisting in the development of law and policy, among other things.

7. In appropriate cases, Buglife seeks to fulfil its charitable objectives by using judicial review proceedings to challenge administrative decisions which unlawfully threaten, or fail to protect, invertebrate life. The Decision in the present case appears to Buglife to be of just such a kind. We consider that Buglife would have standing to bring a challenge of the kind described in this letter before claim and would invite you to agree that that is the case.

<u>The legal framework</u>

Regulation 1107/2009

8. The authorisation of the use of pesticides in the UK is governed by EU law. Regulation 1107/2009/EC concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC ("**Regulation 1107/2009**") lays down harmonised rules for the authorisation of *'plant protection products'* including pesticides, and for their placing on the market, use and control within the EU.

9. Regulation 1107/2009, as its recitals record, is based on the high level of protection principle:

   'The purpose of this Regulation is to ensure a high level of protection of both human and animal health and the environment and at the same time to safeguard the competitiveness of Community agriculture' (Recital 8);

   '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' (Recital 24).

10. Regulation 1107/2009 is also, as Article 1(4) provides, *'underpinned by the precautionary principle, in order to ensure that active substances or products placed on the market do not adversely affect human or animal health or the environment'*.

11. The mechanism of the Regulation, in effect, requires all pesticides available in EU Member States to undergo a two-stage approvals process.

12. At the first stage, *'active substances'* (the active chemicals contained in plant protection products) are assessed at the European level. Article 4 lays down the criteria for approval of active substances. Active substances must be approved if it may be expected, in the light of current scientific and technical knowledge, that plant protection products containing that active substance (or residues of that substance) meet certain requirements. These include the requirement that at least one plant protection product containing the active substance must among other things (see paragraphs 3 and 5 of Article 4):

    a. be sufficiently effective;

    b. have no immediate or delayed harmful effect on human health, including that of vulnerable groups, or animal health, directly or through drinking water;

    c. have no unacceptable effects on the environment, having particular regard to the following considerations where the scientific methods to assess such effects are available:

        i. its distribution in the environment;
        ii. its impact on non-target species, including on the ongoing behaviour of those species; and
        iii. its impact on biodiversity and the ecosystem.

13. There remains, however, a second stage, whereby plant protection products containing an active substance or substances must be approved at the national level before being placed on the market. The requirements for the authorisation of plant protection products are laid down in Article 29. Before approving the plant protection product, Member States must be satisfied that the active substances used in the product have been approved and that, in the light of current scientific knowledge, the substance complies with the requirements of Article 4(3) referred to in paragraph 12 above.

14. Compliance with these requirements must be established by "official or officially recognised tests and analyses carried out under agricultural plant health and environmental conditions relevant to the use of the plant protection product in question and representative of the conditions prevailing in the zone where the product is intended to be used." (Article 29(3)).

15. The assessment of whether the active substance or plant protection product will meet the relevant requirements (i.e. the first and second stage approvals) must be made pursuant to the uniform principles set out in Regulation 546/2011 (the "**Uniform Principles**"). The following Uniform Principles are of particular relevance to the approval of neonicotinoids:

    a. Member States shall ensure that the data submitted is acceptable in terms of quantity, quality, consistency and reliability.

    b. Member States shall consider other relevant technical or scientific information they can reasonably possess with regard to the performance of the plant protection product or to its adverse effects.

c. Member States shall consider possible elements of uncertainty in the information obtained during the evaluation.

d. Member States shall evaluate the possibility of exposure of aquatic organisms to the plant protection product.

e. Member States shall evaluate short-term and long-term risk to honeybees.

16. Both first and second stage approvals involve input from and consideration by different regulatory bodies. At the EU level, the European Food Safety Authority (the **"Authority"**) is the technical body which advises the Commission and carries out risk assessment and risk communication in relation to food safety. In the UK, the Advisory Committee on Pesticides (ACP), an independent scientific advisory committee provides advice to ministers on pesticide related issues. Product approvals are handled by the Chemicals Regulation Directorate (CRD) of the Health and Safety Executive which works with Defra as the competent authority with strategic policy responsibility for the area. Defra also receives technical advice from other expert groups including Defra's Food and Environment Research Agency (FERA).

17. Article 44 governs the withdrawal or amendment of authorisations of plant protection products. It provides in material part as follows:

'1. Member States may review an authorisation at any time where there are indications that a requirement referred to in Article 29 is no longer satisfied.

A Member State shall review an authorisation where it concludes that the objectives of Article 4(1)(a)(iv) and (b)(i) and Article 7(2) and (3) of Directive 2000/60/EC may not be achieved.

2. Where a Member State intends to withdraw or amend an authorisation, it shall inform the authorisation holder and give him the possibility to submit comments or further information.

3. The Member State shall withdraw or amend the authorisation, as appropriate, where:

(a) the requirements referred to in Article 29 are not or are no longer satisfied..."

18. Article 21 empowers the Commission to review the approval of an active substance, including where a request is made by a Member State "*in light of new scientific and technical knowledge and monitoring data...."* as well as where it determines that it should act on its own initiative.

19. Article 55 requires the use of plant protection products to comply with the general principles of integrated pest management set out in Article 14 of and Annex III to Directive 2009/128/EC. Those principles require, among other things, that pesticides *'shall be as specific as possible for the target and shall have the least side effects on… non-target organisms and the environment'* (paragraph 5 of Annex III) and that uses should be kept to the minimum level necessary (paragraph 6).

20. Regulation 1107/2009 and its associated Regulations are directly applicable and so have immediate legal effect in the United Kingdom without the need for implementing legislation; but certain provisions ancillary to Regulation 1107/2009 are made by the Plant Protection Products Regulations 2011.

Directive 91/414/EC

21. Most neonicotinoids currently used in plant protection products in Europe were approved as active substances under the procedure laid down by Directive 91/414/EC, which Regulation 1107/2009 replaced. The old procedure similarly comprised two stages i.e. approval of active substances at EU level and approval of products at Member State level. Authorised active substances were added to a list, contained in Annex I to Directive 91/414/EC, by amending directives.

22. Acetamiprid and thiacloprid were added as active substances with effect from 1 January 2005 following the adoption of Directive 2004/99/EC. Imidacloprid was added as an active substance with effect from 1 August 2009 following the adoption of Directive 2008/116/EC. Thiamethoxam was added with effect from 1 January 2007 following the adoption of Directive 2007/6/EC. Clothianidin was added with effect from 1 August 2006 following the adoption of Directive 2006/41/EC.

23. These directives also set conditions for the inclusion of the active substances in Annex I. For example, the inclusion of thiacloprid was subject to the requirements that Member States pay particular attention to:

    a. the protection of non-target arthropods;
    b. the protection of aquatic organisms; and
    c. the potential for groundwater contamination.

24. Directive 2010/21/EU introduced additional specific provisions relating to seed treatment use of clothianidin, imidacloprid and thiamethoxam. These provisions relate to labelling of seeds, professional application of seed treatments and monitoring of possible impacts on bees following the taking of precautionary measures by certain Member States after substantial losses of bee colonies related to accidental releases of the relevant active substances.

25. Active substances which were included in Annex I are now deemed approved under Regulation 1107/2009 and are listed in a separate implementing Regulation (540/2011/EU). This Regulation replicates the conditions for approval that were previously laid down in the amending Directives.

<u>The factual background</u>

26. The following is a brief overview of the factual background relevant to the Decision and Buglife’s long-running engagement with Defra over the issue.

27. Neonicotinoids are a set of nicotine-based insecticides. They are neurotoxins which attack the central nervous system of invertebrates. They are commonly used in the form of “systemic” pesticides; unlike conventional spray pesticides these may be applied as seed dressings or soil treatments, so the chemical is absorbed by the root system and transported to all parts of the plant, including the nectar and pollen. Systemic pesticides of this kind may have certain advantages: for example, less of the chemical is required. However, such use also carries with it disadvantages: for example, it results in long-term exposure to non-target species and means pesticides are used routinely regardless of whether crops are at risk from pests.

28. Five principal neonicotinoids are currently found in plant protection products (i.e. pesticides) authorised for use in the UK: thiamethoxam, thiacloprid, clothianidin, acetamiprid and imidacloprid.

29. There has been growing concern that neonicotinoids are contributing to declines in populations of pollinating insects including (but not limited to) honeybees, bumblebees and butterflies. These declines are thought to be at least in part attributable to the sub-lethal and chronic (i.e. long-term) effects of neonicotinoids. For example, these insecticides are thought to inhibit bees' ability to navigate and communicate. In social insects such as bumblebees, the health of the colony as a whole relies on the ability of individual bees to forage effectively, therefore sub-lethal effects at the individual level can manifest as lethal effects at the colony level, and as declines at the population level. Non-social insects are unable to fall back on the support of others to survive and may be even more vulnerable to reproduction failure and population decline.

30. These concerns have led to full and partial bans of some neonicotinoid products in France, Germany, Italy and Slovenia in the recent past, including the most recent action taken in France this year in relation to Cruiser OSR.

31. In 2008, Defra commissioned a report "Are pesticide risk assessments for honeybees protective of other pollinators" stated that *'there are many cases where species are several orders of magnitude more sensitive on a per individual or weight basis than honeybees, e.g. Lepidopteran larvae'*, and concluded that *'more detailed toxicity and exposure information for a range of species is required for a robust assessment of the risk posed.'*

32. In January 2009, a group of European NGOs submitted a request for an internal review of the decision by the Commission to authorise imidacloprid, on the basis that it does not meet the requirements of Article 4 of Directive 91/414 as evidence fails to demonstrate that it has no unacceptable effect on the environment. The Commission refused the request on the grounds that the NGOs lack standing.

33. Buglife, along with other UK NGOs, have repeatedly raised concerns about the impacts of neonicotinoids on bees and other non-target invertebrates. In September 2009 Buglife published a report, which was sent to Defra. The report:

    a. summarised several independent scientific studies published between 2001 and 2008 which demonstrated that imidacloprid, a widely used neonicotinoid, had significant negative impacts on bees and other non-target invertebrates at levels predicted to be present in the UK countryside;

    b. criticised the test methodologies used in the EU process for authorising pesticides for failing to properly assess sub-lethal and chronic risks to honeybees and other non-target invertebrates;

    c. called on Defra to adopt a precautionary approach by suspending all existing approvals for products containing neonicotinoids pending a review of their inclusion on the list of authorised active substances.

34. The ACP responded to the Buglife Report in November 2009. The ACP reassessed the data for Chinook, a seed treatment containing imidacloprid, and concluded that "semi field and field studies indicate that there are no gross impacts on foraging honeybees."

35. However, the ACP acknowledged that there was a gap in the Government's understanding regarding the effect of the insecticides on wintering bees: "it is feasible that low level chronic (i.e. long-term) exposure could cause adverse effects on overwintering bees such that the ability of individuals to survive the winter is impaired. It is proposed that this issue is a potential data gap."

36. In July 2010, Defra confirmed that it did not intend to take any action in response to the Buglife Report.

37. There followed a series of correspondence between Buglife and various other NGOs and Defra during 2010 and 2011, in which Buglife continued to criticise Defra's response to the Report and its approach to the regulation of neonicotinoids. In particular, Buglife objected to Defra's focus on domestic honeybees to the exclusion of other non-target invertebrates and the environment, and its failure to apply the precautionary principle. In the course of this correspondence, Professor Bob Watson, Defra's Chief Scientific Adviser endorsed the use of the precautionary principle: "The precautionary principle should be applied to the risk management phase. The UK Government supports the appropriate use of the precautionary principle as a guide to decision-making when evidence is inconclusive."

38. Between 2010 and 2012, a series of scientific studies were published which provided further evidence that low doses of neonicotinoid insecticides have sub-lethal effects on honeybees. For example:

    a. Sub-lethal exposure to thiamethoxam was shown to reduce learning ability, reduce memory, and increase hive death rate by causing foraging honeybees to fail to navigate their way back to the colony.
    b. Imidacloprid (and when studied Clothianidin) reduced waggle-dancing, reduced the capacity of workers to produce food for their young, reduced activity, increased forage time, lowered foraging efficiency, and caused disorientation.
    c. Exposure to sub-lethal doses of imidacloprid and thiacloprid highly increased susceptibility to infection of honeybees, and mortality of honeybees already infected by, Nosema disease.
    d. Sowing dust and guttation fluid produced as by-products of standard use of neonicotinoids have been shown to be capable of killing honeybees.

    These studies, many conducted under field or semi-field conditions (i.e. not just in laboratories), and all using concentrations that can be encountered in arable fields, indicate illustrate not only a direct risk to honeybee colonies (probably responsible for c. 9% of pollination services), but also increase concern levels for wild pollinators. When the risk to one type of insect is shown to be higher than thought, then it is highly probable that wild bees, moths, hoverflies and other insects are also more vulnerable to the effects of low doses of these chemicals than previously thought. These wild pollinators are responsible for over 90% of pollination services and are crucial to a healthy environment.

39. Between 2010 and 2012, there were also been a series of scientific studies published which provided further evidence that low doses of neonicotinoid insecticides could have additional significant effects on the environment. For example:

    a. Colonies of bumblebees exposed to imidacloprid experienced lower colony growth and an 85% reduction in queen production.

b. Imidacloprid reduced the ability of bumblebees to feed and reduced bumblebee brood production by one third.
c. Chronic exposure of bumblebees to imidacloprid and the pyrethroid l-cyhalothrin at concentrations that could approximate field-level exposure impaired natural foraging behaviour and increased worker mortality leading to significant reductions in brood development and colony success.
d. Imidacloprid was shown to have very significant impacts on earthworm growth and activity.
e. Neonicotinoids were shown to be even more toxic to solitary bees than to bumblebees.
f. Dandelions growing near neonicotinoid treated fields and visited by foraging bees were found to contain neonicotinoids.
g. Widespread contamination of Dutch surface waters with imidacloprid was found, with concentrations regularly exceeding the Maximum Tolerable Risk levels.
h. Imidacloprid was detected in 67 samples (89%) of Californian surface water and concentrations exceeding the safety benchmark in 19% of samples.

These studies, many conducted in the field or semi-field conditions and all observing or applying pesticide concentrations encountered in the countryside, indicate a direct significant risk to wild pollinators and the environment.

40. The new science led to renewed calls for the suspension of neonicotinoids in the UK. In April 2012, the Pesticides Action Network UK ("PAN UK") initiated a joint letter on behalf of a group of NGOs, including Buglife, to the Secretary of State for Environment, Food and Rural Affairs (then Caroline Spelman) calling for a precautionary suspension of neonicotinoid approvals. Defra refused to take any action on the basis that "the body of evidence assessed so far supports the conclusion that neonicotinoids to not threaten honeybee populations."

41. In parallel, Buglife engaged in a further round of correspondence with Professor Watson of Defra, again highlighting concerns at Defra's continued failure to address risks posed to non-bee invertebrates and failure to apply the precautionary principle.

42. In May 2012, EFSA published its scientific opinion on the development of a risk assessment of plant protection products on bees, at the request of the Commission. The opinion identified a number of major shortcomings in the current risk assessment methodology. For example:

a. Conventional regulatory tests based on acute toxicity are likely to be unsuited to assess the risks of long-term exposures to pesticides.
b. Laboratory conditions fail to take account of intermittent and prolonged exposures of adult bees, exposure through inhalation and exposure of larvae.
c. The conventional standard tests do not fully assess sub-lethal doses of pesticides.
d. The guideline for field testing has several major weaknesses leading to uncertainties concerning the real exposures of the honeybees – better suited to assessment of spray products than seed and soil treatments.

The opinion recommends separate risk assessment for bumblebees and solitary bees. The opinion formed the basis for EFSA's new draft guidance document which was published for consultation in September 2012 and is due to be finalised by the end of 2012.

43. On 13 September 2012, Defra published the Statement. The Statement found that *"although some of the new studies provided evidence of sub-lethal effects of*

neonicotinoids in the conditions applied in the research, none of the studies give unequivocal evidence that sub-lethal effects with serious implications for colonies were likely to arise from current uses of neonicotinoids and that the existing studies submitted in support of the present regulatory approvals fully meet required standards."

44. Based on these findings, Defra concluded that:

    a. It is appropriate to update the process for assessing the risks of pesticides to bees in the light of developments in the science, including the latest research.

    b. Further research will be carried out to fill identified evidence gaps.

    c. The recent studies to not justify changing existing regulation. However, Defra left open the possibility of changes to the regulation of neonicotinoids in light of new research.

<u>First proposed ground of review: breach of Article 44 of Regulation 1107/09</u>

45. One of Defra's stated purposes in making the Statement is "to consider whether...further restrictions on the use of Neonicotinoids are required" (paragraph 1). It would appear that Defra has conducted a review for the purposes of Article 44, para 1 of Regulation 1107/09 so as to be able to determine whether it is required to act under Article 44 para 3 to withdraw or amend authorisation of products containing neonicotinoids. Article 44 requires Member States to withdraw or amend authorisations where the requirements of Article 29 are no longer satisfied.

46. It is clear, especially in light of recent developments in the scientific literature, that the requirements referred to in Article 29 of Regulation 1107/09 are no longer satisfied in relation to any UK-authorised plant protection products containing the neonicotinoids thiamethoxam, thiacloprid, clothianidin, acetamiprid or imidacloprid. A schedule of such plant protection products (the "**Products**"), including details of their manufacturer and active substances, is enclosed, - titled "Neonicotinoid Products". In particular, none of the Products complies, in light of current scientific and technical knowledge, with the requirements provided for in Article 4(3)(e) (contrary to the requirement in paragraph 1(e) of Article 29): it cannot be established that any of the Products *'have no unacceptable effects on the environment'*. On the contrary, there is significant evidence in the recent literature reviewed in Defra's Statement, that neonicotinoids have unacceptable effects on the environment, having regard to their impact on non-target species, and bees in particular.

47. Regulation 1107/09 is underpinned by the precautionary principle. Defra itself has acknowledged in correspondence between Buglife and Defra's Chief Scientist, Robert Watson) that the precautionary principle must play a key role in the authorisation process; it follows that it must play a key role in the review of any authorisation.

48. The Statement acknowledges that there is solid evidence that products containing neonicotinoids pose a risk to bees. Further, the Statement acknowledges that the current risk assessment process is inadequate for assessing the extent of those risks:

    "it is appropriate to update the process for assessing the risks of pesticides to bees in the light of developments in the science – including the latest research. This exercise should include the development of a new risk assessment for

bumble bees and solitary bees, alongside an update risk assessment for honey bees."

This is consistent with the findings of EFSA, the technical body responsible for advising the Commission on risk assessment.

49. Nowhere in the Statement does Defra mention, still less discuss, the precautionary principle. On the contrary, Defra appears to apply the very inverse of the precautionary principle, justifying its Decision by an assertion that none of the recent studies provides "unequivocal" evidence of serious implications for bee colonies.

50. In the circumstances the only lawful decision compliant with the obligations imposed by Article 44, interpreted in a manner consistent with the precautionary principle, would be to withdraw or amend the authorisations of the Products pending the completion of the revision of the rules for risk assessment and the further research that is underway to fill the gaps in the evidence.

<u>Second proposed ground of review: further breaches of duty or failures to have regard to mandatory, relevant considerations</u>

51. Further, it appears from the Statement that in making the Decision Defra has failed to have regard to a number of considerations, which, as a matter of law Defra was bound to consider, including:

    a. **Impacts on non-target species other than bees**.

        i. The Statement only addresses the impacts of neonicotinoids on bees (domestic honeybees, wild bumblebees and solitary bees). In reviewing the authorisation of a plant protection product under Article 44, Defra must, when considering whether a product has "no unacceptable effect on the environment" consider its impact on "non-target species." While the Uniform Principles specifically refer to short and long term impacts on honeybees, it is clear from an ordinary construction of Article 4(3) that "non-target species" is not limited to honeybees or even to bees. This is also clear from the various conditions laid down for the use of products containing active substances, which require member states to pay particular attention to the protection of a number of non-target species including "aquatic organisms", "non-target arthropods" "granivorous birds" and "small herbivorous animals". This is particularly concerning in light of the 2008 Defra report which highlighted the shortcomings of pesticides risk assessments for a wider range of non-target organisms (see paragraph 31 above). On the face of it, Defra has failed to conduct any "assessment of the risk posed" to any non-target species other than bees before making the Decision.

        ii. The duty to consider non-target species must also be considered in light of the Secretary of State's duties under Section 41 of the Natural Environment and Rural Communities Act 2006. In accordance with Section 41, the Secretary of State has published a list of the living organisms and types of habitat which in the Secretary of State's opinion are of principal importance for the purpose of conserving biodiversity. The list includes the following living organisms:

        Barberry Carpet *Pareulype berberata*

Grey Carpet *Lithostege griseata*
Pale Shining Brown *Polia bombycina*
Striped Lychnis *Shargacucullia lychnitis*
White-spotted Pinion *Cosmia diffinis*
Pale Eggar *Trichiura crataegi*
Garden Dart *Euxoa nigricans*
Dot Moth *Melanchra persicariae*
Hedge Rustic *Tholera cespitis*
Green-brindled Crescent *Allophyes oxyacanthae*
Dusky-lemon Sallow *Xanthia gilvago*
Large Nutmeg *Apamea anceps*
Rosy Rustic *Hydraecia micacea*
Grey Partridge *Perdix perdix*
Yellowhammer *Emberiza citrinella*
Large Garden Bumblebee *Bombus ruderatus*
Shrill Carder Bee *Bombus sylvarum*
Scabious Cuckoo Bee *Nomada armata*
Necklace Ground Beetle *Carabus monilis*
Set-aside Downy-back *Ophonus laticollis*
Mellet's Downy-back *Ophonus melletii*
A Downy-back Ground Beetle *Ophonus puncticollis*
Oolite Downy-back *Ophonus stictus*
River-shore Cranefly *Rhabdomastix japonica*
Iron Blue Mayfly *Nigrobaetis niger*
Depressed River Mussel *Pseudanodonta complanata*
Desmoulin's Whorl Snail Vertigo *moulinsiana*

All of these species occur in agricultural habitats where neonicotinoids are directly used; in habitats adjacent to agricultural habitats that may be affected by airborne dust from seed planting; or in aquatic habitats directly affected by run-off and seepages of water from such habitats that are likely to contain the pesticides. These species are therefore likely to be threatened by neonicotinoid pesticides or the effects of these pesticides on their food supply. By deciding not to withdraw the approvals for the Products without first considering their impact on species other than bees, Defra has failed to have regard to or act in accordance with the Secretary of State’s duty under section 41(3)(a) to take reasonably practicable steps to further the conservation of any of the organisms set out above.

b. **Impacts on protected areas**. Article 6(3) of Directive 92/43/EEC (the “**Habitats Directive**”) requires an *‘appropriate assessment’* to be conducted in relation to any plan or project not directly connected with a special areas of conservation but *‘likely to have a significant effect thereon’*. Since the neonicotinoids in the Products are water-mobile and sowing dust can be air-borne, there is a real possibility or likelihood that by their continued use they will be carried into Special Areas of Conservation and Special Protection Areas, significantly affecting them by causing damage to invertebrate life therein. However, it appears that Defra did not carry out any Habitats Directive analysis of the likely effect of the continued use of neonicotinoids on Special Areas of Conservation before making the Decision.

c. **Potential to compromise compliance with Directive 2000/60/EC (the “Water Framework Directive”)** i It is clear from Regulation 1107/09 (Recital 16, Recital 47, Article 21 and Article 44) that the potential for the adverse impact of pesticides on the achievement of the water quality objectives of the Water Framework Directive is a critical factor in the approval of both active substances and plant protection products.

ii The objectives of Article 4(1)(a)(i) and (ii) of the Water Framework Directive state respectively that Member States shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water, and shall protect, enhance and restore all bodies of surface water, with the aim of achieving good surface water status by 2015.

iii Article 4(1)(b)(i) requires Member States to prevent or limit the input of pollutants into groundwater and to prevent the deterioration of the status of all bodies of groundwater. Member States shall review an authorisation where it concludes that the objectives of Article 4(1)(b)(i) of the Water Framework Directive may not be achieved. Further, Regulation 540/2011/EU specifically requires member states to pay particular attention to the potential for groundwater contamination from thiacloprid, clothianidin, thiamethoxam. Neonicotinoids are water-mobile, toxic chemicals which by their nature leach into surface and ground waters.

iv The Products are ‘pollutants’ (by the definition contained in Annex VIII to the Water Framework Directive). It is recognised that Water Framework Directive delivery is still a work in progress in the UK. However, Defra does not appear to have carried out any analysis of the risk of groundwater contamination or to the achievement of good ecological and chemical statuses for surface waters posed by the use of the Products.

d. **The extent of any benefit to plant protection.** Recital (24) of Regulation 1107/2009 emphasises that it must be demonstrated that plant protection products *‘present a clear benefit for plant production’*. This is reflected in the approval criteria for active substances and plant protection products, which requires that a plant protection product *‘shall be sufficiently effective’*. However, the Decision appears to have been made without any consideration of the effectiveness of the Products or whether their effectiveness is sufficient to outweigh the environmental detriments the Products cause. There is good reason to believe that no such benefit is demonstrated by at least some neonicotinoids. For example, the Product “Biscaya” (containing thiacloprid) is marketed to destroy a pollinator population, namely pollen beetles.[2] However, it is scientifically established that oilseed rape replaces damaged flower buds by creating produces new buds when existing buds are damaged[3]; and in these circumstances it is very difficult to see how the destruction of pollen beetles could have any benefit for oilseed rape production.

To give another example, Dr Phil Botham, Head of Product Safety at Syngenta, has gone on record to say that the Product “Cruiser OSR” creates nearly €1 billion of value for farmers and the oil seed rape chain across the EU.[4] By

[2] the “control of pollen beetles in oilseed rape”(http://www.bayercropscience.co.uk/product/insecticides/biscaya/; 23 Sept 2012).
[3] Ingrid H. Williams and J. B. Free 1979 Compensation of oil-seed rape (Brassica napus L.) plants after damage to their buds and pods. The Journal of Agricultural Science, Volume 92, Issue 1, pp 53-59.
[4] (http://www.independent.co.uk/voices/letters/pesticides-and-bee-health-8005519.html; 8 August 2012).

contrast, pollination services by invertebrates across Europe are worth £17bn.[5] if the use of Cruiser OSR reduced pollination rates by just 5% this economic cost would counteract the economic benefit of the plant protection product. Indeed there is evidence that global productivity of insect pollinated crops has not grown in line with other crops due to pollinator declines[6].

e. **The principle of integrated pest management.** Article 55 of Regulation 1107/2009 requires use of plant protection products to comply with the general principles of integrated pest management set out in Article 14 of and Annex III to Directive 2009/128/EC. Those principles require, among other things, that pesticides *'shall be as specific as possible for the target and shall have the least side effects on… non-target organisms and the environment'* and uses should be kept to the minimum level necessary. Systemic pesticides such as seed treatments by their nature lack targeting and cause chemicals to be used on a prophylactic, blanket basis rather than in response to specific risks of damage caused by pests. However, the Decision appears to have been made without any regard to this principle.

<u>Third proposed ground of review: failure to ensure public participation in the Decision</u>

52. Article 6 of the Aarhus Convention, to which both the EU and the UK are parties, requires that the public be given the opportunity to participate in decisions on proposed activities which may have a "significant effect on the environment." These requirements also apply when a public authority reconsiders or updates the operating conditions for such an activity. The continued use of the Products is plainly such a proposed activity. In those circumstances, Article 6 required the United Kingdom to ensure that the public were consulted before reaching the Decision. Defra has failed to conduct any such consultation. The Decision is therefore vulnerable to judicial review on the grounds of procedural impropriety.

<u>Fourth proposed ground of review: unlawful inclusion of neonicotinoids in Reg. 540/2011</u>

53. Lastly, and to the extent necessary, Buglife will contend that the five neonicotinoids in issue, on grounds associated with the evidence presented above and that previously submitted by others to the ECJ, ought themselves never to have been included as permitted active substances in Regulation 540/2011 or in its predecessor Annex to the Directive. If, as Buglife considers, the inclusion of neonicotinoids in Regulation 540/2011 is unlawful, the entire basis for the authorisation of the Products and for Defra's Decision is undermined.

54. Buglife recognises that the domestic Court will be unable to resolve such a dispute, which concerns the legality of EU legislation. Buglife proposes, therefore, if – but only if – its other grounds of review are unsuccessful, to ask the Court to refer the lawfulness of the inclusion of those neonicotinoids in Regulation 540/2011 to the Court of Justice for a preliminary ruling. Such a route is plainly open to Buglife in principle, particularly since the challenge to the inclusion of imidacloprid by Pesticide

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[5] Nicola Gallaia, Jean-Michel Sallesc, Josef Setteled, and Bernard E. Vaissièrea 2009 Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. Ecological Economics Volume 68, Issue 3, Pages 810–821.
[6] Garibaldia, L A., Aizena, M A., Kleinc, A M., Cunninghamd, S A. and Hardere L D. 2011 Global growth and stability of agricultural yield decrease with pollinator dependence. PNAS April 5, vol. 108 no. 14 5909-5914

Action Network and others was rejected by the Commission on grounds of lack of standing; cf. e.g. *Salt Union v Commission* [1996] ECR II-1475, §39.

Request for information

55. So that we may better understand the Decision and the basis for it, and in the light of the grounds of review we have set out above, we would be grateful if you would provide us with the following information. Please also treat these requests, to the extent relevant, as made under the Environmental Information Regulations 2004. For the avoidance of doubt, please respond to these requests within 14 days rather than the longer timeframes allowed under the Environmental Information Regulations 2004.

    a. The Statement refers to existing studies in which "hives exposed to treated crops did not show any gross effects when compared to control hives exposed to untreated crops". Please can you send us copies of, or references to, all of these studies?

    b. Has a risk assessment has been carried out of the impact of neonicotinoids on the NERC s41 species listed above? If yes, please provide the full risk assessment, details of the process and all relevant supporting documents?

    c. Has an appropriate assessment of the risks that neonicotinoid pesticides present to SACs and SPAs been undertaken? If yes, please provide the full appropriate assessment, details of the process and all relevant supporting documents?

    d. Please describe in detail all monitoring that has been undertaken for neonicotinoids in groundwater, water bodies and freshwater habitats, including the number of sites monitored, the detection levels of the monitoring and the results of such monitoring. Please describe how the process of determining and reviewing neonicotinoid pesticide uses has considered the likelihood of environmental damage to aquatic organisms and ecosystems.

    e. Have any analyses been undertaken of the risks to achieving the aims of the Water Framework Directive from neonicotinoid pollution at site, catchment or national levels? If yes, please provide the full analyses, details of the process and all relevant supporting documents?

    f. Please describe in detail all the monitoring that has been undertaken for neonicotinoids in soil, including the number of sites monitored, the detection levels of the monitoring and the results of monitoring. Please describe how the process of determining and reviewing neonicotinoid pesticide uses has considered the likelihood of environmental damage to soil ecosystems.

    g. Studies undertaken by Bayer in the early 2000's on rhododendron[7] and imidacloprid soil treatments and a paper published in 2012 examining nectar and pollen residues in a pumpkin crop[8] indicate that where the chemical is used as a

[7] 'Residues of Imidacloprid WG 5 in Blossom Samples of Rhododendron sp. (variety Nova Zembia) after Soil Treatment in the Field 2003' (Doering, Maus and Anderson 2004), 'Residues of Imidacloprid WG 5 in Blossom Samples of Rhododendron sp. (variety Nova Zembia) after Soil Treatment in the Field – Application: Spring 2003, Sampling 2003 and 2004' (Doering, Maus and Schoening 2004), 'Residues of Imidacloprid WG 5 in Blossom Samples of shrubs of different sizes of the species Rhododendron sp. after drenching application in the field - Application: 2004, Sampling 2005' (Doering, Maus and Schoening 2004)).
[8] Galen P. Dively, Alaa Kamel 2012 Insecticide Residues in Pollen and Nectar of a Cucurbit Crop and Their Potential Exposure to Pollinators J. Agric. Food Chem., 60 (18), pp 4449–4456

drench or soil treatment the concentrations in nectar are vastly higher than usually recorded with seed treatments, and can persist at high levels for several years. As soil treatments and drenches are likely to predominate in urban areas what studies have been carried out examining the impacts on pollinators and other non-target species in these habitats and at these nectar and pollen concentration levels?

h. Has a risk assessment has been carried out of the impact on the environment of garden and amenity neonicotinoid containing Products? If yes, please provide the full risk assessment, details of the process and all relevant supporting documents.

i. Please supply the evidence that the use of Biscaya to control pollen beetles has a clear benefit for plant production.

j. Please provide the cost benefit analysis that demonstrates that neonicotinoids have a clear benefit for plant protection.

8 November 2012

Written evidence submitted by Dr James Cresswell, University of Exeter

1. Executive summary

1.1. There is insufficient evidence to establish with high certainty that the residues of neonicotinoid pesticides in nectar and pollen threaten the sustainability of bee populations and the pollination services that they provide to crops and wild plants. But there is sufficient evidence to raise concern about bumble bees.

1.2. No experiment has demonstrated that neonicotinoids threaten the viability of honey bee colonies when delivered at realistic dietary levels. Experiments that have demonstrated impacts on colonies used unrealistically high dosages. The lack of evidence for impact is consistent with the observation that the global stock of honey bees has increased by 12% in the last decade.

1.3. Two experiments suggest that neonicotinoids threaten the viability of bumble bee colonies when delivered at realistic levels and I have medium certainty that these findings apply to agricultural landscapes in the UK. Other widely cited experiments are flawed because they used unrealistically high dosages. While there have been observable declines in certain bumble bee species coincident with the increasing use of neonicotinoids, pathogens and habitat degradation are also plausible culprits.

1.4. In the UK, oilseed rape is the principal vehicle for delivery of neonicotinoids to bees. Bumble bees can rapidly recover from neonicotinoid exposure after the crop's bloom subsides and also some/many colonies will escape the crop's peak bloom. If concern over bumble bees is justified, these details offer avenues to mitigation through smart land management.

1.5. My recommendation is to fund further research to establish with high certainty whether bumble bees are affected by the dosages that originate from UK agriculture. If concern about bumble bees is justified, the government should fund investigations of smart mitigation strategies based on an understanding of the interplay of exposure, sensitivity, resilience and recovery.

2. Introduction to the submitter's area of expertise

2.1. I am an academic at the University of Exeter (Biosciences) and I lead an ecotoxicology laboratory that investigates the impacts of neonicotinoid pesticides on bees. I am a member of the European Food Safety Authority (EFSA) Working Group on Bee Risk Assessment. My research is funded in part by Syngenta (£137,000).

3. Factual information to support conclusions

3.1. Below, the following words indicate judgmental estimates of certainty: very certain (98% or greater probability); high certainty (85–98% probability), medium certainty (65–85% probability), low certainty (52–65% probability), and very uncertain (50–52% probability).

3.2. My report examines only effects on bees from neonicotinoids in nectar and pollen. I do not consider effects from guttation fluid (leaf exudates). I consider only honey bees and bumble bees.

3.3. A population is unsustainable when the death rate exceeds the birth rate. Intrinsically, pesticides harm individual bees but they threaten a population only when they cause death rates to exceed birth rates by increasing death rates, decreasing birth rates, or both. I assess experimental evidence for effects on these demographic rates.

3.4. Evaluation of evidence from experiments on honey bees

Study	**↑ death rate**	**↓ birth rate**	**Realistic dose**
Henry *et al*. 2012	✓	0	X
Lu *et al*. 2011	✓	0	X
Cutler & Scott Dupree 2007	0	0	✓
CRD reports: SXR/Am 004/005 (1999)	0	0	✓

Table 1. Summary of outcomes of experiments investigating the impact of neonicotinoids on honey bee colonies. Under increased death rates and decreased birth rates: ✓ = clear effect; 0 = no detectable effect. Under dose: ✓ = realistic dose; X = unrealistic dose.

3.5. No study has demonstrated that neonicotinoids have the capacity to threaten the viability of a honey bee colony when delivered at realistic dietary levels (high certainty). Henry *et al*. (2012) delivered the aggregate daily dose in a single meal (like smoking 20 cigarettes at once), which would likely overwhelm the honey bee's detoxification system (high certainty). Lu *et al*. (2011) delivered neonicotinoids in feeder syrup at an unrealistically high concentration (very certain).

3.6. The failure of some field experiments to detect an effect (e.g. Cutler & Scott-Dupree 2007) may originate in low statistical power (Cresswell 2011). We need trials that are more incisive and the new EFSA guidelines for risk assessments will remedy this.

3.7. The body of evidence that demonstrates that neonicotinoids impair learning in laboratory tests (proboscis extension response, PER) that I reviewed in my meta-analysis (Cresswell 2011) is not applicable to field conditions (low certainty). In the laboratory, the bees are restrained in a metal jacket and their metabolic rate probably drops, which impairs their detoxification system and increases their susceptibility to neonicotinoids (low certainty).

3.8. Evaluation of evidence from experiments on bumble bees

Study	**↑ death rate**	**↓ birth rate**	**Realistic dose**
Whitehorn *et al*. 2012	0	✓	✓?
Gill *et al*. 2012	0	✓	X
Laycock *et al*. 2012	0	✓	✓

Table 2. Summary of outcomes of experiments investigating the impact of neonicotinoids on bumble bee colonies. Birth rate refers to capacity to produce individuals of either worker or sexual caste (queens and males). Under increased death rates and decreased death rates: ✓ = clear effect; 0 = no detectable effect. Under dose: ✓ = realistic dose; X = unrealistic dose; ? = uncertainty about the realism of the dose.

3.9. A laboratory study (Laycock *et al*. 2012) demonstrated that neonicotinoids can threaten the viability of a bumble bee colony when delivered at a realistic dietary level (very high certainty). But the dosages used in other experiments are questionable. Gill *et al*. (2012) used feeder syrup with a dosage (10 ppb) above realistic levels (high certainty). Whitehorn *et al*. (2012) used 6 ppb in pollen and 0.7 ppb in feeder syrup exclusive feeding for 14 days and their findings may apply to agricultural landscapes in the UK (medium certainty). However, Whitehorn *et al*. based their dosage on the peak level recorded in spring-sown oilseed rape that flowered in Minnesota, USA, in June (Scott-Dupree *et al*. 2001), which is higher that due to winter-sown oilseed rape in the UK (low certainty) flowering in April-May (c. 1 ppb in nectar and pollen; Cresswell, unpublished).

3.10. Epidemiological evidence of involvement in population declines

3.11. Honey bees are not in decline (Fig 1; very certain). According to the United Nation's FAO database, the global stock of hives has increased by 12.4% during the 21st century and the stock has decreased by only 0.5% in Europe (excluding Eastern Bloc). The global trade in honey is an important driver of change in stock sizes (high certainty). In most countries, national stocks of hives are largely unchanged in the 21st century (Fig. 2). But increases are evident principally in countries that are net exporters of honey and declines are evident in wealthy countries that are net importers of honey (Fig. 2). Epidemiological evidence does not implicate neonicotinoids as a cause of regional honey bee declines (medium certainty; Cresswell *et al*. 2012).

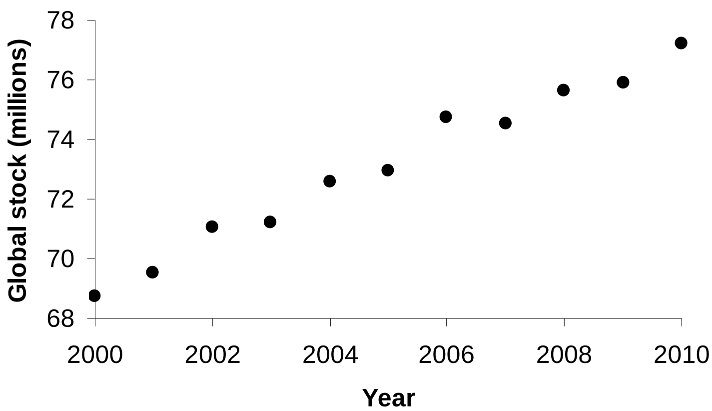

Fig. 1. Change in the global stock of honey bee hives in the years 2000-2010. Figures based on FAOSTAT data for 117 countries.

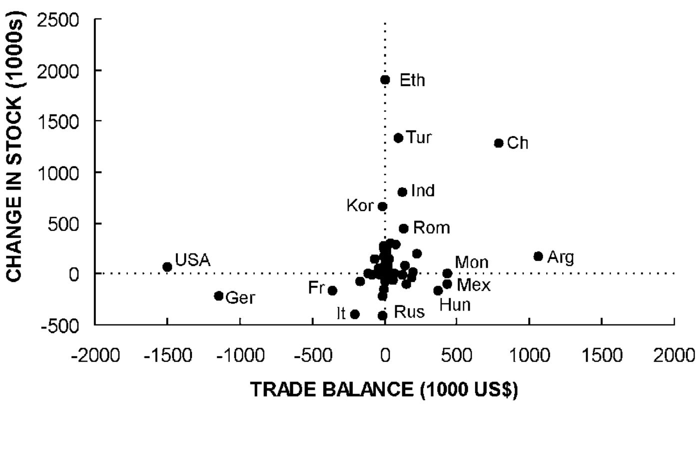

Fig. 2. Change in the national stocks of honey bee hives in the years 2000-2010 in 85 countries in relation to the net trade balance of each country for honey (value of honey exports minus value of

honey imports). Net exporters of honey have a positive trade balance. Figures based on FAOSTAT data.

3.12. There have been observable declines in certain bumble bee species coincident with the increasing use of neonicotinoids (Cameron *et al*. 2011) but neonicotinoids have not been implicated with any certainty and pathogens and habitat degradation are also plausible culprits.

3.13. Demographic resilience

3.14. Honey bee colonies will not collapse because foraging bees are intoxicated by neonicotinoid residues in nectar (high certainty). Although some foragers could be lost (Henry *et al*. 2012), a honey bee colony can produce about 1000 new bees per day and thereby replace bees lost through pesticide-induced navigation failure (Cresswell & Thompson 2012).

3.15. Nobody has yet demonstrated that neonicotinoid exposure of bumble bees causes loss of foragers. Bumble bees are less able than honey bees to replace these losses (high certainty).

3.16. Physiological resilience through detoxification and recovery

Assertions that the effects of neonicotinoids on bees are irreversible (e.g. Tennekes & Sanchez-Bayo 2011) are false (very certain). In the case of imidacloprid, adult honey bees rapidly detoxify the neonicotinoid (very certain; Suchail *et al*. 2004; Cresswell *et al*. unpublished). Bumble bees are less able to clear ingested imidacloprid (very certain; Cresswell *et al*. unpublished) but the residues are rapidly cleared once the diet is clean and toxic effects are rapidly reversible within a few days (very certain; Laycock, Smith & Cresswell, unpublished).

3.17. Mitigation options

If it is established that neonicotinoids threaten bumble bee populations, a multifaceted mitigation strategy could hypothetically involve: moderation of the pesticide's application rate; landscape-scale management of crop sowing time to synchronize flowering across fields and minimize the duration of exposure; and enhancement of pesticide-free alternative forage.

3.18. Recommendations for action by the Government

3.19. My recommendation is to fund further research to establish with certainty whether bumble bees are affected by the dosages that occur in UK agriculture.

3.20. If concern about bumble bees is justified, the government should fund investigations of smart mitigation strategies based on an understanding of the interplay of exposure, sensitivity, resilience and recovery.

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8 November 2012

Written evidence submitted by Syngenta

1. Introduction

1.1. Syngenta welcomes the opportunity to respond to the Environmental Audit Committee's inquiry into 'Insects and Insecticides'.

1.2. Our recently published booklet '*Straight Answers on the disappearance of honey bees in Europe*' will be of value to committee members.

1.3. Syngenta is an integrated global agribusiness selling agricultural inputs – seeds and chemicals – to farm businesses of all scales (including smallholders) around the world. We are the global number one in the agricultural chemicals market and third in the seeds market.

1.4. In the UK, we are unique amongst our agribusiness peer group in that we have a major research and development centre; manufacturing and production facilities for chemical production and conventional seed breeding; and a major commercial sales operation here. We discover, develop, and manufacture world leading agricultural technologies in the UK.

1.5. In doing so, we employ over 2000 people and spend in excess of $250 million on research at our Jealott's Hill research site, the largest commercial agricultural research site in Europe. We also partner with hundreds of public and academic institutions in the UK in the development phases of our products. And our trained and expert agronomists engage with farming businesses of every size from single farmer operations to the largest agricultural producers in the country.

1.6. We understand farming, how our products benefit the agricultural sector, and the ways in which they interact with and help protect the environment. We are committed to delivering technologies which will enable the sustainable intensification of agriculture.

2. Position statement

2.1. Syngenta believes that insecticides, in particular neonicotinoid based seed treatments, are an essential contributor to sustainable intensive agriculture and do not damage the health of bee populations. They significantly reduce the load on the environment when compared to many other pesticides because of their extremely low dose; long lasting protection against pests that destroy crops; and when used in via seed treatment application result in fewer sprays over the course of the growing season.

2.2. Our own active ingredient, Thiamethoxam (TMX), is used as a seed treatment and its safety is reinforced by years of extensive monitoring in the field and based on millions of hectares of treated seed use without a single substantiated report of hive destruction.

2.3. Although several Member State Governments, reputable universities, and experts across Europe share the view that these innovative pesticides are safe, there are a small number of vocal individuals and groups who continue to suggest the opposite by focusing only on the intrinsic hazard of these products. In recent years these groups have leveraged media reporting of individual alarmist studies despite the fact that they are typically based on unrealistic dose rates and/or the forced exposure of bees to the insecticides in question.

2.4. It's clear that we need healthy and thriving bee populations. The sustainability of agriculture and – indirectly our business – depends on this. But we also need safe, modern, and innovative pesticides like TMX if we are to produce the food we need. Rather than looking at the theoretical hazard we need to look at how bees and pesticides co-exist together in a sustainable agriculture system.

2.5. Syngenta is fully committed to this objective. We continue to deepen our understanding through research and by putting in place schemes such as Operation Pollinator. Today, 2,500 hectares of pollinator strips have been sown as part of this project providing essential habitat and nutrition for bees alongside field crops which are treated with pesticides. They have helped to produce a dramatic recovery in bee populations reversing the decline of some bumblebee species close to extinction.

2.6. Given our determination to approach farming in a holistic way, we would like to assure the Committee that we are open to work with any stakeholder who shares our goal of sustaining a thriving bee population in a sustainable agriculture system where the safest and most innovative pesticides are used.

3. Scope of our response

3.1. This written submission focuses primarily on providing information regarding Syngenta's neonicotinoid active ingredient Thiamethoxam (TMX), which is used both for seed treatment application and as a foliar spray in numerous products used on flowering and non-flowering crops. Our response primarily references TMX's use in Oil Seed Rape (OSR). Syngenta's branded TMX product in OSR is *Cruiser OSR*.

3.2. By focusing on this compound and its associated products, we look to address the committee's wider announcement on 25th September, 2012 that the inquiry is, 'a new inquiry into the impact of insecticides on bees and other insects.'

3.3. It should be noted that our response is limited in regard to the Committee's central focus and remit for its inquiry – Defra's analysis and use of a review of recent studies looking at neonicotinoid pesticides and bees - as announced on the Guardian newspaper website on 21st September, 2012.

3.4. However, we do take this opportunity to applaud Defra's commitment to a science based approach on the issue of bee decline and on issues relating to agricultural technology more widely. We believe ministers and officials at the department have acted properly and have ensured in recent times that an emotive and complex issue has not been politicised. To date, we believe that policy decisions in the UK on this issue have been based on rigorous scientific assessment and evidence.

3.5. In calling upon FERA, CRD and ACP to independently and expertly assess recent studies relating to neonicotinoids and bees we believe that Defra has acted impartially and appropriately. We note that the government's subsequent analysis and use of the assessment of these studies is in line with other major European governments including those of Netherlands and Germany.

3.6. We point out that the decision of the French government to withdraw the registration of Cruiser OSR based on the Henry et al study was counter to the assessment and position of their own advisory agency – ANSES – which supported continued registration[i].

4. Multi-variable factors in bee decline - points of reference

4.1. The issue of bee decline is complex. Accordingly, we feel it is essential that political stakeholders are well informed before looking for and deciding on an appropriate course of action or recommendations.

4.2. Based on Syngenta's own detailed and expert technical assessment of the issue we believe that a number of variables are potential causal factors. Insecticides, and particularly seed treatments, when used appropriately and in accordance with label and product guidance are not responsible for colony collapse or large scale bee mortality.

4.3. Accordingly, we stand by the integrity of our insecticide seed treatments and foliar applied products and believe that they play a significant role in protecting yield and quality and by doing so also play a role in environmental protection, particularly in terms of land sparing.

4.4. There is now significant independent research that suggests that bees are impacted by a range of factors. In addition, there is also specific research showing neonicotinoids are not the key variable in bee decline.

4.5. We direct the committee to review the following research papers, which look in detail at the range of likely variables involved in this issue[ii].

- **Data showing no effect of field relevant doses of neonicotinoids to bees or papers that state neonicotinoids are unlikely to be responsible for decline in bee health**

    Schneider et al, 2012 (return to hive imidacloprid + Clothianadin) ; Cresswell 2011 (metanalysis of imidacloprid field trials); Cresswell et al, 2012 (neonics in bee food); Blacquiere et al, 2012 (Neonic bee review); Imdorf et al, 2006 (overwintering losses in Switzerland); Oliver, 2012 (bee keeper view of neonics).

- **<u>Varroa or Varroa + disease/virus are the likely main reason for bee decline</u>**

  Dainan et al, 2012; Martin et.al, 2012; Guzman-Nova, et al, 2010; Szabo et al 2012 (bumble bees); Charriere & Neumann, 2010; Nazzi et al, 2012; Genersch, 2010; Rosenkranz et al, 2010.

- **<u>Complicated and multi-variable nature for bee decline</u>**

  van Enngelsdorp et al, 2012; Neumann & Carreck, 2010;

5. Thiamethoxam (TMX) – assessment of lab based research and field data publication

5.1. Like all insecticides TMX is intrinsically toxic to insects. In the case of honey bees, the LD_{50} for TMX is 5 ng/bee.

5.2. ***However, the committee should note that risk is a factor of both toxicity and exposure*** - and the exposure of bees even within a field of TMX seed treated Cruiser OSR is correspondingly low due to the low application rate and the period of time from drilling the seed to flowering.

5.3. All insecticide applications, including systemic seed treatments such as Cruiser OSR, see a degradation of their activity and hence their effect in the field ensuring that plants have greatest protection at the early and emergent phases. In a crop such as OSR the systemic active ingredient will be at trace levels at the point of flowering, significantly reducing risks to insects such as foraging bees.

5.4. All the independent research studies to date that we are aware of relating to Cruiser OSR have attempted to “simulate” this real world scenario in the laboratory; this is fraught with difficulty and typically doses used by researchers have over- estimated the amounts of chemical that bees are exposed to in the field. For example, in the case of the recent Henry et al study at INRA we estimate the concentration tested in the study was at levels up to 30x those seen in OSR nectar in the field.

5.5. As the committee will be aware, there are also high quality in-field monitoring schemes (Wildlife Incident Investigation Scheme) run by the Chemicals Regulation Directorate (CRD), Natural England and the National Bee Unit, which have detected no incidents with bees related to the use of thiamethoxam.

The Wildlife Incident Investigation Scheme (WIIS)

https://secure.fera.defra.gov.uk/beebase/index.cfm?sectionid=33

5.6. In regard to Syngenta’s own field data (i.e. data taken from the real environment), we have recently submitted a manuscript for publication in peer reviewed open literature, which summarises our comprehensive field study programme which has investigated the potential long-term effect of exposure of honeybee colonies to nectar and pollen from TMX seed treated flowering OSR and maize. This covers four years consecutive exposure, including the sensitive over-wintering phase, where TMX is applied at the maximum label rate.

5.7. ***These in field studies have shown no effects (lethal or sub-lethal) on bee mortality. Factors assessed include foraging behaviour, colony strength and weight, brood development and overwintering success.***

5.8. In addition, Syngenta is currently drafting a second paper summarising our pollen and nectar residue data from our regulatory field trials conducted with TMX as a seed treatment.

4.9 This paper reports that TMX residues in pollen and nectar collected from bees foraging on treated oil seed rape, are typically very low (ie <1 – 3.5 µg/kg in pollen and <0.5 – 2.5 in nectar) with residues in hive pollen and nectar being even lower (typically at or below 1 µg/kg). Residues of the primary metabolite were always lower than parent TMX in both pollen and nectar.

This paper not only confirms low residues of TMX and its primary metabolite in pollen and nectar from TMX seed treated OSR and maize in the field, but will also fill a current data gap in the public literature. This paper will be submitted for publication shortly, and it is hoped that both papers will be published by end of this year/early next year.

6. Use and utility – benefits of Cruiser OSR to UK farmers

6.1. Syngenta estimates that the UK planting of OSR in the UK in the 2012 season was approximately 700,000 hectares. Of this planting, Cruiser OSR was planted on approximately 400,000 hectares - ~57% of the UK market.

6.2. OSR has become a very important crop to UK arable growers, driven in part by the increase in commodity prices in recent years. Previously grown as a break crop to help control pests and diseases in cereals, it now provides a similar gross output to wheat.

6.3. Often grown in tight rotations with wheat, OSR suffers from a significant number of pests and diseases. Two key autumn pests are aphids especially the Peach-potato aphid and flea beetles. Both pests invade newly emerging seedlings. Both feed on the young plants, flea beetles potentially causing significant plant loses if infestations are high. The Peach-potato aphid is responsible for the spread of Turnip Yellows Virus (TuYV), which in severe cases has been shown to cause up to 26% yield loss in UK conditions.

6.4. Control of both of these pests in the autumn is critical to establishing the yield potential of the crop for the following spring. Currently, because of insecticide resistance, there are no effective alternatives to the neonicotinoid seed treatments for control of Peach-potato aphid. There are foliar sprays that are effective against flea beetles but the timing of use of these products is very important and autumn conditions can make the optimum spray timing very challenging. Furthermore the use of pyrethroids in the autumn against flea beetles has the potential to make resistance problems with Peach-potato aphid worse.

6.5. The effect of seed applied insecticides lasts between 6-10 weeks after sowing. Trials have shown yield increases of up to 0.66T/Ha for hybrids (approx. 60% of the area sown), a value-add of £231/Ha (@ £350/T).

6.6. Without the existing seed treatment technology based on the neonicotinoids , more foliar insecticide sprays would be used in the autumn to control flea beetles and new products would have to be approved to provide adequate control of Peach-potato aphid. In marginal areas OSR may be taken out of the rotation leading to tighter cereal rotations which could lead to greater problems with weed management in cereal crops which already face significant issues with Black grass control.

6.7. Cruiser OSR is only sold to seed processors in the UK who apply the treatment through machinery designed and manufactured for the purpose by trained and qualified operators - stewardship of the product in the UK, which is an important component of safety, has been assessed as excellent.

6.8. Seed processors are required to submit representative samples of treated seed for chemical and dust loading analysis to ensure accurate application and all applicators have been independently audited to ensure they are able to apply the treatments correctly.

7. Current regulatory requirements relating to bee health for registration

7.1. We believe that it is important for the committee to note the current regulatory requirements for registering a crop protection product in the EU, specifically with regard to assessing the potential impact on bees.

7.2. Before a pesticide can be used in the UK, it has to be registered under the EU Plant Protection Product Directive 1107/2009 and under this Directive the following first tier honey bee safety toxicity data are required from Registrants:-

- laboratory acute toxicity (both oral and contact) of pesticides to adult honeybees
- chronic toxicity to adult honeybees
- chronic toxicity to larval bees/bee brood

7.3. These studies reflect the intrinsic hazard of a pesticide under worst case laboratory conditions and must be conducted according to published international Guidelines (eg OECD/EPPO) and also meet Good Laboratory Practise requirements.

7.4. Data from the above laboratory studies are assessed by UK CRD, under Directive 1107/2009's Honeybee Risk Assessment Framework, and if EC agreed safety thresholds are not met, either labelled restrictions in use are applied (eg "Harmful / Dangerous / Extremely Dangerous to bees: Do not apply to crops in flower or to those in which bees are actively foraging. Do not apply when flowering weeds are present"); or further honeybee safety testing is required in order to demonstrate safety to honeybees under semi-field/field conditions.

7.5. Such field studies are a better reflection of the actual risk to honeybees under in-use conditions and are targeted to support specific crop/application type scenarios eg foliar applications to OSR.

7.6. The European Food Safety Agency (EFSA) is currently reviewing the EC Guidelines for bee pesticide testing and risk assessment, and a finalised Guideline is expected in early 2013.

8. Human health and neonicotinoids

8.1. TMX is of low acute toxicity and is non genotoxic. TMX has been extensively evaluated in a whole range of toxicity studies up to lifetime bioassays and is not carcinogenic and is not a developmental or reproductive toxicant.

8.2. It causes no significant neurotoxicity and is not developmentally neurotoxic.

9. Henry et al and our commitment to new research

9.1. As we have detailed Syngenta has a comprehensive honeybee safety data package for its TMX containing products, including laboratory/semi-field studies and multiple field studies covering various different crop application type uses worldwide.

9.2. We also assess all new environmental research and data relating to all neonicotinoid products (TMX and competitor compounds) and respond accordingly.

9.3. A recently published paper in Science (Henry et al 2012) reported foraging disruption for bees from an experiment simulating exposure to residues in pollen and nectar (at unrealistically high concentrations – 30x above those found in OSR nectar) from TMX seed treated OSR.

9.4. In light of this study, Syngenta is in the process of developing and conducting an in-use field study exposing honeybees to TMX seed treated OSR, and using the same Radio-Frequency Identification Tags (RFiD) technology as Henry et al, which will investigate any potential foraging effects on honeybees under more realistic in-use field conditions.

9.5. Results from this study should be available after next year's bee season - 2013.

9.6. Syngenta has also recently funded an 18 month Post-Doctoral Research Project at Exeter University to investigate an epidemiological study on European Honeybee health using the established "Hill's Criteria"[iii].

9.7. This study will investigate the following factors:- neonicotinoids; other insecticides; degraded honeybee forage; varroasis; bee viruses; Nosema; honeybee economical factors;

and honeybee husbandry practices. This study will be completed in April 2014. The study author is open to interpret and publish the results of this work without permission or approval from Syngenta.

10. Operation Pollinator

10.1. Forage and habitat for bees are critical to their success. As part of our own commitment to sustainable farming we are supporting the rollout of pollen and nectar rich field margin strips across 10,000 hectares in key European countries through our Operation Pollinator project – www.operationpollinator.com

10.2. To date over 1000 hectares have been planted and established in the UK – with data showing significant increases in pollinator numbers and indications of yield increase in flowering crops grown adjacent and alongside these strips.

10.3. In May 2011, as part of Operation Pollinator, a further project was undertaken in the UK to look at ways of increasing OSR yield and improving oil quality using native and managed pollinators from the landscape as an ecosystem service to enhance the OSR potential.

10.4. A team of six independent entomologists led by the Centre of Ecology and Hydrology (CEH) carried out field observations in twenty four flowering commercial crops of winter OSR across the South Central Region of the UK.

10.5. This action was carried out to establish which pollinators were active in the flowering crop, the level of flower visitation taking place, and pollen transfer active between the stigma and the stamens when pollinators were present on the flower.

10.6. The farmers growing these crops had established them in the previous autumn in 2010, unaware of the project's conception or their future involvement and had all applied Cruiser OSR seed treatments to their OSR seed , drilled the crop, applied full autumn crop protection programmes and subsequently applied a spring crop protection programme as recommended by their farm agronomist which included a foliar applied insecticide in all cases to control a significant attack on the crop at green bud growth stage of Pollen Beetle that season.

10.7. The results concluded from these observations, at peak flowering time within the OSR crop, that visitation to the OSR flowers took place by some 36 different species of bee pollinator, including the Honey Bee (*Apis mellifera*) most abundant visitors, 9 Bumblebee Species (*Bombus spp*.) and 26 Solitary and Mining bee species (*Andrena, Megachile* and *Osmia spp*)

10.8. Indications also suggest that stronger flying species such as honey bees and bumblebees moved from surrounding hives & nest sites to the crop and back whilst foraging for pollen and nectar but the less powerful fliers the solitary and mining bee species actually lived within the crop itself, often setting up nest sites within the “crop tramlines” where bare ground for their burrows could be established.

10.9. The project continues to investigate the potential of using both managed (honey bees) and native bee species (bumblebee and solitaries) within the intensively farmed crop to increase yield and oil quality as a sustainable ecosystem service.

11. Syngenta Bioline

11.1. The committee’s inquiry remit makes reference to integrated pest management (IPM). Syngenta supports the principle of IPM as a component of sustainable agriculture and we work to support these approaches where applicable to context.

11.2. As part of that approach, Syngenta Bioline produces high quality products containing natural beneficial insects and mites for use in Integrated Crop Management programmes to control pests. The principal crops where these products are covered salad vegetables, soft fruit, and ornamentals.

11.3. Syngenta Bioline is an integrated component of Syngenta’s wider business and our crop teams work with customers to look at ways in which beneficial insects can be used to deliver effective outcomes in terms of pest management.

11.4. Although we are ambitious for the continued growth and development of our Bioline business we also believe (based on technical assessment and data) that there are considerable limitations and inherent risks to large scale - in-field - substitution of insecticide chemicals by targeted biological pest management processes.

11.5. However, we remain committed to delivering sustainable farming systems with a range of proven inputs (including IPM practices and beneficial insects), relevant to context, and balanced to ensure optimal environmental and economic output for farm businesses in the UK and around the world.

8 November 2012

ENDNOTES

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[i] http://www.anses.fr/Documents/DPR2012sa0092.pdf - ANSES concluded - ‘In the current state of knowledge, the results presented in the article by Henry et al. 2012 are not considered to challenge the conclusions of risk assessments conducted as part of the application for authorization to market the product CRUISER OSR and done according to current regulatory criteria, but the study shows that the methodologies implemented in this framework have limitations in terms of sensitivity. The bee toxicity information considered for the approval of thiamethoxam under Regulation (EC) No 1107/2009 and listed on page 8 of this Opinion are not modified by the results of this study.’

[ii] Reference points - titles, authors and journals.

- **<u>Data showing no effect of field relevent doses of neonics to bees or papers that state neonics are unlikely to be responsible for decline in bee health</u>**

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Written evidence submitted by Research Councils UK

INTRODUCTION

1. Research Councils UK (RCUK)[1] is a strategic partnership set up to champion the research supported by the seven UK Research Councils. It was established in 2002 to enable the Councils to work together more effectively to enhance the overall impact and effectiveness of their research, training and innovation activities contributing to the delivery of the Government's objectives for science and innovation.

2. This evidence is submitted by RCUK on behalf of the following Research Councils and represents their independent views.

   - Biotechnology and Biological Sciences Research Council (BBSRC)
   - Natural Environment Research Council (NERC)

   It does not include or necessarily reflect the views of the Science and Research Group in the Department for Business, Innovation and Skills, and focuses only on those questions or parts of questions relevant to the individual Councils that have contributed to the response.

BACKGROUND

3. Bees and other insects contribute substantially to the pollination of a wide variety of cultivated and wild plants, and play important roles in both crop production and the maintenance of natural ecosystems. However, there is evidence that populations of managed and wild insect pollinators in the UK and elsewhere have declined significantly over recent years, in the face of threats from changes in the environment including emerging pests and diseases, habitat loss and climate change.

4. The possible effects of insecticides on bees and other beneficial insects should be viewed in a broad context. In the light of specific, high-profile concerns about the use of neonicotinoid pesticides, particular attention has recently focused on honey bees, and to some extent bumblebees. However, any consideration of pollination should take account of the full range of insect pollinators, including all types of bees (wild bumblebees and solitary bees, as well as managed honey bees), hoverflies, butterflies, moths and others. But the current regulatory system for the licensing of pesticides requires the evaluation of their impacts only on honey bees; effects on bumblebees and other non-target insects are not routinely considered and are largely unknown (see also paragraph 10 below).

5. Similarly, concerns about the potential impacts of insecticides should not be considered separately from other possible - and probably inter-related - causes of pollinator decline, such as pathogens and pests, loss of suitable habitats because of changes in land use or farming practices, or the effects of environmental change. Likewise, individual pesticides should not be viewed in isolation; combinations of pesticides, or of pesticides and other chemicals in the environment, also need to be considered.

[1] www.rcuk.ac.uk

THE UK INSECT POLLINATORS INITIATIVE

6. With a common recognition of the importance of bees and other insects in the pollination of food crops and wild plants, and in the light of concerns about widespread declines in their abundance, a consortium of five funders came together in 2009 in the Insect Pollinators Initiative (IPI)[2]. Under the auspices of the Living With Environmental Change Partnership[3], BBSRC[4], the Department for Environment, Food and Rural Affairs[5], NERC[6], the Scottish Government[7] and the Wellcome Trust[8] collectively provided total funding of £9.65M for a joint initiative to support innovative research into the causes and consequences of threats to pollinating insects, and to inform the development of appropriate mitigation strategies.

7. The IPI aims to provide an evidence base to inform the conservation of wild insect pollinators and improve the husbandry of managed species, and thereby reduce current declines and sustain healthy and diverse populations for the future. The purpose of the initiative is to promote and support multidisciplinary research to understand and mitigate biological and environmental factors that adversely affect pollinating insects. The causes of pollinator declines are likely to be multifactorial, involving complex interactions between pollinators, their pests and pathogens and the environment. The funders of the IPI were keen to bring to bear on these issues - alongside the expertise of the established pollinator research community - relevant new skills from other areas at the cutting-edge of biology, such as state-of-the-art genomic technologies and associated informatics, and the latest techniques in epidemiological and ecological modelling.

8. The funders of the IPI invited proposals for research that would address challenges under one or more of the following themes:

- **Health and disease**: understanding and mitigation of factors that have adverse effects on pollinator health, including pathogens, pests and chemical pollutants, or combinations of them, as well as host genetic or other factors that influence susceptibility or resistance.

- **Environmental change**: understanding and mitigation of the adverse effects of climate or other environmental change on pollinators, their pests and pathogens, or plant-pollinator interactions.

- **Agriculture and land-use change**: understanding and mitigation of the effects of changes in agricultural practice or land use that have adverse effects on pollinator abundance, diversity or behaviour, including competition for resources between pollinators.

- **Husbandry**: understanding to inform the better husbandry of managed pollinators, such as improvements in pest or disease control or enhancement of resistance.

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[2] www.bbsrc.ac.uk/pollinators and https://wiki.ceh.ac.uk/display/ukipi/Home
[3] www.lwec.org.uk
[4] www.bbsrc.ac.uk
[5] www.defra.gov.uk
[6] www.nerc.ac.uk
[7] www.scotland.gov.uk
[8] www.wellcome.ac.uk

- **Tools and data**: development and application of new tools for the investigation of pollinator health, including biological reagents, diagnostic techniques, monitoring and surveillance protocols, data analysis and modelling.

The scope of the initiative includes all insect pollinators - both managed and wild - and research at any level of biological organisation from the molecular to the population or ecosystem, as well as interactions with the environment.

9. Details of the nine research projects funded by the IPI are listed in **Annex 1**, together with information about related RCUK-funded research and research training in **Annex 2**. The following IPI project is particularly relevant to the specific focus of the present inquiry by the Environmental Audit Committee (EAC): "An investigation into the synergistic impact of sub-lethal exposure to industrial chemicals on the learning capacity and performance of bees", led by Dr Chris Connolly (University of Dundee), together with Dr Nigel Raine (Royal Holloway, University of London), Dr Geraldine Wright (Newcastle University) and Professor Neil Millar (University College London). This group of researchers is investigating whether chronic but non-lethal exposure to pesticides (and chemicals used to protect honey bees from infestation by the *Varroa* mite) affects the navigation and communication skills and foraging behaviour of both honey bees and bumblebees.

10. Dr Raine and colleagues have investigated the effects of two insecticides (of different classes) on the development and growth of bumblebee colonies and the foraging activities of individual bees. Their results were published in a recent (October 2012) *Nature* paper[9], accompanied by an independent commentary on the significance of the findings[10]. They highlighted a need for the assessment of risks to non-target insects to consider more fully both multiple species and the complex factors that determine the extent to which particular kinds of insects are exposed to individual and combinations of pesticides (paragraphs 4 and 5 above).

OTHER RELEVANT RESEARCH

11. Amongst other issues, the EAC intends to examine "what alternative pest-control measures should be used . . . to make UK farming more insect- and bee-friendly". This is also an area in which RCUK is supporting relevant research, particularly through the BBSRC at Rothamsted Research[11] in Hertfordshire. Rothamsted has a substantial track record in the elucidation and use of "chemical ecology" - biologically-based approaches that exploit plants' natural ("semiochemical") defences against pest attack - applications of which have been particularly successful in parts of Sub-Saharan Africa.

12. In the UK, researchers at Rothamsted are currently evaluating - in licensed and carefully monitored field trials - an approach that combines semiochemical knowledge with genetic modification (GM) technology[12]. GM has been used to develop a variety of wheat that produces high levels of aphid "alarm pheromone", an odour produced naturally both by aphids (to alert one another to danger) and by some plants (but not wheat), and which both repels aphids and attracts their natural predators such as ladybirds. (More straightforward mechanical methods of applying the pheromone to crops did not provide effective delivery of the repellent odour.)

[9] Gill, R. J., Ramos-Rodriguez, O. & Raine, N. E. *Nature* http://dx.doi.org/10.1038/nature11585 (2012)
[10] Osborne, J. L. *Nature* http://dx.doi.org/10.1038/nature11637 (2012)
[11] www.rothamsted.ac.uk
[12] www.rothamsted.ac.uk/Content.php?Section=AphidWheat

13. More broadly, modern approaches to plant breeding, including in some circumstances GM, have the potential to enhance the sustainability of food production through the introduction to commercial crops of genes from related or other plants that confer naturally-occurring resistance to pests or pathogens - thereby offering scope for more environmentally-benign alternatives to the repeated application of pesticides for the management of some widespread and otherwise intractable problems. Although not concerned with insect pests, relevant examples of such applications of GM include research recently supported by BBSRC on the development of potatoes resistant to nematode worms or “blight” fungus, respectively, at the University of Leeds and the Sainsbury Laboratory at the University of East Anglia. The Government’s 2011 Foresight project report[13] - *The Future of Food and Farming: Challenges and choices for global sustainability* - stressed that no single technology or approach would be sufficient to respond to pressing concerns about global food security; equally, no available technology should be ruled out, and, where appropriate, ways of tackling the challenge should include the use of GM crops.

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[13] http://www.bis.gov.uk/foresight/our-work/projects/published-projects/global-food-and-farming-futures

ANNEX 1

INSECT POLLINATORS INITIATIVE PROJECTS[14]

Sustainable pollination services for UK crops

Dr Koos Biesmeijer, University of Leeds
Dr Giles Budge, Food and Environment Research Agency
Dr Simon Potts, University of Reading

£1,033k over 36 months

Modelling systems for managing bee disease: the epidemiology of European foulbrood

Dr Giles Budge, Food and Environment Research Agency
Professor Ed Feil, University of Bath
Professor Matt Keeling, University of Warwick
Professor Steven Rushton, University of Newcastle

£750k over 36 months

Investigating the impact of habitat structure on queen and worker bumblebees in the field

Dr Claire Carvell, Centre for Ecology and Hydrology
Professor Andrew Bourke, University of East Anglia
Dr Seirian Sumner, Zoological Society of London

£523k over 36 months

An investigation into the synergistic impact of sub-lethal exposure to industrial chemicals on the learning capacity and performance of bees

Dr Chris Connolly, University of Dundee
Professor Neil Millar, University College London
Dr Nigel Raine, Royal Holloway, University of London
Dr Geraldine Wright, University of Newcastle

£1,458k over 48 months

Linking agriculture and land use change to pollinator populations

Professor Bill Kunin, University of Leeds
Dr Daniel Morton, Centre for Ecology and Hydrology
Professor Jane Memmott, University of Bristol
Professor Simon Potts, University of Reading
Dr Nigel Boatman, Food and Environment Research Agency

£1,394k over 42 months

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[14] More information on these grants available at http://www.bbsrc.ac.uk/pollinators/

Urban pollinators: their ecology and conservation

Professor Jane Memmott, University of Bristol
Professor Graham Stone, University of Edinburgh
Dr Koos Biesmeijer, University of Leeds
Professor Simon Potts, University of Reading

£1,239k over 42 months

Impact and mitigation of emergent diseases on major UK insect pollinators

Dr Robert Paxton, Queen's University Belfast/University of Halle, Germany
Dr Mark Brown, Royal Holloway, University of London
Dr Juliet Osborne, University of Exeter

£1,615k over 36 months

Unravelling the impact of the mite *Varroa destructor* on the interaction between the honeybee and its viruses

Professor David Evans, University of Warwick

£800k over 36 months

Can bees meet their nutritional needs in the current UK landscape?

Dr Geraldine Wright, University of Newcastle
Dr Phil Stevenson, Royal Botanic Gardens, Kew

£843k over 36 months

ANNEX 2

OTHER CURRENT RCUK-FUNDED RESEARCH ON INSECT POLLINATORS[15]

A synthetic & recombinant approach to the production and characterisation of IAPV - an associated agent of honey bee Colony Collapse Disorder

Professor Ian Jones, University of Reading (BBSRC research grant)

£320k over 40 months

Honeybee population dynamics: Integrating the effects of factors within the hive and in the landscape

Dr Juliet Osborne, University of Exeter/Rothamsted Research

£764k over 39 months (BBSRC research grant - Industrial Partnership Award with Syngenta)

The potential of gene-knockdown for controlling *Varroa* mites

Dr Alan Bowman, University of Aberdeen

£118k over 24 months (BBSRC research grant)

To exchange knowledge between researchers working on pollinating insects across the NERC remit, and stakeholders interested in conserving pollinators

Dr Lynn Dicks, University of Cambridge

£66k over 31 months (NERC Knowledge Exchange Fellowship)

Establishing transatlantic links between groups investigating managed pollinator populations

Dr Giles Budge, Food and Environment Research Agency

£47k over 36 months (BBSRC United States Partnering Award)

Effect of *Varroa* mite viral diseases on the honeybee (*Apis mellifera*) recognition system

Professor Roger Butlin, University of Sheffield

£75k over 48 months (BBSRC research training grant - Industrial CASE studentship with a consortium of local beekeeping associations in the East of England)

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[15] More information on these grants available at http://www.bbsrc.ac.uk/PA/grants/

Surveying the levels of pesticide residues in bees and stored pollen, and their effects on bees

Dr Falko Drijfhout, Keele University

£75k over 48 months (BBSRC research training grant - Industrial CASE studentship with the British Beekeepers' Association)

Epidemiology of European foulbrood disease of honeybees using molecular tools

Dr Thorunn Helgason, University of York

£75k over 48 months (BBSRC research training grant - Industrial CASE studentship with the British Beekeepers' Association)

Written evidence submitted by Amanda Williams

General Inadequacies Of Regulatory Risk Assessement For Bees And Industry Influence versus lack of public consultation

1. The Civil Servants Code Of Practice, states that Civil Servants must:
(Point 8): *"Set out the facts and relevant issues truthfully, and correct any errors as soon as possible"*
(Point 9): *"You must not: deceive or knowingly mislead Ministers, Parliament or others; or be influenced by improper pressures from others or the prospect of personal gain".*
(Point 10): *"You must provide information and advice, including advice to Ministers, on the basis of the evidence, and accurately present the options and facts".*
(Point 11): *"You must not ignore inconvenient facts or relevant considerations when providing advice or making decisions".*

The EAC is requested to consider whether the Civil Servants' Code has in any way, been breached.

2. EU Regulation 1107/2009 (Annex II, 3.8.3.) *"An active substance, safener or synergist shall be approved only if it is established following an appropriate risk assessment on the basis of Community or internationally agreed test guidelines, that the use under the proposed conditions of use of plant protection products containing this active substance, safener or synergist: will result in a negligible exposure of honey bees, or has no unacceptable acute or chronic effects on colony survival and development, taking into account effects on honey bee larvae and honey bee behaviour*."

EFSA find many weaknesses in the standards of testing for Risk Assessment **http://www.efsa.europa.eu/en/efsajournal/pub/2668.htm** . It actually appears the requirements of EU law have not been met, and that serious faults with, for example, field study design have been identified. Members of FERA have been involved in developing regulatory test guidelines (EPPO 170), and it is surprising that these weaknesses have not been addressed by our civil servants.

3. Regardless of any regulatory guidelines is it not the duty of DEFRA to ensure standards ARE robust, and to reject any chemical not adequately tested, because not to do so, would break EU law?

4. DEFRA have repeatedly stated: *"The UK has a robust system for assessing risks from pesticides and all the evidence shows neonicotinoids do not pose an unacceptable risk when products are used correctly. We will not hesitate to act if presented with any new evidence".* The EFSA report referred to above, was published in May 2012 – yet no action has been taken.

5. DEFRA state: *"The regulatory field studies fully comply with current guidance……hives exposed to treated crops did not show any gross effects on a wide range of important endpoints when compared to control hives exposed to untreated crops."*

6. A comment from the EFSA report indicating that **field tests by manufacturers provide unrealistically LOW levels of exposure to pesticides:** *"Hence, the bees could be exposed to an unrealistically low total quantity of toxic substance, if residues are expected to be* *available in a large area at a similar time, e.g. in the case of SSST. This quantity will be **much lower than that to which bees are exposed in real conditions**, when the surface of all the treated fields in their foraging area will be significant (hundreds of hectares or more), and where the interval between the flowering periods for the different fields in the same area, can lead to exposure lasting for several weeks to more than a month".*

7. In their Sept 18 report, despite deficient regulatory standards for field studies, CRD frequently raised queries over the application of these studies to 'realistic field conditions' in response to independent papers (even when studies have been at least partially field based). This formed part of CRD's view of papers by: *Henry et al; Whitehorn; Pettis et al; Vidau et al; Wu et al; Mommaerts V et al; Schneider et al and Teeters et al.*

8. It appears that DEFRA have never justified how or why field tests are scientifically more acceptable and robust than laboratory assessments, in response to any of the independent studies they have criticised, nor have they published guidelines as to what they would accept for those particular study areas not covered by regulatory tests, but covered by independent scientists.

Agrochemical Industry Involvement In Setting Regulatory Standards

9. The agrochemical industry has been exceedingly influential in setting the terms of pesticide research for regulatory submissions via the EPPO and industry sub-group "The Bee Protection Group". http://www.eppo.int/PPPRODUCTS/honeybees/honeybees.htm

10. Despite presence of FERA Civil Servants within these groups, they have failed to ensure tests were adequate for assessing risks to bees and non-target invertebrates.

11. At the **ICPBR- Bee Protection Group 10th Symposium** (Bucharest, 2009-10-08/10 - **Proceedings** published in the Julius-Kühn-Archiv 423, 2009) the WGs presented "proposals for the revision of EPPO Standards" and attendees were primarily from industry (or related background), although some UK and other civil servants were present: ***http://www.jki.bund.de/fileadmin/dam_uploads/_veroeff/JKI_Archiv/JKI_Archiv_423.pdf*** Two beekeepers raised concerns with the standards (these same concerns were also raised by EFSA).

12. In 2003, Helen Thompson, a scientist from FERA, published a paper: ***(2003) Behavioural effects of pesticides in bees – their potential for use In risk assessment Ecotoxicology 12 317-330.*** The paper notes *"Further work is required to allow risk assessment to include significant behavioural effects and their longer term consequences on colony survival and development"* and: *"The OECD and EPPO guidelines require all abnormal behavioural effects to be reported but give no guidance on the types of effects to be recorded"* (despite this, guidelines for regulatory submissions remained inadequate).

13. In spite of the above paper from Thompson discussing behavioural effects in 2003, in 2007, she produced a paper in co-operation with Bayer CropScience's Christian Maus: *"Perspective: The relevance of sublethal effects in honey bee testing for pesticide risk assessment";* publ: Pest Management Science (sublethal effects include behavioural effects). It states: *"The authors conclude that sublethal studies may be helpful as an optional test to address particular, compound-specific concerns, as a lower-tier alternative to semi-field or field testing, if the effects are shown to be ecologically relevant. However,*

available higher-tier data (semi-field, field tests) should make any additional sublethal testing unnecessary, and higher-tier data should always override data of lower-tier trials on sublethal effects".

Lack of Balance: Industry vs Public Consultation

14. According to the FERA website, part of FERA's remit is: *"Research and assurance: Fera provides its public and private sector stakeholders with robust scientific evidence and thorough analysis to support them in both the strategic and day-to-day decisions they face"*

15. Despite the level of activity with industry, DEFRA/FERA/CRD do not appear to proactively consult truly independent organisations and scientists that receive no funding directly or indirectly by industry. The public are also not consulted – despite use of neonicotinoids on 1,278,811 ha of crops in 2011, http://pusstats.csl.gov.uk/myindex.cfm. and many public petitions requesting a ban on neonicotinoids.

16. The EAC are asked to consider whether Article 6 (2) *CONVENTION ON ACCESS TO INFORMATION, PUBLIC PARTICIPATION IN DECISION-MAKING AND ACCESS TO JUSTICE IN ENVIRONMENTAL MATTERS* applies, and if so, whether DEFRA and its bodies must do more (and have done enough) to involve and consult the public PRIOR to registering chemicals that will be used on large surface areas of the UK. It should also be noted that there have been many public petitions requesting a ban on neonicotinoids.

17. The UK tax payer may prefer funds and advisory positions to be allocated to independents scientists and institutions not those with connections to industry.

Efficacy Claims In Insecticides Product Patents: Implications For Non-Target Insects

EAC are asked to consider whether the use of insecticides and potential effects on other species, generally ***out of balance*** with the reality of threat from 'crop pests'.

1. Patents are on public view via: www.**google**.com/**patents** for insecticides. It is interesting to note the claims of efficacy against various insect orders, and provide crucial insight as to their potential for effects on a wide range of invertebrates. In other words, insecticides may claim within patents to be effective against species within an Order of insects, but for the sake of targeting a small number of 'pest species' within that insect order, it may be reasonable to assume many beneficial species may be harmed.

2. For example, a patent for an insecticide containing neonicotinoid imidacloprid, can be viewed and downloaded here: http://www.google.co.uk/patents/US5994331?dq=5994331&hl=en&sa=X&ei=sliNUMbCE6qs0QXN5YBI&ved=0CC8Q6AEwAA It is active against species of 'lepidoptera' (for the purpose of killing 'pest moths and butterflies'). According to the Royal Entomological Society, Britain has 2,500 lepidoptera species, and few 'pest' Lepidoptera (butterflies and moths). Indeed, it appears FERA mention only 10 lepidoptera 'pest' species specific to agriculture and approximately 4 specific to trees. It seems reasonable to suppose that many beneficial species of Lepidoptera could be at risk, for the sake of targeting a small number of 'target' species. It is interesting to note that statistics suggest specific agriculture related butterflies are declining on farmland in the UK, and have been doing so since 2003 - source

Butterfly Conservation report: page 3: http://www.butterfly-conservation.org/uploads/State%20of%20the%20UK%27s%20Butterflies%202011%281%29.pdf Vespa spp (wasps) also is listed. Bees are hymenoptera, believed to be descended from wasps. Given regulatory system flaws and significant independent study outlining effects of neonicotinoids on bees it seems unreasonable to ask the intelligent public to convince ourselves these insecticides present 'no unacceptable risk to bees'.

3. It should be noted that in regulatory testing, only a tiny number of invertebrate species must be tested as a representative sample: honey bees, waterfleas, earth worms, and 2 further species. http://www.pesticides.gov.uk/Resources/CRD/Migrated-Resources/Documents/D/DRH_v2_2_Complete.pdf

4. There is no requirement by law that this author is aware of, which compels manufacturers to list all the beneficial insects potentially harmed.

Chronic And Behavioural Effects Of Insecticides

5. The EFSA report May 2012, outlined weaknesses in standards for testing pesticides, and these weaknesses included failure to test for chronic, behavioural, colony, larval, effects, among many others. **http://www.efsa.europa.eu/en/efsajournal/pub/2668.htm**

6. Behavioural, sublethal and chronic effects of insecticides are recognised by pesticide manufacturers as providing efficient means of killing insects. There are multiple means of exposure and the spreading of a toxin through a colony on insects – again, this is acknowledged within industry.

7. A significant example of this is described in detail within an information leaflet for Bayer's neonicotinoid Imidacloprid Termite killer: Premise 200sc, and in the Bayer brochure *"The Secret Life Of Termites"*. Though not present in the UK, Termites are social colony insects (interdependent) with a queen, like bumblebees and honeybees, but their colonies can be significantly greater – according to *The Secret Life Of Termites"* they can reach from 250,000 to 3 million individuals.

8. Bayer CropScience Product Claim Premise 200SC (imidacloprid) leaflet:
"Unlike other termiticides, termites cannot detect the treated zone, so they enter it and are immediately affected. Termite stop feeding, grooming and becomes disoriented."
"Imidacloprid binds to the nicotinergic acetylcholine receptors at the nervous systems which leads to paralysis and eventual death".
"Low doses of Premise 200SC such as the edge of the Treated Zone, disorientate the termites and cause them to cease their natural grooming behaviour. Grooming is important for termites to protect them against pathogenic soil fungi. When termites stop grooming, the naturally occurring fungi in the soil attack and kill the termites. Premise 200 SC makes fungi 10,000 times more dangerous to termites. Nature assists Premise in giving unsurpassed control. This control is Premise 200SC plus Nature."

9. From Bayer CropScience Brochure "The Secret Life Of Termites":
"When one termite meets another, it uses its mouthparts to clean and tidy it. This behavior, which scientists refer to as 'grooming', opens up an opportunity for more effective control

of termites, as it allows an active substance to be passed from one insect to the next. This mode of transmission helps imidacloprid reach the furthest corners of the complex system of tunnels inside a termite nest, so that it has the potential to affect the entire population very quickly,"

10. Independent evidence testing on bees have found similar effects as those seen in termites, e.g. M.E. Colin et al 2004: They tested both Imidacloprid and Fipronil, and found ability of honey bees to forage was severely impaired. *V. Girolami et al 2009:* Fed guttation drops collected from a canola treated field and noted effects were agitation, arching of the abdomen, regurgitation, uncoordinated movement, wing paralysis, and death.

11. Grooming and social grooming in honey bees has been detailed in a number of research studies, (forexample: Moore et al 1995; Winston and Punnett, 1982; Frumhoff and Baker, 1988; Kolmes, 1989; van der Blom, 1993).

12. Importance of grooming has also been highlighted as a defence against Varroa mite in both *Apis cerana* (Peng *et al.,* 1987) and *Apis mellifera* (Ruttner and Haenel, 1992) and this phenomenon can even be observed on computer screen at : http://www.brnda.com/Beefightingvaroa/tabid/66/language/en-US/Default.aspx). Varroa mite has been increasing in the UK: Page 9 http://www.juliegirling.com/images/stories/Bee_Conference/Thompson_MEPs_presentation_30032011.pdf

13. On April 2011, David Hanson MP tabled a parliamentary question asking the Secretary of State for Environment, Food and Rural Affairs, if she would commission a comparative study of the effects of neonicotinoid pesticides on the grooming behaviour of (a) termites and (b) bees (50755). In his reply, Jim Paice said "Effects of insecticides on grooming behaviour are not currently a standard data requirement in the regulatory process, and have not been identified as a requirement in the revised regime to be introduced shortly by Council Regulation 1107/2009".

14. Bayer CropScience publicly admit not to have tested for effects on grooming in bees: "Government asked to investigate new pesticide link to bee decline" - The Independent; 30th March 2011: *"Dr Julian Little, Bayer's UK spokesman, said: "We do a lot of tests of the effects of insecticides on bees, and impairment of grooming has never shown up." Specific tests to see whether or not bees' grooming ability was impaired by neonicotinoids had not been carried out, he added".* **http://www.independent.co.uk/environment/nature/government-asked-to-investigate-new-pesticide-link-to-bee-decline-2256737.html**

15. Bayer CropScience Product Claim Premise 200SC (imidacloprid) leaflet:

"Termite colonies work as interdependent units – they all rely on each other for survival. Premise 200 SC interferes with this instinctive social behaviour, contributing to the termites' demise."

From Bayer CropScience Brochure "The Secret Life Of Termites":

*"Genetic analysis from the house studies has now proven this. Feeding on the wooden structure was stopped in days, termites disappeared within a week or two from soil monitors immediately outside the structure, **and after three months** all termite colonies attacking these structures were eliminated. After two years of monitoring since treatment, not one of these colonies has recovered."*

16. Whilst manufacturers acknowledge the importance of colony effects, EFSA have stated that guidelines are inadequate in this area. The field tests being only of 28 days required duration, and the semi-field tests of only 7 days, have no requirement for, nor realistic method of observing multiple distribution routes through the colony.

Do Neonicotinoids Increase Vulnerability of Non-Target Insects To Fungi?

17. A number of studies have highlighted relationships between neonicotinoid pesticides and mortality in bees due to pathogenic fungi nosema by: Cédric Alaux et al, Cyril Vidau et al; Jeffery S. Pettis et al: Pesticide; and Judy Y. Wu et al.

18. The relationship between neonicotinoids and disruption to grooming in insects, and also vulnerability to fungi, has been noted in studies: *Galvanho et al, 2012: Imidacloprid Inhibits Behavioral Defences of the Leaf-Cutting Ant Acromyrmex subterraneus subterraneus (Hymenoptera:Formicidae)* (Ants are in the same insect order as bees – i.e. Hymenoptera); *Santos et al 2006: Selection of entomopathogenic fungi for use in combination with sub-lethal doses of imidacloprid: perspectives for the control of the leaf-cutting ant Atta sexdens rubropilosa Forel (Hymenoptera: Formicidae); Albrecht M. Koppenhöfer et al in 2000, Synergism of imidacloprid and entomopathogenic nematodes against white grubs: the mechanism.*

19. EFSA Panel on Plant Protection Products - EFSA Journal 2012; 10(5):2668 comment: *"Indeed, it has been shown that low levels of some pesticides may have synergic actions with diseases such as Nosema. Finding diseases in test colonies, which were healthy before the experiment, and not finding such diseases in control colonies, can imply a synergic effect of pesticides and diseases".*

20. The final results of the 2 year project in England and Wales, were published, and indicate that 45% of the colonies had nosema – 8% of which had 2 strains: https://secure.fera.defra.gov.uk/beebase/downloadNews.cfm?id=60

Link Between Neonicotinoids And Varroa Mite?

21. Some research suggest a link between neonicotinoids and increased abundance of certain mites belonging, like Varroa mite, to the arachnid taxon 'Acari' (i.e. mites and ticks), for example: *Chun-Xiang Zeng and Jin-Jun Wang 2008: Influence of exposure to imidacloprid on survivorship, reproduction and vitellin content of the carmine spider mite, Tetranychus cinnabarinus:* http://www.insectscience.org/10.20/i1536-2442-10-20.pdf; *Adrianna Szczepaniec et al 2011: Neonicotinoid Insecticide Imidacloprid Causes Outbreaks of Spider Mites on Elm Trees in Urban Landscapes* http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0020018; *Tessa Van Dyk's earlier study: Effects of neonicotinoid pesticide pollution of Dutch surface water on non-target species abundance 2010:* http://www.boerenlandvogels.nl/sites/default/files/FinalThesis_VanDijk.pdf Do neonicotinoids) favour/assist VARROA MITES?

<u>Persistent, Cumulative And Mobile Properties And Chronic Effects Of Insecticides</u>

Cumulative and chronic effects are not adequately assessed, and when insecticides are persistent and mobile in soil – such as neonicotinoids, they have the potential to accumulate. Neonicotinoids may also to trespass into areas not intended for treatment.

22. And: From Bayer CropScience Brochure "The Secret Life Of Termites":
"After two years of monitoring since treatment, not one of these colonies has recovered."

23. Bonmatin et al have confirmed persistence in soil, and that after 2 years (duration of the experiment), imidacloprid could be taken up from the soil and presented to bees through pollen and nectar, at toxic levels, even after usage ceased.

24. EFSA: P 42: **http://www.efsa.europa.eu/en/efsajournal/pub/2668.htm** *"biological persistence nevertheless presents a potential risk to bees that should be assessed. However, the conventional regulatory tests are likely to be unsuited to assess the risks of long-term exposures because they are based on short-term measurements (48 to 96 h), and may fail to detect the true potential for long-term effects".*

25. Bayer CropScience Product Claim Premise 200SC (imidacloprid) leaflet:
"Any termiticide is less effective if there are gaps in the treated area. Lateral Soil Movement (LSM), however, helps Premise 200C achieve a more complete treated zone. LSM refers to movement in all directions in the soil. Because of its moderate water solubility, imidacloprid moves with the wetting front of the soil. Then as the soil dries, it binds with the soil particles, ensuring a continuous treated zone."

26. If chemicals have the potential to **trespass** beyond the treated zone (which results in superfluous application of pesticide in areas not intended for treatment), what benefit can wildflower 'pollinator' strips planted along the sides of agricultural fields really serve?

27. **The EAC are asked to consider whether the general public and bodies shall be entitled to suitable compensation for trespass of pesticides, and who should pay the compensation? The EAC are asked to investigate whether this feature has been properly explained to end users on product application instructions.**

28. Tennekes ***The significance of the Druckrey–Küpfmüller equation for risk assessment—The toxicity of neonicotinoid insecticides to arthropods is reinforced by exposure time. Publ: Toxicology 2010*** illustrates the risk of repeated exposure to neonicotinoid (imidacloprid and thiacloprid) doses at very low levels. Thus chemicals that persist in soil offer repeated exposure risk.

29. Toxic Soup Effects EFSA from page 102 onwards:
http://www.efsa.europa.eu/en/efsajournal/doc/2668.pdf

A Misleading And Unbalanced View Of Independent Evidence

30. FERA present and have presented, an unbalanced summary of independent Scientific data – especially with regard to neonicotinoid impacts on bees, which are then released into the public domain, and may have serious implications for decision making and the environment. An example of this is the Girolami study: *Translocation of Neonicotinoid Insecticides From Coated Seeds to Seedling Guttation Drops: A Novel Way of Intoxication for Bees. Journal of Economic Entomology 2009, 102 (5), 1808-1815)* summarised by FERA here: http://randd.defra.gov.uk/Document.aspx?Document=PS2361_9170_FRP.pdf

31. Directly within the Executive summary, the document states: *"Only one study (Girolami et al 2009) has shown a significant effect in honeybees but this should be treated with caution as*

the data were generated by feeding collected droplets directly to bees and in many cases sucrose was added to ensure the honeybees consumed the dose."

This is a misleading and unbalanced statement. Even if the above statement were true, then it should be noted that for regulatory assessment measuring acute oral toxicity in the laboratory, the tested pesticides are mixed with a sucrose solution. In addition, in regulatory tests, small quantities of test solution are mixed with sucrose and fed to bees via single use feeders. FERA know this they conducted the oral toxicity tests on behalf of Bayer CropScience to support the DAR for imidacloprid. In these test, they fed bees the test solution mixed with sucrose. The bees in the Girolami study are fed the guttation fluid using a capillary glass tube. FERA fed the test+sucrose solution directly to the bees also, "the dose being measured into a small, pre-weighed, glass feeder with the cage using a variable Gilson pipette". How is the methodology used by FERA anymore robust/better/fair than that used by Giorlami? In actual fact, Girolami added 15% honey only to some of the samples, and other bees were fed plain guttation drops. The addition of honey or not made no difference to the toxic effects - this significant point is not mentioned above.

The Full Summary Of The Girolami Study By FERA:

32. "Girolami et al (2009) undertook laboratory studies with honeybees in which they fed guttation fluid from treated maize to honeybees in the laboratory. The maize seeds were treated with imidacloprid (0.5mg Gaucho 350/seed), clothianidin (1.25 mg Poncho/seed), thiamethoxam (1mg Cruiser FS/seed) or fipronil (1mg Regent FS/seed) and grown in open field conditions. Guttation droplets were collected at 0800-0900 each morning for the first 3 weeks after emergence (when guttation reduced). In the field 1-3 mls of fluid could be collected from 100 plants (in the laboratory 30-150µl /plant/ day was collected) and each sample was split into two, one for chemical residue analysis and the other for bioassay. The bioassay was conducted with honeybees deprived of food and water for 2 hours before dosing and individuals dosed with guttation fluid only or guttation fluid with 15% honey. 20 minutes after fluid consumption fresh honey was provided. The time to first toxic symptoms was recorded. Field collected guttation fluid resulted in wing block within 2-9 minutes after consumption of fluid collected from plants grown from clothianidin, thiamethoxam or imidacloprid treated seed but not from control plants or plants grown from fipronil treated seed. There was a significant delay in the consumption of guttation fluid alone and only addition of honey resulted in consumption within 5 minutes of the dose being offered. The residues in the guttation fluid from plants grown from treated seed were 47± 9.96 mg imidacloprid/ L; 23.3 ± 4.2 mg clothianidin/ L and 11.9 ± 3.32 mg thiamethoxam/ L.; no fipronil was detected. Although the authors relied on sublethal effects for their bioassay the published LD50 data are 0.0037 µg imidacloprid/bee, 0.004 µg clothianidin /bee, 0.005µg thiamethoxam /bee. Based on intake of 20µl per bee these are equivalent to test solution concentrations of 0.185 mg imidacloprid/L, 0.084 mg clothianidin/L and 0.25 mg thiamethoxam/L.. Therefore the levels in guttation fluid were 254 times the LD50 for imidacloprid, 280 times the LD50 for clothianidin and 48 times the LD50 for thiamethoxam".

33. **For clarity, quotes are lifted from the passage above, with comment below:**
FERA: *"honeybees deprived of food and water for 2 hours before dosing"*

- This is exactly the same procedure for regulatory tests. Note in regulatory tests, they are dosed for a max 4-6 hours. Note that in regulatory studies, "a dose of 10 or 20µl of test solution per bee" is offered, and bees that do not drink are still included within the results.

There is an assumption that “bees share the test solution between themselves and so receive similar doses”. Yet some bees may not feed at all, hence affecting the results! In the Girolami study, a drinking event is defined by the consumption of 5µl solution, and bees that do not drink are discarded from the analysis. If an oral toxicity study is to measure just that, shouldn’t the question be “If X number of bees consume solution Y, how many will die?”? If bees do not drink the solution, is it right for them to be included in the analysis of oral toxicity. If tests for repellency are required, surely they should be carried out separately?

34. ***FERA:*** *“20 minutes after fluid consumption fresh honey was provided”.*
Again, in regulatory assessments, sucrose is offered following the experiment period (max 4-6 hours).

35. ***FERA:*** *“In the field 1-3 mls of fluid could be collected from 100 plants”*
The study actually states: *“Collection in the field was carried out from 8:00 to 9:00 a.m. from all plants within a row, until a volume of 5ml was available. In the laboratory, because guttation occurs throughout the days and night, it was possible to collect them three times a day, yielding a volume of≈ 1-2 ml/d”.* And: “whereas in the field a single collection in the morning easily allowed to gather 1-3ml from 100 plants.”

36. ***FERA:*** *“The bioassay was conducted with honeybees deprived of food and water for 2 hours before dosing and individuals dosed with guttation fluid only or guttation fluid with 15% honey. 20 minutes after fluid consumption fresh honey was provided. The time to first toxic symptoms was recorded. Field collected guttation fluid resulted in wing block within 2-9 minutes after consumption of fluid collected from plants grown from clothianidin, thiamethoxam or imidacloprid treated seed but not from control plants or plants grown from fipronil treated seed. There was a significant delay in the consumption of guttation fluid alone and only addition of honey resulted in consumption within 5 minutes of the dose being offered”.*

To be clear, there were several types of toxicity test conducted by Girolami. The guttation from field crops had NO honey added – and it resulted in wing block within 2 – 9 minutes. Honey was added to guttation drops from laboratory pot grown plants. For this sample, he ensured some of the pot grown guttation samples had honey added, and some did not. This can be clearly seen in Fig 4. Regardless, Girolami found that the addition of honey or not made no difference to the intoxication symptoms. The above description by FERA almost sounds as though the honey was significant to the results in the experiment. The reason for the addition of honey, however, was to speed up the experiment.

37. ***FERA:*** *“The residues in the guttation fluid from plants grown from treated seed were 47± 9.96 mg imidacloprid/ L; 23.3 ± 4.2 mg clothianidin/ L and 11.9 ± 3.32 mg thiamethoxam/ L.; no fipronil was detected. Although the authors relied on sublethal effects for their bioassay the published LD50 data are 0.0037 µg imidacloprid/bee, 0.004 µg clothianidin /bee, 0.005µg thiamethoxam /bee. Based on intake of 20µl per bee these are equivalent to test solution concentrations of 0.185 mg imidacloprid/L, 0.084 mg clothianidin/L and 0.25 mg thiamethoxam/L.. Therefore the levels in guttation fluid were 254 times the LD50 for imidacloprid, 280 times the LD50 for clothianidin and 48 times the LD50 for thiamethoxam”.*

Guttation drops were collected directly from corn that was planted using the manufacturers insecticide treated seeds. When this guttation fluid was fed to bees, sub-lethal effects were exhibited and ultimately death.

38. FERA's treatment of the Girolami study is in contrast to their treatment of a Swiss study, using methodology which is flawed, but nevertheless, it appears to comply with the EPPO regulatory standards for field tests. The flaws of the Swiss study, are not pointed out to the reader of the report. This is the **full** summary from document:

    FERA: *"The Swiss Federal Government for Agriculture commissioned a study in 2009 (www.blw.admin.ch/themen/00011/00077/00590/index.html?lang=fr) to assess the risks to honeybee colonies during sowing of maize seed treated with Poncho (25g ai/ 50,000 seeds, i.e. 0.5 mg ai/seed) through drift of dust and guttation. No effects were observed due to dust drift. Guttation fluid collected from maize after emergence (7-10 days after sowing) was reported to contain 25-37 mg clothianidin/L reducing to around 0.1 mg/L by 40 days after sowing (as above the LD50 for clothianidin is around 0.084 mg/L) (Figure 3). No clothianidin residues were detected in the honeybees or in honey sampled from the colonies and no increased mortality was identified at honeybee colonies placed at the edges of the treated fields and the colonies developed normally".*

39. The link to study is to a French version, not an English version. It would have been useful if FERA had provided the English translation. The study was called: ***"Presence of Clothianidin in Hives (Monitoring)",*** and the objective of this study was ***"Quantitatively and qualitatively establish the presence of neonicotinoids (clothianidin)"*** The study investigated clothianidin residues in guttation, pollen, honey and dead bees.There were 2 elements of this test:

Test 1

A 2 ha field was used. Foraging bees will fly several kilometres – even at only *2.5 km, this corresponds to a theoretical foraging area of 19.6 km2, i.e., about 2000 hectares (EFSA).* **Only 36%** of this tiny field was sown with clothianidin, the pesticide that was the subject of the study! 74% of the field had no clothianidin at all. The rest of the field was sown with: Gaucho - imidacloprid , Cruiser – thiamethoxam, Mesorol which is not a systemic neoniocotinoid. It is a bird repellent and molluscicide and a **non-systemic** carbamate pesticide. The study does not refer to these other pesticides later – so we don't know anything further about residues of other neonicotinoids. Colonies of bees with 20,000 bees each were installed by the side of the clothianidin treated field. 6 colonies of bees were used – 3 on each side – in reality, these colonies must have been close together – a regulatory field trial fault also identified by EFSA. Six days before planting, the hives were installed. The fields were close to wildflowers and trees, and dandelions. 4 colonies from the sample of 6 (2 from each side) were used for monitoring of dead bees collected in traps at the hive. Pollen and honey samples were collected from the remaining 2 hives and analysed for residues of clothianidin. In the case of the honey, the samples were taken 3-5 weeks before and after planting the corn. Trial began 17 April – seeds sown April 23rd. The trial lasted just 50 days from April 23rd (where April 23rd = 0). Guttation fluid was collected from the corn in this field early in the morning. Indeed from the results, it appears that no guttation was collected until day 15 of the study FOLLOWING the sowing of the seeds on 23rd April. However, the study confirms that guttation is collected only on **14 times**.

Test 2

The second field test was only 200m to 300m from the first field test. The field was surrounded by wildflowers, dandelions, clover. The bee colonies were "placed on either side of the cornfield in a meadow". The size of this field was a mere 1 ha. Again, residues were measured, with predicable results.

40. Results: Not surprisingly, the authors find no significant mortality of bees. They do not detect residues of clothianidin in pollen and honey, with the exception of one sample of pollen. The authors state the contamination of this sample is likely to be caused by increased exposure to clothianidin of the dandelions close by, due to frequent use of the field for trials. Thus an admission by the authors that the bees are more likely to have foraged on dandelions than the corn**.** A 2 ha field sown with a few rows of corn over just 36% of the surface area appears very unrealistic. The authors do find very significant levels of clothianidin in guttation samples: with levels of 27 to 37,000 (thirty seven thousand) microlitres per litre. The authors (concede that this is high, but since they haven't found any clothianidin residues in dead bees, honey or pollen during the time period the corn was guttating, the authors conclude this must mean the guttation doesn't pose a threat, but they advise that if water is of limited availability to the bees, then beekeepers should engage in good beekeeping practice, by supplying water in the beehive.

41. FERA go on to summarise a further study by *Shawki et al (2006).* This study does not add any weight at all to the notion that guttation from crops treated with ***systemic insecticides***, is not harmful to bees. Nor does it support in any way, the findings of the Swiss study above. The fact that the crops were treated with a non-systemic insecticide seems highly relevant. This is not explained by FERA, nor is it properly explained why guttation results would be so different from those in the other studies. As such, FERA are omitting important information that will potentially mislead the reader of this report.

42. FERA refer to the Swiss study again, to cast doubt on other evidence suggesting that guttation could be highly toxic for bees: *"The only oral toxicity data available for non-target arthropods readily available are those for the honeybee……**However, as studies in Switzerland showed no significant mortality in bee colonies located at the edge of treated maize fields the significance of guttation fluid as a source of water for bees is unclear**".*

WIIS And Monitoring Of Diseases Associated With Colony Collapse In Honey Bees

43. The scheme for reporting poisoning of honey bees by pesticides (WIIS - Wildlife Incident Investigation Scheme) to the National Bee Unit (NBU), is inadequate in the UK, and does not provide a true picture A report by Dr Bernie Doeser draws out inadequacies with the scheme: http://www.buzzaboutbees.net/support-files/wiis.pdf

44. Yet IMPORTANTLY, data provided by the WIIS is used in setting regulatory analysis measures to assess risks of pesticides to bees. The EFSA report: http://www.efsa.europa.eu/en/efsajournal/doc/2668.pdf

45. It should be noted that WIIS can only gather acute poisoning data where direct poisoning is concerned, and cannot give the whole picture with regard to practical effects of pesticides in the field through chronic exposure.

46. Meanwhile, there is no on-going recording by the NBU to monitor prevalence of nosema, despite presence of nosema in CCD cases, and data linking nosema with neonicotinoids. A project involving 4600 colonies in England and Wales found nosema in 44% of cases.

9 November 2012

Written evidence submitted by Dr Lynn Dicks, University of Cambridge

SUMMARY

1. Wild bees and other pollinating insects are known to be declining in the UK and elsewhere in response to multiple interacting pressures, including the use of pesticides.
2. There is an urgent need for data on the actual exposure of wild pollinators to neonicotinoids or combinations of pesticides in their natural environment.
3. The Defra project (PS2371) that is supposed to fill this knowledge gap seems unlikely to. I cannot scrutinise the methods, but as described it is a small case study with a potential methodological flaw.
4. Recent evidence on the sub-lethal effects of field-realistic levels of neonicotinoids on bumblebees shows that serious implications for bumblebee colonies are possible.
5. No similar evidence has been published for solitary bees or other flower-feeding insects.
6. There is a lack of transparency in the pesticide regulatory system. The details of studies supporting the regulatory assessment are inaccessible.
7. There are many alternative farm management measures to enhance the natural pest control service provided in farmed ecosystems. My team at Cambridge are compiling a synopsis of scientific evidence on the effectiveness of these.

TEXT OF SUBMISSION

1. Wild pollinators are declining

1.1 This document considers wild pollinators native to the UK. Following the UK National Ecosystem Assessment (Smith *et al.*, 2011) this includes all flower-visiting insect groups that have the potential to pollinate crops or wild flowers, including bees, flies, wasps, beetles, butterflies and moths. It does not consider the managed honey bee *Apis mellifera*.

1.2 Wild insect pollinators pollinate many crops and wild plants at no direct cost to farmers or land managers. For crops, the pollination service is currently valued at £510.2 million (Breeze *et al.*, 2012). Under favourable assumptions for honey bees, 34% of the service is provided by them in the UK (Breeze *et al.*, 2011), leaving 66% that must be provided by wild insect pollinators.

1.3 There is evidence of recent declines in wild pollinators (Potts *et al.*, 2010) and indications of parallel declines in wild plants dependent on pollination (Biesmeijer *et al.*, 2006), but no evidence of declines in insect-pollinated crop yields (Aizen & Harder, 2009; Breeze *et al.*, 2011).

1.4 Much of the evidence for wild pollinator decline is inferred from changes in the recorded occurrence of species of bee, fly, beetle, or wasp (e.g. Biesmeijer *et al.*, 2006; Cameron *et al.*, 2011). These records are generally collected by volunteer participants without following a defined survey protocol. The primary aim of such recording is to produce distribution atlases (Collins & Roy, 2012), although methods to extract trends in geographic range and frequency from these data are developing (Biesmeijer *et al.*, 2006; Hill, 2011; Morris, 2010).

1.5 The direct evidence we have of declines in wild pollinator abundance over time (as opposed to declines in diversity or range) comes largely from long-term data on butterflies (and, to a lesser extent, moths), collected through participatory monitoring schemes with defined survey protocols involving standardised observations repeated regularly over space and time (Conrad *et al.*, 2006; Fox *et al.*, 2011; Warren *et al.*, 2001). There is some direct evidence for dramatic falls in the relative abundance of long-tongued bumblebee species in Sweden (Bommarco *et al.*, 2012). The Bumblebee Conservation Trust has recently started a national bumblebee survey in the UK.

1.6 Current scientific opinion is that pollinator decline is likely to be caused by multiple interacting pressures lowering pollinator health, abundance and diversity, rather than any single threat (Brown & Paxton, 2009; Potts *et al.*, 2010). Pesticides are one of these multiple, interacting threats.

2. The need for data on actual exposure

2.1 To assess the magnitude of the threat from pesticides, there is an urgent need for data on the actual exposure of wild pollinators to neonicotinoids, or to multiple pesticides including neonicotinoids, in their natural environment.

2.2 There are data on pesticide residues in nectar and pollen in crop plants (Cresswell, 2011), and in pollen, honey and wax collected or made by honey bees (Blacquiere *et al.*, 2012). Most of these data are not accompanied by data on the usage of the chemicals in the landscapes where the bees foraged.

2.3 I know of no published data on pesticide residues in products collected by free-living wild bees or ingested by other flower-feeding insects such as hoverflies. The foraging behaviour and life histories of flower-feeding insects mean that reported levels of pesticide residue in crop plant nectar and pollen do not equate to actual exposure (Brittain & Potts, 2011). Most flower-feeding insects are generalists and opportunists. They feed on a range of available resources, including wild plants and crop plants.

3. Defra Project PS2371

31. Defra has commissioned a project (PS2371) to 'fill identified evidence gaps, including the questions raised about the relevance of recent studies to field conditions' (Defra, 2012). This project is described as an 'edge of field exposure' study that will take place over a single season. It will presumably use captive-reared colonies of the buff-tailed bumblebee *Bombus terrestris*. I have not been able to see any detailed methods or plans for the project.

3.2 Whilst the project will undoubtedly provide interesting results, they will probably be limited to one common bumblebee species, in one landscape, in one year. The species, *Bombus terrestris*, is common and widespread. Its range has not declined, but there are no data on whether its abundance is changing over time. This project should be considered a single case study. It will not provide the evidence required to establish whether, or to what extent, wild pollinator declines are caused by pesticides.

3.3 One potential methodological flaw in the PS2371 study is that buff-tailed bumblebees have been experimentally shown to prefer to forage more than 100 m away from the colony site (Dramstad *et al.*, 2003). If the experimental colonies are placed on the edge of 1 ha (100 m x 100 m) fields of experimental oilseed rape, as suggested in the risk assessment guidelines, it is likely that they would choose not to forage in the rape. This species has an estimated foraging range of up to 625 m (Darvill *et al.*, 2010). The workers could be foraging anywhere in a 1.3 km diameter circle of landscape around the experimental fields and avoiding the experimental treated rape. It is unclear how this problem will be dealt with in the method.

3.4 This project provides no information about the exposure of wild solitary bees, hoverflies, butterflies and other flower feeders to pesticides.

4. Serious implications for bumblebee colonies

4.1 The existing published evidence about the sublethal effects of neonicotinoids on bumblebees (particularly Gill *et al.*, 2012; Whitehorn *et al.*, 2012) show serious implications for bumblebee colonies are possible, if they are being exposed in the wider environment at the levels tested. Effects have been measured on reproductive fitness (85% reduction in new queen production) and colony foraging (69% of workers lost over four weeks when exposed to neonicotinoid and pyrethroid combined). Such effects would be unacceptable.

4.2 Defra's position seems to be that it would not change regulation unless there was unequivocal evidence that serious implications for bee colonies were likely.

4.3 The precautionary principle would suggest a planned phase out or temporary restriction of neonicotinoid use, awaiting further evidence of the likelihood of the demonstrated effects.

4.4 The Chemicals Regulation Directorate's comments reported by Defra (Defra, 2012) suggest that control and treatment groups were fed different diets in the Whitehorn study, with control bees consuming nectar while treated bees had sugar water. This is wrong. Both control and treatment controls were fed sugar water during the two-week experimental phase, then both control and treatment colonies were allowed to forage freely outside.

5. No published evidence on sublethal effects for other wild pollinators

5.1 There is no published evidence about the sublethal effects of field-realistic levels of neonicotinoids on solitary bees or other wild flower-feeding insect groups such as butterflies, moths and hoverflies.

5.2 Emerging evidence from the STEP project (www.step-project.net), not yet published, is expected to show adverse reproductive impacts on the solitary bee species *Osmia bicornis*.

6. Lack of transparency in the regulatory process

6.1 There is a distinct lack of transparency about the methods used to make regulatory assessments for individual pesticides. The multi-year/multi-site field trials referred to for thiamethoxam in the Defra document on neonicotinoids (Defra, 2012) are unpublished and apparently not available for scrutiny. Given the challenges of such field scale assessments, due to the foraging range of bees (see point 3.3) and the spatial and temporal variability of landscapes, the methods used are highly pertinent to any assessment of whether or not there is a likely unacceptable influence on non-target species. Why can scientists outside the regulatory process not have access to these studies?

7. Measures to enhance natural pest control

7.1 Alternative non-chemical approaches to pest control in a commercial farming context have not been given enough attention in policy or research. Pest and disease regulation is identified as an ecosystem service, delivered mostly in enclosed farmland and continuing to be highly impacted by the conversion and intensification of natural habitats to farmland (UK NEA, 2011). As pest regulation is largely delivered by free-living predatory invertebrates, the service is likely to be adversely affected by the use of insecticides and conversely, is likely to be enhanced by reducing insecticide use.

7.2 In France, the primary agricultural producer in Europe, the Ministry of Agriculture and Forestry's ECOPHYTO2018 Programme aims at a progressive eradication of 53 of the most dangerous chemicals, and a decrease of 50% in the use of pesticides within 10 years (by 2018). By contrast, the UK has no coordinated national effort to reduce pesticide use. Data published by the Food and Environment Research Agency show that overall pesticide application rates rose 6.5% between 2005 and 2010 in the UK, due to greater intensity of treatment per ha on some crops (Breeze *et al.*, 2012).

7.3 My team at the University of Cambridge are synthesizing scientific evidence on enhancing natural pest control, as part of a Natural Environment Research Council Knowledge Exchange Programme on Sustainable Food Production (www.nercsustainablefood.com). We are working with an international group of advisors, including experts in insect ecology and agronomy.

7.4 So far we have identified 59 different measures that can enhance natural pest control in arable or livestock farming. This list is unpublished, but can be provided on request. We have carried out a literature search using a systematic search protocol (submitted to the journal *Environmental Evidence*), and so far identified over 4,000 individual studies that provide evidence for the effectiveness of one or more of the 59 measures. We will begin summarising these studies in plain English in a synopsis of evidence format (see www.conservationevidence.com) early next year, and evidence should be compiled and available for a selection of the measures by summer 2013.

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Written evidence submitted by the Royal Society for the Protection of Birds

Executive summary

- The aim of pesticide policy decisions must be to improve the overall sustainability of pest control. Any actions taken to address current concerns over neonicotinoids must be set in this broader context.

- The RSPB is highly concerned by emerging evidence of the impacts of neonicotinoids on pollinating insects. We further believe that the possible environmental impacts of a ban on neonicotinoids must play a key part in any decision to suspend approvals. It is imperative that any regulatory action does not drive farmers to resort to pesticides that are more environmentally damaging overall.

- We therefore feel that Government and industry should place a high priority on developing and promoting environmentally-benign alternative means of pest control (both chemical and non-chemical) to replace the use of neonicotinoids. At the same time, research must continue to clarify the impacts on neonicotinoids on pollinators, and to understand how farmer practice might change if these chemicals were banned.

- Pesticide usage in the UK is monitored and reported in terms of weight of active substance applied. There is a clear need to develop more direct and realistic ways of assessing pesticide impacts in the field. Lack of evidence does not necessarily imply lack of impacts.

- The RSPB believes that the UK policy response to date has been inadequate to address the known environmental risks from pesticide use and does not follow the precautionary principle. The Sustainable Use Directive sets out a clear framework for Member States to reduce the risks of pesticide use by applying an Integrated Pest Management approach (IPM). However, the UK government has failed to take this opportunity to increase support for IPM approaches in the UK.

Introduction

1. The RSPB’s agriculture vision is for sustainable systems of farming that produce adequate supplies of safe, healthy food; protect the natural resources of soil, air and water that farming depends on; help to protect and enhance wildlife and habitats; provide jobs in rural areas and contribute to a diverse rural economy. The RSPB strives to achieve this vision by engaging with agriculture in a variety of ways. Our long-standing science programme

includes monitoring farmland bird populations, researching causes of declines and testing solutions. We work with farmers to develop and promote farm management that benefits biodiversity, and with government to develop agricultural policies that support more sustainable farming. We have first-hand experience of the challenges of farming through ownership and running of Hope Farm, a conventional arable farm in Cambridgeshire.

2. The RSPB recognises pesticides as one of a range of tools in both agriculture and conservation land management, but one which must be used appropriately and sparingly due to the associated risks and negative environmental impacts. RSPB believes that the aim of pesticides policy must to be to continually improve the sustainability of pest control. The approvals processes in place at EU and UK level must stringently assess the risks of active substances before allowing them to be used, applying the precautionary principle where data are lacking. Substances that are found to have negative impacts on non-target organisms must be actively phased out according to appropriate timescales, while less harmful alternatives are developed. Pesticides policies must also ensure responsible pesticide use. This includes protecting the most vulnerable sites and habitats (for example sensitive waterbodies, SSSIs) from negative effects of pesticides; and promoting an 'Integrated Pest Management' approach in all sectors[1], with reduced reliance on chemical control and incorporation of measures beneficial for biodiversity. We urge that any actions taken to address current concerns over neonicotinoids should be set in this broader context.

3. The RSPB has not undertaken an assessment of Defra's recent analysis and we are therefore not equipped to comment on the use of evidence in this particular case, for setting policy and regulations on pesticides. However, we would like to comment more generally on current policies on neonicotinoids, as well as the broader questions posed by the Committee on monitoring of pesticide use and alternative methods of pest control.

Policy on neonicotinoids

4. The RSPB is highly concerned by emerging evidence of the impacts of neonicotinoids on pollinating insects. Such impacts include lethal effects; in particular direct poisoning during drilling of treated seeds[2]; and chronic effects of exposure via pollen and nectar of treated plants[3]. Researchers have also detected neonicotinoids in non-crop plants growing in the

[1] As defined in Annex III of Directive 2009/128/EC on the sustainable use of pesticides

[2] Marzaro et al. (2011) Lethal aerial powdering of honey bees with neonicotinoids from fragments of maize seed coat. Bulletin of Insectology 64: 119-126

[3] See Pesticide Action Network UK factsheets for a summary of research on this issue: PAN (2012) Sub-lethal and chronic effects of neonicotinoids on bees and other pollinators. http:// bees.pan-uk.org/assets/downloads/ Bee_factsheet2.pdf

margins of treated fields at concentrations high enough to kill herbivorous insects.[4] However, the evidence for population-level impacts on pollinators is still equivocal[5].

5. There is an urgent need to fill the gaps in scientific knowledge to understand the impacts of neonicotinoids on pollinators. Nevertheless, the RSPB believes that the current evidence is strong enough that the Government and industry should place a high priority on developing and promoting environmentally-benign alternative means of pest control (both chemical and non-chemical) to replace the use of neonicotinoids.

6. The RSPB believes that the possible environmental impacts of a ban on neonicotinoids must play a key part in any decision to suspend approvals. Current alternatives, such as broad spectrum insecticide sprays, may be equally or more harmful to non-target organisms. It is imperative that any regulatory action does not drive farmers to resort to pesticides that are more environmentally damaging overall. Before changing the rules on neonicotinoids, it is therefore necessary to a) understand how farmer practice would change if neonicotinoids were banned, and the environmental implications of this; and b) actively work towards replacing neonicotinoids with pest management strategies that are known to be less environmentally damaging.

7. The RSPB is supportive of the activities at UK and EU level to carry out further research on neonicotinoids and to review the risk assessment process for bees. We urge the authorities to push forward with these processes and to fully implement any recommendations that arise, as well as continuing to follow closely the research being produced by independent scientists. We suggest that the UK government should also review experiences in other EU countries (France, Germany, Italy and Slovenia) where regulatory action on neonicotinoids has already been taken.

Monitoring of actual levels of pesticide usage, and the extent to which that influences policy on pesticides

8. The Pesticide Forum annual reports[6] bring together monitoring information on pesticide use and impacts. Pesticide use is reported in terms of estimated annual usage in tonnes of active substance applied and average inputs per crop (again in kg active substance applied per

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[4] Krupke CH et al. 2012. *PLoS ONE* 7: e29268

[5] See for example Creswell, J. E., Desneux, N. & vanEngelsdorp, D. (2012) Dietary traces of neonicotinoid pesticides as a cause of population declines in honey bees: an evaluation by Hill's epidemiological criteria. Pest Management Science 68: 819-827.

[6] http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/pesticides-forum/pesticidesforum-annual-reports

hectare). The draft National Action Plan on pesticides published by Defra in July 2012[7] also includes data on the total area treated with pesticides in Great Britain (an indicator which is a multiple of the area of crop grown and the number of times it is treated). However, these metrics are of limited use in assessing the changes in environmental impact of pesticide use over time, because different active substances have different characteristics (for example toxicity to different taxa and persistence in the environment).[8]

9. There is a clear need to develop more direct and realistic ways of assessing pesticide impacts in the field. A promising new approach using ecological modelling is being pioneered by researchers at the University of Reading[9] .

10. The indicators of environmental impact reported by the Pesticides Forum include water quality monitoring and population trends in selected bird species. Monitoring shows that pesticides continue to be a major cause of water pollution, with implications for both the aquatic environment and the cost to water companies (and therefore to water customers) of supplying safe drinking water. Populations of birds that depend on farmland habitats continue to decline. Scientific evidence[10] implicates the indirect effects of pesticides in the declines of some farmland birds including yellowhammer and corn bunting which have declined by 55% and 89% respectively. However, it is difficult to quantify the link between bird declines and pesticide use, since birds are affected by many other factors as well as pesticides. Most pesticide impacts on birds are indirect, by altering food chains. It would be valuable to also consider data for other taxa (such as certain insect or plant groups) that are more directly affected by pesticide use.

11. The RSPB believes that the UK policy response to date has been inadequate to address the known environmental risks from pesticide use and does not follow the precautionary principle. The precautionary principle allows for a decisive policy response in situations where possible risks are high but evidence is lacking to quantify these risks. The RSPB believes that such evidence as is available on the impacts of pesticides on the environment points to a high level of risk. A lack of quantitative evidence on impacts may point to a lack of research rather than lack of a problem. Although it is vital for policy to be evidence-led, policy makers must be aware of situations where policy can be evidence-limited.

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[7] http://www.defra.gov.uk/consult/2012/07/30/uknap-pesticides/
[8] Reus, J. et al. (2002) Comparison and evaluation of eight pesticide environmental risk indicators developed in Europe and recommendations for future use. AGRICULTURE ECOSYSTEMS & ENVIRONMENT 90: 177-187
[9] http://cream-itn.eu/projects/wp-3/bird-1-modelling-the-importance-of-landscape-structure-and-life-history-traitsfor-the-risk-to-populations-of-skylarks-phd-university-of-reading-uk
[10] Boatman, N.D. et al. (2004) Evidence for the indirect effects of pesticides on farmland birds. Ibis 146: 131–143

12. The government's insistence on "no gold plating"[11] in its implementation of the Sustainable Use Directive[12] has resulted in a missed opportunity to put pest control in the UK on a more sustainable footing. Government's draft National Action Plan on the sustainable use of pesticides does not propose any new measures nor set any targets or timetables to reduce the negative impacts of pesticides. The RSPB calls for a more proactive implementation of the Sustainable Use Directive that is in keeping with the intention of this Directive to promote a shift to more sustainable pest control practices in farming.

What alternative pest-control measures should be used?

13. The Sustainable Use Directive sets out a clear framework for Member States to reduce the risks of pesticide use by applying an Integrated Pest Management approach (IPM). IPM has the potential to simultaneously improve pest control while helping farming to become more sustainable and resilient overall. From the point of view of individual farmers, it may help them to reduce their costs and avoid or overcome problems of pesticide resistance[13]. Some IPM measures can also contribute to biodiversity objectives, for example providing habitat for beneficial insects[14].

14. IPM describes an overall approach to pest control and cannot be achieved by implementation of one or two measures in isolation. However, one important set of measures that may be included in a successful IPM strategy is creating and managing habitat for the natural enemies of pest species. Evidence on the success of such approaches was reviewed by Natural England in their recent report on ecosystem services delivered by Environmental Stewardship[15].

15. Organic farming aims to avoid the need for pesticides[16] through maintaining healthy crops and soil and promoting natural control of pests, and has clear benefits for biodiversity[17]. The RSPB wishes to see increased funding for organic farming and more research into organic techniques as part of the strategy for more sustainable farming in the UK. Techniques used

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[11] http://www.defra.gov.uk/news/2010/12/15/pesticides/
[12] DIRECTIVE 2009/128/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides.
[13] Data on known resistance problems are available from the Resistance Action Groups: http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/Resistance-Action-Groups.
[14] Food and Environment Research Agency. 2012. Ecosystem services from Environmental Stewardship that benefit agricultural production. Natural England Commissioned Reports, Number 102.
[15] Food and Environment Research Agency. 2012. Ecosystem services from Environmental Stewardship that benefit agricultural production. Natural England Commissioned Reports, Number 102.
[16] See the Soil Association's standards http://www.soilassociation.org/LinkClick.aspx?fileticket=l-LqUg6iIlo%3d&tabid=353 (section 4.11) and factsheet http://www.soilassociation.org/LinkClick.aspx?fileticket=XN06h4o5BOs%3D&tabid=143 for details of the use of pesticides in organic farming.
[17] Hole, D.G. et al. (2005) Does organic farming benefit biodiversity? Biological Conservation 122: 113–130

in organic farming to minimise chemical use should be incorporated into the IPM toolkit used by conventional farmers.

16. The draft UK National Action Plan states that many users adopt practices that are in line with the principles of IPM. A 2009 report by the Rural Economy and Land Use Programme[18] supports the assertion that some measures are widely adopted, but also highlights a lack of uptake of a truly integrated approach making use of the full range of techniques. Effective IPM cannot be delivered by uptake of one or two techniques in isolation.

17. The RSPB calls on government to develop a clear definition of IPM that builds on the principles set out in the Sustainable Use Directive[19]; develop crop and sector-specific IPM protocols; and provide extension and outreach services to assist farmers in implementing IPM. The IPM plan currently under development represents an opportunity to achieve many of these outcomes. The plan should offer farmers a clear benchmark for their current performance, along with recommendations to improve and links to the resources available to help with this.

Hope Farm example

18. The RSPB owns and manages a 181 hectare arable farm in Cambridgeshire[20], known as Hope Farm. Our aim at Hope Farm is to develop, test and demonstrate farming techniques that produce food cost-effectively and benefit wildlife within a conventional arable system. Management of the farm is a continuous process of learning and improvement – we do not claim to have all the answers. We have taken some steps towards IPM on the farm and we intend to develop this approach further.

19. The RSPB has had significant success in increasing levels of biodiversity on the farm since we took over management in 1999. Farmland birds, the most systematically monitored group, have more than doubled in number. Our focus has been on creating sufficient habitat to support sustainable bird populations within the farmed landscape. This includes refuges for insects – margins, hedgerows, beetle banks etc – which should mitigate the negative effects of pesticides and help improve natural pest control.

20. We employ an agronomist to help us decide on the most appropriate pesticides to use, we follow best practice in terms of when and how we apply chemicals, and we minimise our

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[18] Relu policy and practice note no. 10 (2009). Overcoming Market and Technical Obstacles to Alternative Pest Management in Arable Systems. http://www.relu.ac.uk/news/policy%20and%20practice%20notes/Bailey/Bailey%20PPN10.pdf

[19] Annex III of the Directive sets out the general principles of IPM.

[20] Further information available from the RSPB website: http://www.rspb.org.uk/ourwork/farming/hopefarm/

use of pesticides as far as possible within this conventional farming system. For example some years ago we changed our variety of wheat to one that is orange blossom midge resistant, considerably reducing the likelihood of needing to spray insecticides on our wheat crops within the bird breeding season.

21. Data from Hope Farm is being used to develop a model to assess the risks that pesticides pose to skylark populations[21] (see also paragraph 9 above). Skylark is a useful indicator species of the effects of pesticides because of it is field-dwelling and therefore vulnerable to agricultural practice such as pesticide application. This makes it a key species for regulatory risk assessments but at present there is no way to fully assess the risks that pesticides pose to skylark populations.

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[21] http://cream-itn.eu/work-packages-and-projects/wp-3-vertebrates/bird-1-modelling-the-importance-oflandscape-structure-and-life-history-traits-for-the-risk-to-populations-of-skylarks-phd-university-of-reading-uk

Written Evidence submitted by Georgina Downs, UK Pesticides Campaign

Executive Summary

1.1 On the understanding[1] that the Environmental Audit Committee will be considering wider issues in its inquiry than just the impact of neonicotinoid pesticides on bees and other pollinators, then the UK Pesticides Campaign submits the following written evidence, which is primarily in relation to the exposures, risks and adverse health impacts of pesticides[2] *in general* (and not specifically neonicotinoids) on residents and the public.

1.2 A **short summary** of the UK Pesticides Campaign's written evidence is as follows:-

- All chemical pesticides are deliberately designed to be toxic, that is their purpose, and therefore all chemical pesticides have inherent hazards for human health.
- The dangers of pesticides can clearly be seen on the data sheet for each pesticide product that can carry various warnings such as *"Very toxic by inhalation," "Do not breathe spray; fumes; vapour," "Risk of serious damage to eyes," "Harmful, possible risk of irreversible effects through inhalation,"* and even *"May be fatal if inhaled."*
- It is now beyond dispute that pesticides can cause a wide range of both acute, and chronic, adverse effects on human health, including on the health of residents exposed to them. This includes irreversible and permanent chronic effects, illnesses and diseases.
- Approx. 80% of pesticides used in the UK each year are related to agricultural use.
- The majority of poisoning incidents and acute adverse health effects recorded annually in the Government's own monitoring system are from agricultural pesticides used on crops.
- The Government has **repeatedly failed to take action** when faced with, including in its own monitoring system, evidence of actual harm, as well as the risk of harm, to human health from crop-spraying under the current policy and approvals regime.
- Yet **EU law requires** that pesticides can only be authorised for use if it has been **established** that there will be ***no harmful effect* on human health**. It also **requires** a proactive approach to reviewing authorisations *after* approval, including that authorisations shall be cancelled and pesticides prohibited where there is a risk of harm.
- The Government's monitoring system currently only considers the acute effects of *individual* pesticides and therefore does not, in general, monitor or deal with either (i) chronic ill-health effects caused by pesticides or (ii) the effects of mixtures of pesticides.

[1] As indicated by the Committee Clerks of the Environmental Audit Committee.
[2] The main types of pesticides used in agriculture include insecticides, herbicides, and fungicides.

The fact that there has been, to date, no specific monitoring or collection of data in the Government's monitoring system in relation to the chronic effects, illnesses and diseases reported by people is a situation that has previously been criticized in a number of official reports dating back to 1987 and Government has *still* not changed its policy to rectify this.

- The **reality of crop spraying in the countryside** is not merely related to exposure to one individual pesticide or to one single group of pesticides, as agricultural pesticides are rarely used individually but commonly sprayed in mixtures (cocktails) – quite often a mixture will consist of 4 or 5 different products. Each product formulation in itself can contain a number of different active ingredients, as well as other chemicals, such as solvents, surfactants and co-formulants (some of which can have adverse effects in their own right, *before* considering any potential synergistic effects in a mixture(s)). Studies have shown mixtures of pesticides (and/or other chemicals) can have synergistic effects.

- Scientific papers have concluded that *"the total emissions of pesticides may range from several percent up to almost all the applied quantities"* and in relation to vapour that, "*Volatilization may represent a major dissipation pathway for pesticides applied to soils or crops, accounting for up to 90% of the application dose in some cases"*, and that *"Volatilization may last for a period of several days to a few weeks (or sometimes even longer), and sometimes exhibits a diurnal cycle"*.

- Scientific studies have found pesticides **miles** away from where they were applied and have calculated health risks for residents and communities living within those distances.

- **The existing UK Government policy and approvals system fundamentally fails to protect people in the countryside from pesticides, particularly rural residents.**

- There are serious flaws in the approach to exposure and risk assessment for public health.

- The fact that, to date, there has never been ***<u>any</u>*** assessment in the UK of the risks to health for the long term exposure for those who live in the locality of pesticide sprayed fields, and/or who go to school in the locality of sprayed fields, means that under EU law **pesticides should never have been approved for use in the first place for spraying in the locality of residents' homes, schools, children's playgrounds, among other areas.**

- Children are particularly vulnerable to the effects of pesticide exposure because their bodies cannot efficiently detoxify chemicals, as their organs are still growing and developing. Also when children are exposed at such a young age they will obviously have a longer lifetime to develop long-term chronic effects after any exposure.

- The Government previously **failed to act** on its *own findings* of 82 exceedances of the EU limits set for exposure (the AOEL), in some cases the AOEL **was exceeded up to 20 to 30 times over**, which is an *order of magnitude higher,* when **any** exceedance, on the Government's *own previously stated case,* and most importantly **under EU law**, **would lead to immediate action of authorizations being refused (or trigger prohibition/revocation if the AOEL exceedance is discovered *after* approval).**

- The Government's previous estimated exceedances of the AOEL clearly demonstrated that products have been in use in the UK which resulted in residents (and others in the countryside) being exposed to levels greatly in excess of the AOEL, year after year.

- Yet the UK Government has **not, to date, taken any action** to prevent the exposure and risk of harm for residents in these circumstances, and has violated its obligation under EU law to prohibit the use of pesticides where the AOEL is known to be exceeded.

- The UK Government has continued to refuse to introduce **<u>any</u>** statutory conditions of use to protect residents and others from exposure. Such conditions of use would include, most importantly, the prohibition of the use of pesticides in the locality of residents' homes, as well as schools, children's playgrounds, nurseries, hospitals, amongst other areas. Yet such a measure is absolutely crucial for public health protection, especially that of vulnerable groups, including babies, children, pregnant women, and those already ill.

- Therefore, in relation to the health of rural residents and communities, the UK Government has, to date, knowingly failed to act, has continued to shift the goalposts, cherry picked the science to suit the desired outcome and has misled the public, especially residents, over the safety of agricultural pesticides sprayed on crop fields throughout the country. The Government's continued line that there is no evidence of harm from pesticides, as well as no risk of harm, is just untenable and inexcusable. The evidence is there and has been there for a considerable time, the Government is just determined not to act on it. The Government's response to this issue has been of the utmost complacency, is completely irresponsible and is definitely not *"evidence-based policy-making."*

- The failings in the UK Government's policy and approach to exposure and risk assessment regarding human health, and related and repeated inaction, is also comparable to the serious concerns that have been raised regarding the UK Government's policy and approach to exposure and risk assessment in relation to other species, such as bees.

- Bees and other species, just like residents and other humans, could be exposed to innumerable *mixtures* of pesticides, repeatedly, throughout every year, and for years.

- In relation to the risk of harm to bees from pesticide mixtures, a US study in 2010 highlighted the potential synergistic effects on bee health from mixtures and combinations of different pesticides as the researchers found 121 **different** pesticides and metabolites within 887 wax, pollen, bee and associated hive samples. Therefore aside from the individual products that carry warnings of a risk to bees on the product label and safety data sheet information (such as *'harmful', 'dangerous', 'extremely dangerous' or 'high risk'* to bees), there will also be the risk of adverse impacts on bee health from the cumulative effects of multiple exposures to mixtures of different pesticides.

- The **reality of pesticide spraying in the countryside** is **<u>not</u>** reflected in any of the risk assessments under the UK Government's existing approach, whether for humans or bees.

- The principal aim of pesticide policy and regulation is supposed to be the protection of public health and the environment. Yet the Government, DEFRA, PSD (now CRD), and ACP, have all continued to base decisions in relation to pesticides on the protection of industry and business interests as opposed to what is absolutely required as the number one priority of pesticide policy and regulation **– to protect public health.**

- Sales of pesticides in the UK *alone* for 2011/12 was £627 million, and reports have put the value of the world pesticides industry at around a staggering $52 billion.

- There are clear conflicts of interests in relation to those advising DEFRA Ministers over the pesticides policy agenda, especially regarding the Chemicals Regulation Directorate (CRD) that receives approx. 60% of its funding from the agrochemical industry. This is broken down into the fees charged to companies for applications, and a charge on the UK turnover of pesticides companies. For a number of years now this has resulted in the CRD receiving around £7 million or more per year from the agro-chemical industry.

- A number of ACP members have links to the pesticides industry. For eg., some members may undertake consultancy work, have shares in and/or receive funding for research support. This has always been an inappropriate structure, as so-called *"independent"* advisors cannot possibly be classified as independent if they have financial or other links with the very industries they are overseeing in relation to the hazards to human health.

- Ministers have also been receiving advice from the Pesticides Forum for many years, and yet year after year the Forum has wrongly asserted in its annual reports that, *"the use of pesticides is **<u>not</u>** adversely impacting on the health of UK citizens or the environment."* Considering the grossly inaccurate statements that the Pesticides Forum has continued to make, effectively denying the adverse health and environmental impacts of pesticide use, then it is also of serious concern that it is intended that the Forum be responsible for the monitoring and review of the UK's Action Plan on pesticides after it has been adopted.

- The UK's policy and approvals regime is based on a wholly inappropriate structure and it goes some way to explaining why the pesticide industry has, for many years, had such control over successive Governments' policy decisions on pesticides, particularly in relation to the use of pesticides in agriculture. Successive Governments' have continued to reflect the position of the pesticides industry in **all policy decisions taken to date on pesticides**, (at least since the UK Pesticides Campaign has been in existence since 2001).

- The only real solution to **eliminate** the adverse health and environmental impacts of pesticides is to take a **preventative approach** and avoid exposure altogether with the widespread adoption of truly sustainable **non-chemical farming methods**. This would obviously be more in line with the objectives for sustainable crop production, as the reliance on complex chemicals designed to kill plants, insects or other forms of life, cannot be classified as sustainable. **Therefore it is a complete paradigm shift that is needed, as no toxic chemicals that have related risks and adverse effects for any species (whether humans, bees or other) should be used to grow food.**

1. Introduction

1.3 The UK Pesticides Campaign was founded in 2001 and is the only campaign, not only in the UK, but also across Europe, that specifically exists to highlight the risks and adverse health, environmental and financial impacts of pesticides on rural residents and communities, as well as on other members of the public exposed. I myself, as the Founder and Director of the UK Pesticides Campaign, have lived next to regularly sprayed fields for over 28 years, and I therefore have the direct experience of living in this situation.

1.4 Over the last 11 years the UK Pesticides Campaign has produced extensive written and visual materials, and has made a number of presentations across Europe, to highlight the UK Government's fundamental failure to protect public health, in particular rural residents and communities, from exposure to agricultural pesticides sprayed in the locality of residents' homes, schools, children's playgrounds, and public areas. The visual materials produced include two videos entitled *"Pesticide Exposures for People in Agricultural Areas – Part 1 Pesticides in the Air; Part 2 The Hidden Costs"* to illustrate chemical exposure and the acute and chronic adverse impacts on rural residents exposed.[3]

1.5 The work of the UK Pesticides Campaign is widely recognised both nationally and internationally,[4] and has led to a considerable number of prestigious environmental awards and nominations.[5]

1.6 The position of the many residents and members of the public that have contacted the UK Pesticides Campaign (whether by email, phone, post, or other) is always very clear, in

[3] The second video on the DVD entitled *"Pesticide Exposures for People in Agricultural Areas –Part 2 The Hidden Costs"* featured, just as an example, a few of the individuals and families from all over the country reporting acute and/or chronic adverse health effects in rural communities surrounded by sprayed fields.

[4] The work of the UK Pesticides Campaign has been featured in national and international media since 2002. Examples of national media coverage include: in the Times, Sunday Times, Financial Times, Guardian, Observer, Daily Telegraph, Sunday Telegraph, Daily Mail, Daily Express, Daily Mirror, Independent, Independent on Sunday, Metro; as well as on a number of BBC TV and radio programmes (including BBC News, Politics Show, Countryfile, The Food Police, Radio 4's: Today programme, Woman's Hour, You and Yours, PM, The World at One, Costing the Earth; BBC World Service, BBC Radio 5 Live); ITV and Channel 4 programmes (including ITV News, Channel 4 News,); and on Sky News. In relation to international media coverage, articles that have featured the work of the UK Pesticides Campaign have appeared in, amongst others, the US (including CNN), Canada, Australia, New Zealand, France, Germany, Portugal, India, and The Beijing News in China. In addition a diverse range of magazines have also featured the work of the campaign including: Cosmopolitan, Marie Clare, Grazia, Red, Vogue, Ecologist, Resurgence, Lifescape, Private Eye, Science in Parliament, Country Living, The Big Issue, New Consumer, Easy Living, Ethical Living, Spirit and Destiny, Landworker, Positive Health, amongst others. The work of the campaign has also been featured in a number of books including "*The Vitamin Murders*" by James Fergusson; "*Scared to Death*" by Christopher Booker/Richard North; "*Toxic Airlines*" by Tristan Loraine; "*People Power*" by Jon Robins and Paul Stookes.

[5] A list of awards and nominations can be seen at Wikipedia at:- http://en.wikipedia.org/wiki/Georgina_Downs

that they are fully supportive of, and sign up to, the aims and objectives of the campaign, (and are often very pleased to discover that there is a campaign specifically representing and fighting on residents' behalf). The emails the campaign has received, often detail the individual's own acute and/or chronic adverse health effects (or that of a family member(s) or other(s), or on their domesticated animals/pets etc.) as a result of exposure to agricultural pesticides from crop spraying in their locality. It is important to stress that the UK Pesticides Campaign does not just receive reports from residents, but also from farmers, operators, ex-farm managers and other workers exposed to pesticides. The UK Pesticides Campaign also receives reports from people who are exposed and suffer acute and/or chronic adverse effects from other pesticide sources, (eg. such as amenity use) **however, agricultural exposure does make up the majority of the cases reported.**

1.7 The UK Pesticides Campaign has continued to campaign for the introduction of the following necessary **mandatory measures** for the protection of residents from pesticides:

- The **prohibition of pesticide use** in the locality of residents' homes, schools, children's playgrounds, hospitals, nurseries, and other buildings where people may be situated. Considering the distances that pesticides have been shown to travel then the distance where the use of pesticides is prohibited needs to be **substantial**.
- A new legal obligation to give rural residents **at least 48 hours' prior notification** before any pesticide spraying in their locality, including notification of the chemicals to be used.
- A new legal obligation for farmers and other pesticide users to provide information on the pesticides they use **directly** to residents (as third party access is inadequate, especially in the event of an acute poisoning when getting that information immediately is critical).

1.8 The UK Pesticides Campaign has continued to argue that the only real solution to eliminate the adverse health and environmental impacts of pesticides is through the widespread adoption of **non-chemical farming methods**. This would be more in line with the objectives for sustainable crop production, as the reliance on complex chemicals designed to kill plants, insects or other forms of life, cannot be classified as sustainable.

2. Adverse impacts of pesticides on human health

2.1 **All** chemical pesticides are deliberately designed to be toxic, that is their purpose, and **therefore all chemical pesticides have inherent hazards for human health.**

2.2 The dangers of pesticides can clearly be seen on the safety data sheet for each pesticide product that can carry various warnings such as *"Very toxic by inhalation," "Do not* *breathe spray; fumes; vapour," "Risk of serious damage to eyes," "Harmful, possible risk of irreversible effects through inhalation,"* and even *"**May be fatal if inhaled.**"*

2.3 It is now beyond dispute that pesticides **<u>can cause</u>** a wide range of both acute, and chronic, adverse effects on human health. This includes irreversible and permanent chronic effects, illnesses and diseases. The European Commission (EC) clearly acknowledged when publishing the proposals for the new EU pesticides legislation (in July 2006) that pesticides can cause various adverse effects on human health, including on the health of rural residents who are exposed to them. For example, in the European Commission's July 2006 document entitled *"Questions and answers on the pesticides strategy"* [6] under the heading *"How do pesticides affect human health?"* the EC stated:

"Direct contact with the pesticide itself may occur during the time of application of the chemical but indirect exposure is the most common form of contamination. Residents and bystanders can be indirectly exposed to pesticides via spray drift. .. The effects of indirect exposure can be worse for especially vulnerable population groups such as children, the elderly or other particular risk groups (chronically sick people for instance).

Long term exposure to pesticides <u>can lead to</u> serious disturbances to the immune system, sexual disorders, cancers, sterility, birth defects, damage to the nervous system and genetic damage."

2.4 In the EC's July 2006 *"Impact Assessment of the Thematic Strategy on the Sustainable Use of Pesticides,"* that accompanied the proposal for a new Use Directive, the EC stated[7]

*"**Acute impairment of health** - Short-time exposure to pesticides **<u>can cause severe acute health effects</u>**, including diarrhoea, nausea, vomiting, abdominal pain, profuse sweating, salivation, blurred vision, irritation of skin **<u>and death</u>** are examples that have been reported in various publications.*

***Chronic impairment of health** - Chronic health impairment results from a low but constant level and has a long-term character. Major incidents, in particular clear correlations between exposure and chronic effects, are not often recognised immediately since no obvious symptoms of poisoning exist.*

*There are various sources for continuous exposure, like the consumption of polluted water, pesticide residues in food, regular application of PPP over many years, **<u>or residential proximity to it and consequently direct exposure via air</u>**. **People regularly or repeatedly exposed to or working with pesticides, may have a higher risk of incidence of cancer or other chronic***

[6] Source: *"Questions and answers on the pesticides strategy"* published on 12th July 2006 and available at:- http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/06/278&format=HTML&aged=0&language=EN&guiLanguage=en
[7] Source: Page 23 of the *"Impact Assessment of the Thematic Strategy on the Sustainable Use of Pesticides"* published on 12th July 2006 and available at:- http://ec.europa.eu/environment/ppps/pdf/sec_2006_0894.pdf

diseases, birth defects, cancer in offspring, stillbirths and reproductive problems, skin rashes and disorders, disturbed enzyme and nervous system.”

2.5 The EC’s July 2006 *“Impact Assessment of the Thematic Strategy on the Sustainable Use of Pesticides,”* that accompanied the proposal for a new Use Directive, went on to state: [8]

*“Under real life conditions, **acute and chronic adverse effects associated with exposure to the common classes of pesticides** can vary a lot for a given substance or substance class. Conversely, different substances or substance classes **can cause** similar symptoms. For example, the following have been reported for certain classes of insecticides:*

- *ORGANOPHOSPHATES **can cause** headaches, pain, weakness, numbness in extremities, dizziness, damage to memory, mood control, chest tightness, loss of coordination, uncontrolled urination, seizures, death due to respiratory failure;*
- *CARBAMATES **can cause** headaches, genetic mutations, vomiting, birth defects, dizziness, reduced fertility, seizures, kidney damage, shortness of breath, nervous system damage;*
- *PYRETHRINS and PYRETHROIDS **can cause** lack of coordination, deep lung allergy, convulsions, pneumonia, muscle paralysis, vomiting, asthma and death due to respiratory failure.”*

2.6 These are just some of the acute and chronic adverse health effects that can result from exposure to a given substance or substance class. Residents can of course be exposed (unknowingly) to **all** these classes of pesticides, along with other classes, (as well as to innumerable *mixtures* of these and other classes), repeatedly, throughout every year, and in many cases, like my own situation, for decades, and currently under the UK policy and approach residents have **absolutely no protection at all** from the risks and related acute and chronic adverse health impacts. (See further paras 3.1 – 3.37 in the following section)

2.7 The EC Impact Assessment document goes on to again highlight the position of other vulnerable groups where any health risks may be increased, as it states[9]:

“Effects could be amplified for especially sensitive population groups, such as children (due to specific physiological and developmental factors), the elderly (due to their possibly compromised metabolic capacity), or other particular risk groups (immunologically compromised people, chronically sick, etc.)”

2.8 In addition to the European Commission statements, Cornell University’s teaching module *“Toxicity of Pesticides”* [10] clearly states that,

[8] Ibid.
[9] Ibid.

"Pesticides can: cause deformities in unborn offspring (teratogenic effects), cause cancer (carcinogenic effects), cause mutations (mutagenic effects), poison the nervous system (neurotoxicity), or block the natural defenses of the immune system (immunotoxicity)." [11]

"Irreversible effects are permanent and cannot be changed once they have occurred. Injury to the nervous system is usually irreversible since its cells cannot divide and be replaced. Irreversible effects include birth defects, mutations, and cancer." [12]

2.9 There has been a significant increase in recent years of a number of these chronic health conditions. For example, according to cancer statistics, an estimated 12.7 million new cancer cases and 7.6 million deaths occurred worldwide in 2008.[13] There are around 309,500 new cases of cancer (excluding non-melanoma skin cancer) diagnosed each year in the UK alone, and more than 1 in 3 people will develop some form of cancer during their lifetime.[14] In 2009, there were more than 156,000 cancer deaths in the UK, and over one in four (28%) of all deaths in the UK were due to cancer.[15]

2.10 As recognised by the European Commission, pesticides can damage the brain and central nervous system of humans. This is not surprising considering that many pesticides are neurotoxic. Parkinson's Disease is a neurological disorder that has been repeatedly linked to pesticide exposure in numerous international studies. One reputable study published in March 2009 found that exposure to just two pesticides within 500 metres of residents' homes increased the risk of Parkinson's Disease by **75%.**[16] According to statistics from Parkinson's UK, 127,000 people live with Parkinson's in the UK, or 1 in 500 people.[17] One in 20 people who get Parkinson's is under 40 years of age.[18] There is currently no cure for Parkinson's.[19]

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[10] Cornell University's teaching module *"Toxicity of Pesticides"* can be seen at:- http://psep.cce.cornell.edu/Tutorials/core-tutorial/module04/index.aspx

[11] To see this quote in Cornell University's teaching module *"Toxicity of Pesticides"* click on *"Check Answer"* to the study question at:- http://psep.cce.cornell.edu/Tutorials/core-tutorial/xml/CoreTest.aspx?Q=4-19

[12] This quote can be seen in Cornell University's teaching module *"Toxicity of Pesticides"* at:- http://psep.cce.cornell.edu/Tutorials/core-tutorial/module04/index.aspx

[13] Source: Worldwide cancer statistics from GLOBOCAN 2008 published in June 2010, which can be seen at:- http://info.cancerresearchuk.org/cancerstats/world/index.htm

[14] UK statistics from Cancer Research UK published December 2011, which can be seen on the first page at: http://info.cancerresearchuk.org/prod_consump/groups/cr_common/@nre/@sta/documents/generalcontent/018070.pdf

[15] UK statistics from Cancer Research UK published December 2011, which can be seen on the 2nd page at: http://info.cancerresearchuk.org/prod_consump/groups/cr_common/@nre/@sta/documents/generalcontent/018070.pdf

[16] *"Parkinson's Disease and Residential Exposure to Maneb and Paraquat From Agricultural Applications in the Central Valley of California,"* by Sadie Costello, Myles Cockburn, Jeff Bronstein, Xinbo Zhang, Beate Ritz.

[17] Source: Parkinson's statistics taken from the Parkinson's UK website at:- http://www.parkinsons.org.uk/about_parkinsons/what_is_parkinsons.aspx

2.11 The cost to the UK economy of just a few of the chronic health conditions that pesticides can cause is massive. In the UK alone, in 2008, cancer cost £5.13 billion in terms of NHS costs alone, and the total costs to society in England was estimated to be a staggering £18.33 billion, with these costs predicted to increase to £24.72 billion by 2020[20]. It has been calculated that Parkinson's Disease costs the NHS £384 million per year with 78% of these costs being taken up by hospitalisations,[21] and the total cost in the UK of the disease is estimated to be between £449 million and £3.3 billion annually, depending on the cost model and prevalence rate used[22].

2.12 **Although there are a number of different causes for these chronic conditions, even if pesticides are only causing a proportion, the costs would still be enormous, particularly when added up with all the health costs of other related conditions, along with all the environmental costs.** For example, the cost of removing pesticides from drinking water *alone* is estimated to be approx. £140 million per year.[23] It has been estimated to cost approx. a further £4.75 million to monitor pesticides at 2500 surface and groundwater sites.[24] It costs £2 million a year to check for pesticide residues in food[25] and an estimated £5.4 million for pesticide monitoring in both food and livestock together.[26] [27]

2.13 It is therefore clear that chemical farming has enormous external costs in the UK every year. Obviously it goes without saying that the personal and human costs to those suffering chronic diseases and damage cannot be calculated in financial terms. The significance of these consequences requires the adoption of a **preventative approach** to

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[18] Ibid.
[19] Ibid.
[20] Source: Policy Exchange, Research Note, Feb. 2010, entitled *"The cost of cancer,"* page 1, which can be seen at:-http://www.policyexchange.org.uk/images/publications/the%20cost%20of%20cancer%20-%20feb%2010.pdf
[21] Source: Parkinson's statistics taken from the Parkinson's UK website in September 2010 in a section entitled *"The cost of Parkinson's to the NHS."* The website has been rejigged recently and the link for that page no longer works. However, the costs statistics were on there in September 2010 as I cited them in an article I wrote for the Ecologist published on 22nd October 2010 at:- http://www.theecologist.org/blogs_and_comments/commentators/other_comments/649883/the_pesticides_scandal_government_inaction_is_destroying_lives.html
[22] Source: *"The economic impact of Parkinson's disease"* by Leslie J Findley, published in September 2007. Abstract can be seen at:- http://www.prd-journal.com/article/S1353-8020(07)00105-8/abstract
[23] Source: Jules Pretty, Professor of Environment and Society in the Department of Biological Sciences at the University of Essex.
[24] Source: *"An assessment of the total external costs of UK agriculture,"* Prof Jules Pretty *et al*, August 2000.
[25] Source: Pesticide Residues Committee (PRC) secretariat, pers comm, September 2010.
[26] Source: *"An assessment of the total external costs of UK agriculture,"* by Prof Jules Pretty *et al*, August 2000
[27] These few examples given of some of the environmental costs are just in relation to the UK *alone* and before considering the equivalent costs across Europe.

make sure that the protection of human health ***is*** (which it currently is not, see further below) the overriding priority of the UK Government's pesticides policy and regulations.

2.14 Although UK citizens can be exposed to pesticides from a variety of agricultural and non-agricultural sources (including agricultural and horticultural uses; forestry; uses in the home and garden; and amenity uses) **the agricultural sector is the largest sector, as approximately 80% of pesticides used in the UK each year are related to agricultural use**[28] (and which is predominantly related to **ground spraying**, as there is only *limited* aerial spraying that still takes place in the UK). Therefore it is not surprising that the majority of poisoning incidents and acute adverse health effects that are recorded annually in the UK Government's own monitoring system are from agricultural pesticides that are used in crop spraying.[29] Further, it is also important to stress that the majority of these poisoning incidents and acute adverse health effects as a result of crop-spraying, are for **residents**, rather than operators, which is again not surprising considering operators generally have protection and residents do not.

2.15 For example, the acute adverse health effects recorded in the Government's own monitoring system[30] include, amongst other adverse health effects, the following:

- Chemical burns (including to the eyes and skin);
- Skin and eye irritancy (eg. itching, stinging, burning sensations, rashes and blistering);
- Throat irritation (eg. sore and painful throats); damaged vocal chords;
- Sinus pain; respiratory irritation; difficulty swallowing and chest discomfort; coughing; breathing problems; shortness of breath and asthma attacks;
- Headaches; dizziness; nausea; vomiting; stomach pains; flu-type illnesses; aching joints.

2.16 It is important to stress the fact that the Government's monitoring system currently only considers the acute effects of *individual* pesticides and therefore does not, in general, monitor or deal with either (i) chronic ill-health effects caused by pesticides or (ii) the

[28] Agricultural and horticultural uses account for approx. 80 per cent of the amount of pesticides used per year in the UK. Garden, home, forestry and amenity uses account for the balance per year in the UK. (NB. Amenity use only accounts for a mere 4% of pesticide use in the UK per year).
[29] For example, the Pesticide Incidents ("PI") Reports, and the Field Operations Directorate ("FOD") Reports. For further information on these reports, and the Government's monitoring system in general, see paragraphs 72 to 118 of the second Witness Statement produced for the legal case *Georgina Downs v DEFRA*, available on the UK Pesticides Campaign website at:- http://www.pesticidescampaign.co.uk/documents/Downs%202.pdf
[30] Ibid.

effects of mixtures of pesticides. The fact that there has been, to date, no specific monitoring or collection of data in the Government's monitoring system in relation to the chronic effects, illnesses and diseases reported by people is a situation that has previously been criticized in a number of official reports[31] dating back to 1987 (which is now 25 years ago) and the Government has *still* not changed its policy to rectify this situation.

2.17 For the last 11 years the UK Pesticides Campaign has collected reports of both acute adverse health effects, as well as chronic long-term effects, illnesses and diseases, in rural communities where residents live in the locality of pesticide sprayed fields. The **acute effects** reported are the same types of acute effects recorded in the Government's very own monitoring system and include, sore throats, burning eyes, nose, skin, blisters, headaches, dizziness, nausea, stomach pains, burnt vocal chords and flu-type illnesses, amongst other things. The most common **chronic long-term illnesses and diseases** reported include various cancers, (especially breast cancer among rural women, as well as cancers of the prostate, stomach, bowel, brain, and skin), leukaemia, non-Hodgkins lymphoma, neurological conditions, (including Parkinson's disease, Multiple Sclerosis (MS) and Myalgic Encephalomyelitis (ME)), asthma, allergies, along with many other medical conditions. It is important to stress that there are a number of cases where the individuals involved **do have** confirmation from either their doctor (or other medical professional) that the acute and/or chronic effects **are caused** by pesticides. The reports cover all different age groups from the very young (including babies and young children) to the elderly. It is important to note that reports of this nature have gone on for decades.

2.18 **The UK Government has repeatedly failed to take action when faced with, including in its own monitoring system, evidence of actual harm, as well as the risk of harm, to human health caused by crop-spraying with pesticides under the current policy and approvals regime. Yet EU legislation requires that pesticides can only be authorised for use if it has been established that there will be *no immediate or delayed harmful effect* on human health.**[32] **It also requires a proactive approach to reviewing authorisations *after* approval, including that authorisations shall be cancelled and pesticides prohibited where there is a risk of harm to human health**.

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[31] UK Agriculture Committee of the House of Commons, *The Effects of Pesticides on Human Health*, Second Special Report, Session 1986-87, London: HMSO 1987; the British Medical Association report, *The BMA Guide to Pesticides, Chemicals and Health,* BMA (Edward Arnold) 1990, 1992; the Royal Commission on Environmental Pollution 2005 report, *Crop Spraying and the Health of Residents and Bystanders.*

[32] Article 4(3)(b) and Article 4(2)(a) of the European Regulation 1107/2009 which can be seen at:- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0001:01:EN:HTML

2.19 It is important to stress the fact that the principal aim of any domestic pesticide policy, under then EU Directive 91/414/EEC, and now the new EU Regulation 1107/2009, [33] is based on the **risk of harm**, and ***not* that harm has to have already occurred**. Therefore as I have continued to argue both throughout my campaign, and the legal case proceedings, under EU legislation the UK Government is **not** supposed to be exposing residents (and others) to the ***risk* of harm** (whether it be acute or chronic adverse health effects) from exposure to pesticides. This was rightly recognized by Collins J in the High Court Judgment (eg. see the final sentence of paragraph 23 of the High Court Judgment)[34]

3. Failings of the current UK policy to protect residents (and the public) from pesticides

3.1 The existing UK Government policy and approvals system **fundamentally fails** to protect public health from pesticides, particularly in relation to rural residents and communities. Considering that the full policy failings are so extensive then, in addition to the summarised failings set out in the section above regarding the Government's repeated failure to take action when faced with, including in its own monitoring system, evidence of actual harm, as well as the risk of harm, to human health caused by crop-spraying, I will again only be able to summarise below the key points regarding the failings of the UK approach to exposure and risk assessment for human health. However, I can always provide further documentation if members of the Environmental Audit Committee want to see the **full detailed factual evidence** relating to the UK Government's policy failings regarding human health, and which is on the UK Pesticides Campaign website at:- http://www.pesticidescampaign.co.uk/witnessStatement_1.htm in particular the **second** Witness Statement that I produced for the legal case *Georgina Downs v DEFRA*.

3.2 It is important to note that, as will be seen from what is set out below, the failings in the Government's approach to exposure and risk assessment regarding **human health** is also comparable to the serious concerns that have been raised regarding the Government's approach to exposure and risk assessment in relation to other species, such as bees.

[33] Available at:- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0001:01:EN:HTML
[34] http://www.bailii.org/cgi-bin/markup.cgi?doc=/ew/cases/EWHC/Admin/2008/2666.html&query=title+(+downs+)&method=boolean%20%3Chttp://www.bailii.org/cgi-bin/markup.cgi?doc=/ew/cases/EWHC/Admin/2008/2666.html&query=title+(+downs+)&method=boolean%3E

3.3 As said above, European legislation regarding the authorisation of pesticides (formerly EU Directive 91/414 and now EU Regulation 1107/2009[35]) **requires** that ***before*** pesticides can be approved for use, risk assessments **must** be undertaken **to establish** that there will be **no harmful effect** on human health. This must apply to **all** the necessary exposure groups, including operators, workers, **residents** living in the locality of pesticide sprayed fields, as well as other members of the public exposed (eg. such as bystanders).

3.4 In early 2001, I identified serious flaws in the Government's current policy and approvals system for protecting residents (and other members of the public) from pesticides and as a result I started to present a case to the Government (which was also highlighted to the EU). This case was in relation to both the serious flaws within the current UK exposure and risk assessment for *bystanders*, and the fact that, to date, **there has been no exposure and risk assessment for a residents specific exposure scenario** (as residents have a completely different exposure scenario to a mere *bystander* and therefore residents and bystanders are two separate exposure groups). The case presented also included the serious inadequacies in the UK monitoring system. *(For further information regarding the serious inadequacies in the UK monitoring system see paragraphs 64 to 152 of the second Witness Statement produced for the legal case).* The campaign I launched in early 2001, the UK Pesticides Campaign, has been calling for urgent changes to pesticides policies ever since to address the lack of **any** protection for residents that currently exists.

3.5 The risk assessment failings are important for me to briefly detail considering that the adverse health impacts that are reported by residents in the UK will be **as a direct result** of the flaws in the UK's approach to exposure and risk assessment for human health.

3.6 Therefore I have briefly detailed below at paras 3.7 to 3.37 some of the key points contained within the critical second Witness Statement that I produced for the legal case *Georgina Downs v DEFRA* regarding the current exposure and risk assessment failings, and which importantly, are based on the UK Government's **very own documents, findings and statements**. The second Witness Statement is available to see in full on the campaign website at:- http://www.pesticidescampaign.co.uk/documents/Downs%202.pdf

3.7 To date, the UK Government's only assessment of the exposure and risks of humans other than workers and operators is based on the *predictive* model of a *bystander* which

[35] Available at:- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0001:01:EN:HTML

assumes that there will only be occasional short-term exposure of transient *bystanders*. The *bystander* model estimates *"maximum daily exposure"* as equal to **five minutes'** exposure (or even less, as a previous paper by the Government regulators, the Pesticides Safety Directorate (PSD) now changed to the Chemicals Regulation Directorate (CRD))[36] in fact shows calculations based on just **one minute** exposure)[37], to the spray cloud at the time of the application only, **from a single pass of a sprayer**, **at eight metres** from the spray boom and based on exposure **to only one individual pesticide at any time**. The Government asserts that it then assumes this level of daily exposure (that is, exposure for five minutes (or less)) to occur once a day over a period of 30 days or at most 3 months.

3.8 My case has always been from the outset that it is impossible to justify taking this short-term *bystander* model (to spray drift (droplets) only, from a single pass of the sprayer, and via inhalation and dermal absorption only) in order to address the position of **residents** who are repeatedly exposed to mixtures (often referred to as *cocktails*) of pesticides from a multitude of exposure factors (see para 3.9 below) and via all exposure routes (ie. oral, dermal and inhalation, as well as via the eyes), throughout every year, and in many cases, like my own situation, for decades. Residents are therefore **not** the same as transient *bystanders*. In the words of a representative of a UK interdepartmental group[38]:

"..it's only when we bring together the information about the hazard (about whether the chemical is toxic and in what way it is toxic), its only when we bring that together with the exposure (the route of exposure, the frequency of exposure, the amount of exposure and the duration of exposure) that we can hope to assess what the risk to the health of the individual is."

3.9 The UK Government's transient *bystander* exposure assessment (exposure of an adult with 60kg bodyweight) for five minutes (or less), to spray drift *only* at the time of application, from a single pass of a sprayer, at eight metres, via dermal and inhalation routes only, and to just one pesticide only, rather than to a mixture) **fails entirely** to address the chronic, long-term, repeated and cumulative exposure of residents. As set out in meticulous detail at para 56 of the second Witness Statement produced for the legal case, the Government's current *bystander* risk assessment model **excludes** the following altogether (and which would **all** be relevant for the exposure scenario of **residents**):

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[36] But referred to in these comments in some places as the Pesticides Safety Directorate (PSD), as that was the name of the regulators at the time the Witness Statement that is referred to in these comments was produced.
[37] See paragraphs 7 and 8(a) of the second Witness Statement.
[38] Statement by a representative of the Interdepartmental Group on the Health Risk of Chemicals (IGHRC) at the UK Advisory Committee on Pesticides open meeting held on 10th July 2002.

(a) exposure at less than eight metres from the sprayer[39];

(b) inhalation and dermal exposure outside the five minute (or one minute) time frame[40];

(c) any exposure from subsequent passes of the sprayer: for example, the UK Government knows that dermal exposure will be increased threefold by subsequent passes of the sprayer, yet ignores this increase in its bystander exposure model[41];

(d) any exposure through oral ingestion and via the eyes[42];

(e) long-term exposure to pesticide particles, droplets and vapours in the air in the hours, days, weeks and months after application(s): see para 56(c) of the second Witness Statement. Also the paper by Bedos *et al*, entitled *"Occurrence of pesticides in the atmosphere in France,"* (referred to in the High Court Judgment at paragraph 33) states, *"Pesticides are present in the atmosphere in 3 forms: in liquid and solid phases – as aerosol particles or adsorbed on pre-existing aerosols, or incorporated in fog or rain droplets – or in gaseous phase"* and that, *"These three processes result in highly variable amounts of pesticides contaminating the atmosphere during the days or weeks following pesticide application. The total emissions of pesticides may range from several percent **up to almost all the applied quantities**."* In relation to vapour, the paper by Bedos *et al*, entitled "*Mass transfer of pesticides into the atmosphere by volatilisation from soils and plants: overview"*, Agronomie 22 (2002) 21-33, concluded that, "*Volatilization may represent a major dissipation pathway for pesticides applied to soils or crops, **accounting for up to 90% of the application dose in some cases**"*, and that "***Volatilization may last for a period of several days to a few weeks (or sometimes even longer), and sometimes exhibits a diurnal cycle***";

(f) exposure to pesticides in pollen, dust (including, but not limited to, harvest dust) and soil[43];

(g) exposure to pesticides transported from outdoor applications and redistributed into an indoor air environment: see paragraph 56(d) of the second Witness Statement. Also, see Lu *et al*, "*Pesticide exposure of children in an agricultural community: evidence of household proximity to farmland and take home exposure pathways"*;

[39] See paragraph 56(b) of the second Witness Statement.
[40] See paragraph 56(c) of the second Witness Statement.
[41] See paragraph 56(a) of the second Witness Statement.
[42] See paragraph 56(a) of the second Witness Statement.
[43] See paragraph 56(d) of the second Witness Statement.

(h) exposure to pesticides in precipitation and via reactivation[44];

(i) exposure to pesticides from long-range transportation: studies have shown pesticides found **miles** away from where they were originally applied, eg. a reputable study in California found pesticides located up to **3 miles away** from the treated areas, and calculated health risks for residents and communities living within those distances[45];

(j) exposures to mixtures of pesticides (and other chemicals that may be in the formulation(s)) and any potential synergistic effects[46]: agricultural pesticides are rarely used individually, but are commonly sprayed in mixtures (cocktails) – quite often a mixture will consist of 4 or 5 different products mixed together. Each product formulation in itself can contain a number of different active ingredients, as well as other chemicals, such as solvents, surfactants and other co-formulants (some of which can have adverse effects in their own right, even before considering any potential synergistic effects in a mixture(s)). The existing *bystander* model does not factor in the additional exposures which someone will receive if exposed to a mixture of pesticides at the same time. Various studies have shown that mixtures of pesticides (and/or other chemicals) can have synergistic effects[47]. Further, as highlighted earlier at paragraph 2.10, the study published in March 2009 entitled, *"Parkinson's Disease and Residential Exposure to Maneb and Paraquat From Agricultural Applications in the Central Valley of California,"* by Sadie Costello, Myles Cockburn, Jeff Bronstein, Xinbo Zhang, and Beate Ritz, **found exposure to just two pesticides within 500 metres of residents' homes increased Parkinson's Disease risk by 75%**;

(k) exposures due to previous or subsequent spraying events (on the same or different days), and cumulative effects[48]: I often receive reports from residents where their houses are surrounded on 3 or even on all 4 sides by sprayed fields, all of which may be sprayed on any given day, (whether it be the same day or on subsequent days), repeatedly, throughout every year. Therefore if a resident is surrounded on all sides by crop fields and is subjected to repeated exposures from all sides then this increases the

[44] See paragraph 56(e) of the second Witness Statement.
[45] Lee *et al*, *"Community Exposures to Airborne Agricultural Pesticides in California: Ranking of Inhalation Risks"* (2002). See paragraph 56(f) of the second Witness Statement.
[46] See paragraph 56(g) of the second Witness Statement.
[47] For example, a study published in "*Toxicology*," in January 2002 entitled, *"Interactions between pesticides and components of pesticide formulations in an in vitro neurotoxicity test,"* by J.C. Axelrad, C.V. Howard, W.G. McLean. See further paragraph 56(g) of the second Witness Statement.
[48] See paragraph 56(h) of the second Witness Statement.

exposure *even further*. Therefore again this scenario is the **reality** for residents living near sprayed fields, particularly those surrounded by sprayed fields on all sides;

(l) any exposure of babies and children: the current "*bystander*" model assumes a body weight of an adult weighing 60kg,which does not cover those of a lower bodyweight, eg. the bodyweight of a new-born baby (that could be present in a home or garden in the locality of pesticide sprayed fields) might be something like one-twentieth of this amount at 3kg (and have a higher breathing rate and smaller airways) and so can have very significantly higher total exposure per kg bodyweight per day than that of adults, or even toddlers. Babies may spend significant amounts of time out of doors, in prams or (for older babies) playing on the ground in gardens. The evidence in the second Witness Statement showed that again, astonishingly, to date, the UK Government has not made *any* exposure estimates for babies. (See 56(i)(k) of 2nd Witness Statement);

(m) exposure of other vulnerable groups including pregnant women, the elderly, those who are already ill or disabled, and those taking medication (and where any interactions or synergistic effects between pesticides and the medication must be taken into account)[49];

(n) multiple exposure scenarios[50]: where one individual's exposure takes place not only at home but also elsewhere – eg. at school, playground, office, or other buildings situated in the locality of pesticide sprayed fields. These are all **realistic** long-term multiple exposure scenarios that **have not been accounted for** in the UK Government's existing approach, which is again astonishing. It is not uncommon for a child to live near sprayed fields ***and*** attend school near sprayed fields as well, which obviously increases the level of exposure to an even higher level. Children are particularly vulnerable to the effects of pesticide exposure because their bodies cannot efficiently detoxify chemicals, as their organs are still growing and developing. Also when children are exposed at such a young age they will obviously have a longer lifetime to develop long-term chronic effects after any exposure.

3.10 In January and July 2003, an official from the PSD (now CRD) prepared two papers (that were submitted for the consideration of the UK Advisory Committee on Pesticides (ACP) at the January and July 2003 ACP meetings), that considered a *limited* number of additional exposure estimates other than that already relied upon (that is, the five minutes,

[49] See paragraph 56(j) of the second Witness Statement.
[50] See paragraph 56(k) of the second Witness Statement.

at eight metres, spraydrift only *bystander* model etc.) It should also be noted though that the PSD's additional exposure estimates were for just a *limited* number of pesticides only, and **not** for ***all*** the pesticides authorized for use in the UK at that time (and nor has this been done subsequently). See for example paragraph 18 of the second Witness Statement.

3.11 **My second Witness Statement contained a detailed analysis (prepared specifically for the purposes of the UK legal proceedings) of the UK Government's very own figures and findings and showed how the PSD papers themselves flatly contradicted the UK Government's assertion that its existing *bystander* model protects residents.** For the detailed analysis of the January and July 2003 PSD papers, see paras 12 to 36 of the second Witness Statement. The following are some key points.

The January 2003 PSD paper:

3.12 Exposure at less than eight metres: dermal exposure at one metre from the sprayer was found to be up to about eight times that expected at eight metres under the current model, and airborne levels were found to be similarly increased. PSD clearly acknowledged that those "*closer to the sprayer bystanders may experience higher exposures than currently predicted.*" Yet despite this, the UK Government did not modify its bystander exposure assessment to take this higher exposure into account. (See paragraph 14 of the second Witness Statement).

3.13 24-hour air exposure (inhalation only): both German and Californian data on 24-hour air levels that were considered in the January PSD paper (and which was to vapour *only* and excluded exposure to any droplets and particles in that time-frame) produced estimated 24 hour exposures in excess of the Government's current estimated systemic exposure (from exposure to spraydrift (droplets) *only* (ie. excluding any exposure to vapour and particles) at eight metres for five minutes). But again, no change was made to the UK exposure and risk assessment approach. (See para 15 of 2nd Witness Statement).

3.14 Harvest dust (inhalation only): estimates in the PSD paper of exposure by inhalation of harvest dust showed that in just six and a half minutes of breathing such dust, a person would experience exposure equal to the UK Government's current *maximum daily exposure* estimate (on the five minutes (or less) at eight metres model). Someone breathing such dust for one hour would suffer exposure almost ***ten times*** that of the *maximum daily exposure* in the current bystander model. Yet the UK Government again did not alter its exposure model; nor did it ever give any further consideration to this specific exposure factor subsequently. (See paras 16 and 56(d) of 2nd Witness Statement).

3.15 The only suggested justification given in the Jan. 2003 PSD paper for the failure to protect people in relation to harvest dust is that *"bystanders are not likely to experience dust concentrations as high as this nor are they expected, due to the general nuisance of high dust concentrations, to be exposed for long"*. Three points should be noted about this

(a) The justification put forward is not scientific in nature. Rather, it is a mere assertion about whether the assessed exposure scenario is or is not realistic.

(b) As to that assertion, while it may be that a transient bystander will, given the choice, limit his or her exposure to harvest dust, the same cannot be said of <u>residents</u>, who have no choice. For example, a resident living close to wheat fields which are harvested year after year may experience, as my family and I have experienced, high levels of harvest dust going over their whole property and land (as shown in my first video on the DVD that I produced to highlight pesticide exposure for rural residents).

(c) Despite this, and despite the results in the PSD paper, once again, no adjustment has been made to the current UK assessment in order to include in the exposure calculations exposure to pesticides in harvest dust, let alone in other sources, such as <u>pesticides in pollen and topsoil carried by the wind</u>, (eg. when it is eroded by, and then carried by, the wind). The UK Government has not even considered these additional potential exposure factors, let alone estimate what that exposure may be for residents (or even bystanders) in the locality. See paragraph 56(d) of the second Witness Statement. Also see Bedos et al, *Occurrence of pesticides in the atmosphere in France*, section 1, Introduction: "..*due to the wind erosion process, wind can remove soil particles with pesticide molecules fixed on them from the soil surface.*"

3.16 <u>Exposure of children following drift into gardens</u>: the January 2003 PSD paper estimated the systemic absorption (from dermal and oral exposure (excluding inhalation)) of a toddler (weighing 14.5kg) playing for two hours on surfaces adjacent to sprayed fields to be about **<u>sixty-nine times higher</u>** than the estimated systemic exposure using the current bystander assessment model (ie. from exposure to spraydrift for 5 minutes (or less) from the single pass of the sprayer at 8 metres). But once again, despite this significant finding, of toddlers exposure from playing on surfaces adjacent to sprayed fields over just that *limited* two hour period *only* (and for oral and dermal absorption only, not inhalation) the UK Government did not, at that time, make any change to its exposure and risk assessment approach. (See paragraph 17 of the second Witness Statement).

The July 2003 PSD paper:

3.17 **Exposure at one metre**: the July 2003 PSD paper (despite unwarrantedly discounting potential inhalation exposure[51]) showed estimates of exposure for someone at one metre from the sprayer which **exceeded the EU limits set for exposure, the so called Acceptable Operator Exposure Level (AOEL),** sometimes by **many times over at an *order of magnitude* higher**: for example, exceedances of up to twenty-two times above the AOEL at one metre for trifluralin[52] (in Hawk); and in relation to orchard spraying of Dithianon (in Dithianon Flowable) exposure at eight metres (ie. under the current UK bystander exposure assessment) exceeded the AOEL up to thirty-one and a half times over. (See paragraph 20 examples (a) to (j) of the second Witness Statement).

3.18 Yet again, despite this very significant finding, the Government did not modify its exposure and risk assessment approach, apparently on the unsupportable assumption in the July 2003 PSD paper that people were *"unlikely to stand much closer than 8 metres,"* (and also that *"any person closer would be more likely to have some involvement in the pesticide application, and therefore be wearing at least overalls."*) [53] It is to be noted that again, that was a purported justification based not on science but upon an unsupported assertion about the presumed situation, and which, in relation to the situation of residents, is one that is very seriously and fundamentally incorrect, and is simply **not the reality**.

3.19 The **reality** is very different, as evidence before the courts, including visual materials showed that in many cases crop-spraying can take place (on a regular basis) within inches of a resident's home. For example, I had two photos sent to me which show a resident's home within approx. 12 inches of a regularly sprayed field, and also have additional photos of crop-spraying taking place right next to residents' homes and gardens. Also the

[51] The July 2003 PSD paper adjusted the potential dermal exposure at one metre (compared with that at eight metres) but **did not** adjust the potential inhalation exposure, despite the January 2003 PSD paper's finding that at low wind speeds, inhalation exposure was **five times higher** at one metre than at five metres.

[52] Trifluralin was withdrawn in March 2008 in all Member States following a European Commission decision, (Member States had a grace period which expired on 20 March 2009), but this action was at the behest of the European Commission rather than the PSD, which took no action as a result of the July 2003 PSD paper.

[53] "*Exposure of bystanders to pesticides*", Matthews and Hamey, *Pesticide Outlook* October 2003.

reality of crop spraying in the close proximity of residents homes, schools, children's playgrounds is clearly shown on the DVD, including footage showing a mannequin family (that I previously placed at the edge of our garden) made up of some of the most vulnerable groups including a pregnant woman, 2 babies, and a young child, that was to illustrate **a typical and realistic residential setting**, where people are out in their garden, and then with no warning, spraying takes place. **All these visual materials can all be made available to members of the Environmental Audit Committee on request.**

3.20 It is important to note that the Government's own Field Operations Directorate (FOD) reports *themselves* (which are part of the Government's *own monitoring system*) contain cases where crop-spraying has taken place within a metre or so of the boundary of a resident's property and therefore the Government is actually well aware that this is a very realistic and common situation for residents living in the locality of sprayed fields.[54]

3.21 It is important to note that even if there is a boundary structure, (eg. a hedge, fence etc.) this will not make any difference when it comes to pesticide droplets, particles or vapours in the air, as farmers cannot control pesticides once they are airborne (either at the time of application or subsequently) and therefore pesticides can travel over and above (or even through) any structure of this nature. If a house or its garden, (or a school), is situated less than eight metres from where the sprayer passes, (and in some cases less than even a metre away) then a resident may be exposed at this distance at any time when spraying occurs. Also the spray can enter an open window or airvent and contaminate the inside of the house. Clearly a house (or children's school or other building) cannot be moved from its position and so the situation of people being a metre or less away from a sprayer is most definitely not rare. Speaking personally, for the first 9 years that my family and I lived in our current home, we knew nothing about the pesticide spraying whatsoever (as no one had informed us about this hazardous practice) and thus we did not know they were being applied to the fields adjoining our home. Therefore often I would be playing in the garden as a young girl standing only inches away from a crop sprayer as it passed, without any knowledge that it was dispersing hazardous chemicals. Therefore to reiterate the situation of people being a metre or less away from a sprayer is the **reality** for many people living near sprayed fields, who of course will not be involved in the pesticide application, and thus who, unlike operators, will **not** be wearing any personal

[54] See footnote 74 of the second Witness Statement.

protective equipment (PPE), such as respirators, masks, *overalls* etc., on their own property and land, nor, unlike operators, will they be sitting in specifically filtered cabs.

3.22 Very importantly, as said at para 3.17 above, there were also a number of examples in the July 2003 PSD paper of high exceedances of the AOEL at *eight metres* from the sprayer (ie. under the current UK bystander exposure assessment). An example of this is in relation to the orchard spraying of Dithianon (in Dithianon Flowable) where exposure at 8 metres exceeded the AOEL up to thirty-one and a half times over. It is important to note that the January 2003 PSD paper found that based on drift fallout data from applications in orchards that the drift deposit at 3 metres (the closest distance at which measurements were taken) was *"about 3 times that expected at 8 metres."* Therefore as I pointed out in para 20(e) of my second Witness Statement that if going by that finding then the exceedance of the AOEL for Dithianon of up to thirty-one and a half times over (at 3155% of the AOEL), if multiplied by 3 (to give an estimate for exposure at 3 metres) would be almost **95 times above the AOEL**. This exceedance could be increased further still if the exposure was at 1 metre away. **Yet any exceedance of the AOEL (even just by 1 time over) is supposed to lead to authorizations being refused, or trigger prohibition if already approved. Products containing Dithianon remain approved for use in the UK, including Dithianon Flowable.**

3.23 The exposure of residents and bystanders at a distance of one metre from the sprayer is, in these circumstances, **plainly realistic** – and the exceedances identified in the July 2003 PSD paper of the EU exposure limit (the AOEL) at a distance of one metre, as well as very importantly the considerable number of exceedances of the AOEL at eight metres (ie. under the current bystander exposure assessment that the UK Government has continued to stand by), sometimes by many times over at an *order of magnitude* higher[55] therefore give rise to an obligation on the UK Government to prohibit use, which obligation has not been fulfilled. In fact, as can be seen in the second Witness Statement, once all relevant exposure factors and exposure routes are taken into account and included in the exposure calculations, it becomes clear that separation distances of **miles, not metres,** would be needed in order to prevent any exceedance of the AOEL, and in order to protect residents from the risk of harm. For example, in the High Court Judgment in the case *Georgina Downs v DEFRA* at paragraph 28, the Judge referred to the UK

[55] See paragraphs 20 (d), (e), (f), (g), (i) and (j) of the second Witness Statement.

Government's own data on air levels that had pointed out that *"high levels of a particular pesticide had been identified 300 metres from the sampling station"*; also as highlighted earlier there are international studies where pesticides have been found **miles** away from where they were originally applied and the documented risks for rural residents and communities of various adverse health effects from living within those distances; another study published in the Journal of the American Medical Association (JAMA) in 2005 that confirmed acute illnesses in children and employees from pesticides sprayed on farmland in the locality of schools, pointed out that, at the time the study was prepared that, a number of US states require **the prohibition of spraying in the locality of schools in an attempt to protect children from exposure**, including one state where the distance of the area where the use of pesticides is prohibited in the locality of schools is **2.5 miles**.[56]

3.24 **24-hour inhalation exposure (excluding other routes such as dermal, oral and eyes):** the PSD's calculations in the July 2003 paper showed examples of cases where the 24-hour inhalation exposure to vapour *alone* (ie. ignoring all other exposure sources such as direct inhalation of spray droplets and particles) **substantially exceeded the AOEL**, either in children, or in both adults and children, with exposures for children of up to more than 27 times above the AOEL and even for adults more than twelve and a half times above the AOEL. It is important to note that there were also a number of examples of cases where the 24-hour inhalation exposure (which is to vapour *only* and excludes exposure to droplets and particles in that time-frame) was estimated, by itself, to be very near the AOEL in children (as much as 92% of AOEL) so that there would be a very serious risk of exceeding the AOEL once other exposure factors were taken into account and included in the exposure assessment calculations, and again in some cases the AOEL exceedances could be many times over. (See paras 22 and 23 of 2nd Witness Statement).

3.25 **Children's dermal and hand-to-mouth and object-to-mouth exposure**: in the July 2003 paper the PSD exposure estimates through these routes *alone* (that excluded inhalation exposure altogether, and that were said to be estimated based on a toddler weighing 15kg playing on grass for two hours following drift into gardens) were found to **exceed the AOEL** by up to about four and a half times. But again, no conditions of use have, to date, been imposed to prevent such exposure (eg. by prohibiting spraying and pesticide use in the locality of homes, schools, children's playgrounds, nurseries etc.) And

[56] Study by Alarcon *et al*, (2005), entitled, *"Acute Illnesses Associated with Pesticide Exposure at Schools."*

once again, the UK Government gave no consideration whatsoever to the exposure of **<u>babies</u>** having a lower bodyweight (and therefore higher total exposure per kg bodyweight per day) than toddlers. (See paragraph 24 of the second Witness Statement).

3.26 When questioned in 2005 about the cases in the July 2003 PSD paper where exposures for children exceeded the AOEL, a then Department of Health representative stated, *"We would not simply accept an AOEL being exceeded twice in children."* Despite this, (and despite the fact that there were cases where the exposure for children was estimated to exceed the AOEL many more times than two, eg. child 24 hour inhalation where the exceedance was more than 27 times the AOEL) the Government made no adjustment at the time to its existing exposure assessment model (five minutes at eight metres from the sprayer for an adult weighing 60 kg).

3.27 **<u>Combination of exposure estimates</u>**: it is important to stress the fact that the AOEL exceedances were based on each exposure factor *individually*, as the PSD, as well as the Advisory Committee on Pesticides have, to date, **<u>wrongly</u>** calculated each factor in *isolation* and have failed to ***<u>ever</u>*** calculate exposure factors together in the exposure calculations, (which is obviously essential to do in relation to the overall exposure scenario in totality for residents). The estimates given in the July 2003 PSD paper clearly showed that if combining a number of the exposure factors together, the AOEL for a number of pesticides would be <u>greatly exceeded for children, and adults,</u> (and of course *even further exceeded* if already exceeded just from any one exposure factor *individually*)

3.28 Despite this, to date, the PSD and ACP have continued to knowingly fail to calculate exposure factors together.

3.29 As set out above (and in more detail in the second Witness Statement at paragraphs 27-55), the UK Government did not, as a result of either of the 2003 PSD papers, alter its bystander exposure assessment model (exposure at eight metres for five minutes (or less) to spraydrift only from a single pass of a sprayer) to include in the exposure calculations all other relevant exposure factors. No further estimates were carried out on all the other pesticides approved for use in the UK at that time, and nor has this been done subsequently. In fact despite the results obtained in the July 2003 PSD paper, astonishingly the stated conclusion of the PSD paper was that, *"For products applied as sprays, these examples demonstrate that the current approach is protective of longer-term* *bystander exposure"*. Therefore **no action** was taken by the UK Government to revoke the authorisations for pesticides where exposure (even on the *limited* number of additional exposure factors considered by the regulators in the 2003 PSD papers, and even when taken *alone* rather than in combination) exceeded the EU exposure limit, the AOEL. This is despite the requirements in the European legislation, (as EU law clearly specifies that the AOEL **must not be exceeded**, if it is, then authorizations **must be refused**, and if the AOEL exceedance is discovered *after* approval, **it must trigger prohibition/revocation**), and further, it is despite the recognition in the UK Government's very own previously stated case that **any exceedance** of the AOEL would trigger prohibition/revocation.

3.30 **The PSD's previous estimated exceedances of the AOEL clearly demonstrated that products have been in use in the UK which would have led to residents being exposed to levels greatly in excess of the AOEL, on a regular basis, year after year.**

3.31Further still, evidence in the second Witness Statement showed that DEFRA Ministers were not even informed by the PSD of these very serious AOEL exceedances. For example, in PSD's advice to Ministers, dated 24th March 2004, following the 2003 DEFRA Consultation on pesticides, in referring to the estimates of 24 hour air inhalation exposure in the July 2003 PSD paper, the PSD stated, *"Exposure assessments for a large number of pesticides using the worst case Californian value as surrogate data are within the AOELs* ***in all but a very few cases****…The ACP reviewed these assessments before they confirmed that the risk assessments applied* ***are robust****."* This failed to inform Ministers not only of the details regarding the exceedances of the AOEL for 24-hour inhalation exposure, but also the exceedances of the AOEL for children playing in the fallout area; in estimates of exposure at 1 metre, and even in some estimates relating to the current UK bystander exposure model of 5 minutes exposure at 8 metres, (any of which of course could be in relation to either adults, or babies, children or other vulnerable groups).[1]

3.32 To reiterate, the Government has previously assessed exposure in a number of **realistic scenarios** in which residents are regularly exposed, including (i) exposure at less than eight metres; (ii) 24 hour inhalation exposure (although to vapour *only* excluding spray droplets and particles) for both adults and children; (iii) the dermal, hand-to-mouth and object-to-mouth exposure of small children playing on grass for two hours (without any account being taken of any exposure from breathing ie. droplets, particles and

[1] See paragraphs 27 to 30 and 33 to 36 of the second Witness Statement.

vapours, during those two hours). As detailed earlier, it will be appreciated that these are by no means all the exposure factors/sources relevant to a residents overall realistic exposure scenario in totality. (See para 56 of the 2nd Witness Statement and in summary above at para 3.9). The PSD's **own findings** found significant exceedances of the EU exposure limits, the AOEL (in some cases an *order of magnitude* higher), in relation to each of those exposure factors taken *alone*. Many more exceedances would be found if the exposures were totalled - as they plainly should be in order to allow for a **realistic worst-case scenario**, as required by the existing Annex VI to the EU legislation.[58] **Yet the Government has not, to date, taken any action to prevent the exposure and risk of harm for residents in these circumstances, and has violated its obligation under EU law to prohibit the use of pesticides where the AOEL is known to be exceeded.**

3.33 It is clear from what is set out in summary above that the current UK assessment model for *bystanders* is inadequate to assess even the exposure of such bystanders, and **fails entirely** to address the exposure of **residents**, as the overall exposure a resident receives cannot possibly be calculated if some of the exposure factors are ignored in the exposure calculations, which they currently are. See para 53 of the 2nd Witness Statement.

3.34 **The fact that, to date, there has never been *any* assessment in the UK of the risks to health for the long term exposure for those who live in the locality of pesticide sprayed fields, and/or who go to school in the locality of sprayed fields, means that under EU law pesticides should never have been approved for use in the first place for spraying in the locality of homes, schools, playgrounds, amongst other areas.**

3.35 Further, it is clear that if a proper and full assessment was undertaken to assess the exposure and risk for residents, that would have to include in the exposure calculations **all** the exposure factors and exposure routes, both higher and lower levels of exposure, **and then added together (summed) then the result would be that pesticides would simply not be allowed to be approved at all for use in the locality of residents' homes, as well as schools, children's playgrounds, nurseries, hospitals, amongst other areas**.

3.36 Therefore in summary, the factual evidence that I produced for the legal case, and which, as said earlier, is based on the UK Government's **very own documents, findings and statements**, (and thus **anyone** who analyses the same UK Government documents

[58] The European legislation regarding the authorisation of pesticides was formerly European Directive 91/414 and is now European Regulation 1107/2009.

and materials as referred to in the second Witness Statement would obviously see the same results) clearly confirms that the UK Government has fundamentally failed to:

- protect public health from pesticides, particularly rural residents;
- undertake ***any*** exposure and risk assessment for the long-term exposure for those who live, work or go to school in the locality of pesticide sprayed fields (**which means that under EU and UK equivalent legislation pesticides should never have been approved for use in the first place for spraying in the locality of residents' homes, schools, etc., in the absence of any actual risk assessment for those exposed in such scenarios**);
- act on its *own findings* of 82 exceedances (in **realistic** exposure scenarios for residents) of the limits set for exposure (the AOEL), in some cases the AOEL **was exceeded up to 20 to 30 times over**, which is an *order of magnitude higher,* when **any** exceedance, on the UK Government's *own previously stated case*, and most importantly under EU law, **would lead to immediate action of authorizations being refused (or trigger prohibition/revocation if the AOEL exceedance is discovered *after* approval).** It is important to reiterate that these AOEL exceedances were based on each exposure factor *individually,* as the UK Government's advisors, the Advisory Committee on Pesticides (ACP), and the PSD (now CRD), **wrongly** calculated each factor in *isolation* and have failed to ***ever*** calculate (sum) exposure factors together in the exposure calculations, which is obviously essential to do in relation to the overall exposure scenario for residents. **Therefore on the results shown in PSD's (CRD's) own findings the AOEL would have been exceeded *even further* when calculating exposure factors together**;
- act on the evidence of the risk of harm to human health, and further than that, act on the evidence of **harm** that is occurring, including in the Government's *own monitoring system*. Yet EU legislation **requires** that pesticides can only be authorised for use if it has been **established** that there will be ***no harmful effect*** on human health. It also **requires** a proactive approach to reviewing authorisations *after* approval, including that authorisations shall be cancelled and pesticides prohibited where there is a risk of harm.

3.37 The factual evidence clearly shows that the UK authorities have approved pesticides for use (a) without first assessing the exposure and risks for **residents living in the locality of pesticide sprayed fields**, (and which the UK Government is required to do under the relevant European and UK equivalent legislation); and (b) without imposing **any** statutory conditions of use to protect residents from exposure, including exposures which give rise to risks to health, as well as exposures in excess of the AOEL. Such conditions of use would include the prohibition of the use of pesticides in the locality of residents' homes, as well as schools, children's playgrounds, hospitals etc. As said, the full detailed evidence regarding the failings of the current UK policy and approach are contained in the 150 page second Witness Statement (available at: http://www.pesticidescampaign.co.uk/documents/Downs%202.pdf).

The legal case Georgina Downs v DEFRA

3.38 The aforementioned detailed factual evidence led to my landmark victory in the High Court in November 2008 that ruled that the UK Government's policy on pesticides was not in compliance with European legislation. My case was the first known legal case of its kind to reach the High Court to directly challenge the Government's pesticide policy and approach regarding crop-spraying in rural areas. The critical evidence contained in my second Witness Statement resulted in the High Court Judge, Mr. Justice Collins, concluding (at paragraph 39 of the High Court Judgment[59]) that, *"**The alleged inadequacies of the model and the approach to authorisation and conditions of use have been scientifically justified. The claimant has produced cogent arguments and evidence to indicate that the approach does not adequately protect residents and so is in breach of the** **[EU]** **Directive**"* [60] and at paragraph 70 of the High Court Judgment that DEFRA *"**must take steps to produce an adequate assessment of the risks to residents**"*[61]

3.39 **The Judge also concluded at paras 39 to 43 of the High Court Judgment that I had produced "*solid evidence*"…*that residents have suffered harm to their health*"**. [62]

3.40 The Order of Mr. Justice Collins issued on 15th December 2008 ordered that DEFRA must reconsider and as necessary amend its policy in accordance with the terms of the judgment. It should be noted that although Mr. Justice Collins granted DEFRA leave to appeal, **he made it clear that he did not think that an appeal had a real prospect of success.**[63] **This would have been based on the assumption that the Court of Appeal would form its Judgment on the very same evidence and arguments that he did.**

3.41 However, my critical evidence and arguments were then subsequently ignored by the Court of Appeal in its judgment of July 2009, as it was all bizarrely ***substituted*** with the

[59] http://www.bailii.org/cgi-bin/markup.cgi?doc=/ew/cases/EWHC/Admin/2008/2666.html&query=title+(+downs+)&method=boolean%20%3Chttp://www.bailii.org/cgi-bin/markup.cgi?doc=/ew/cases/EWHC/Admin/2008/2666.html&query=title+(+downs+)&method=boolean%3E
[60] Ibid.
[61] Ibid.
[62] Ibid.
[63] In the High Court Order issued on 15th December 2008 Mr. Justice Collins stated that, *"While I recognise that the arguments raised by the defendant were and are by no means without substance, **I do not think that in all the circumstances an appeal has a real prospect of success.**"*

conclusions of a UK Government requested and funded report from four years earlier in 2005. Therefore the Court of Appeal's judgment was **not** based on the same cogent case, detailed factual evidence and arguments that had led to the High Court ruling in my favour. A striking example of this is demonstrated by the fact that **there is absolutely no reference whatsoever** in the Court of Appeal's Judgment of the very serious exceedances of the EU exposure limit, the AOEL, in **realistic** exposure scenarios for residents (and that were in clear breach of the legislative requirements of the then EU Directive 91/414) and importantly, that had been based on the UK Government's *very own findings*.

3.42 Although Judicial Review is about points of law, any decisions on the legal points must be based on the correct factual evidence presented. The High Court Judge, Mr. Justice Collins, had **correctly** based his Judgment on the critical detailed factual evidence I had set forth, in a number of Witness Statements, and that I had produced specifically to support the legal arguments and Grounds for challenge raised in my case. By substituting my evidence, the Court of Appeal judges fundamentally misrepresented my case. The Court of Appeal's only explanation for ignoring my evidence was that I had "*no formal scientific or medical qualifications*." **Yet this is completely irrelevant, and it would effectively mean an end to any citizen taking a Judicial Review case in the UK if the courts will not take any notice of the evidence presented by that citizen because he/she is not a qualified scientist or doctor.** Also this is a highly prejudicial approach. Any legal judgment or decision is supposed to reflect the arguments and evidence set forth by the named parties involved in that case, irrespective of their professional background. Therefore the Court of Appeal judges were supposed to be basing their judgment as to whether to uphold or overturn the High Court Judgment based on the **exact same evidence** that led to that judgment in the first place, and which they did not.

3.43 Therefore the Court of Appeal overturned the High Court Judgment but **only** as a result of very wrongly (and possibly intentionally) **substituting** the cogently argued case I had presented with the findings of another party, thus resulting in the Court of Appeal judgment being formed on the wrong basis, and which did not in any way resemble the same case, arguments and evidence that Mr. Justice Collins based his Judgment on in the High Court, and which resoundingly found in my favour on all grounds, ruling that the UK Government was in breach of **both EU law and Article 8 of the European Convention of Human Rights**. Therefore the Court of Appeal Judgment was a complete whitewash and there was not even a hint anywhere in the Judgment of any criticism of the Government at all. The Court of Appeal basically just passed the issue back to the Government to deal with and yet it was the Government I am challenging! I said at the time the Court of Appeal Judgment came out and will reiterate it again here, that the Government could not have wished for a better result than if it wrote the Judgment itself!

3.44 It is important to point out the fact that I actually had **5 legal decisions in my favour** between 2007 and 2009 in the legal case against the Government. These included: 1) the original permission granted by Mr. Justice Mitting in January 2007 for an application for Judicial Review; 2) the High Court ruling from Mr. Justice Collins in my favour in November 2008; 3) Mr. Justice Collins then refused in December 2008 the Government's first application for a "*stay*" of the High Court Judgment and Order; 4) the Court of Appeal Judge Lord Justice Laws then refused the Government's second application for a "*stay*" in February 2009; 5) the Court of Appeal Judge Lord Justice Sullivan then refused the Government's third application for a "*stay*" in March 2009 following an oral hearing and ordered that the Government should get on with its review as ordered by the High Court ruling in November 2008. In fact at that March 2009 oral hearing Lord Justice Sullivan criticized the Government for not having already initiated *any* action as a result of the High Court ruling. Yet just four months later it was the same Lord Justice Sullivan who wrote the lead Judgment for the Court of Appeal in July 2009 in which my evidence and arguments were ignored and bizarrely ***substituted*** with the findings of another party!

3.45 The only observational point I would make in relation to this (there are of course other points, but for the purposes of this submission I shall only highlight this one) is that Lord Justice Sullivan had announced at the oral hearing in March 2009 that he was most likely going to be a Judge involved in the main Court of Appeal hearing on the case (which subsequently took place in May 2009). Therefore the Government and other parties (such as the pesticides industry) would have known 2 months in advance who one of the Judges was most likely going to be. I of course do not know what went on behind the scenes, but I do know that it was clear to a number of those who attended the Court of Appeal hearing in May 2009 that the Judges came in with a pre-formed view and did not display any genuine interest in the case, evidence and arguments presented by my side.

3.46 It is also important to point out that the original High Court ruling in my favour was obviously a very significant and landmark ruling for the potentially millions of residents throughout the country who, like myself, live in the locality of pesticide sprayed fields. The High Court judgment was extremely damaging to the Government, all the Government departments, officials and scientific advisors, responsible for pesticides, as it clearly confirmed what I had always said from the outset of presenting my arguments since 2001, that the Government has fundamentally failed to protect people in the countryside from pesticides and has also knowingly allowed residents to continue to suffer from adverse health effects without taking any action to prevent the exposure, risks and adverse impacts occurring. Therefore the High Court ruling had massive legal and political implications on the Government involving issues of responsibility, accountability and liability. Further confirmation of this could be seen in a number of legal articles on the internet, at the time, that reported on the significance of the High Court ruling. For example, one article published in *Environmental Liability*[64] stated, *"This case is a landmark one because it is the first case in which a judge has pointed to solid evidence of residents suffering ill health caused by exposure to pesticides in nearby fields, and it will no doubt be referred to as a precedent in future cases brought by residents."* Thus the Government knew that, amongst other implications, the ruling by the High Court could have opened the floodgates to compensation claims against the UK Government from the many individuals and families who have suffered adverse health effects from exposure to pesticides sprayed in the locality of residents' homes.

3.47 There was also very heavy lobbying on the Government from the industry to ensure that the Government appealed the High Court Judgment (which I am in no doubt the Government would have appealed anyway with or without the industry lobbying) and it was reported in the press at the time that the Government maintained that if the High Court Judgment stood then the *"Government's pesticide policy would be fundamentally undermined"* and that the policy and approvals system *"might even grind to a halt."* [65] This would undoubtedly have cost the Government many millions not only in relation to lost income from the pesticide industry to the regulators, the CRD [66] (who were the acting defendants in the legal case on behalf of DEFRA/Government), but also in the threat of any potential legal action against the Government by the industry if new product approvals were no longer able to be granted, as well as any potential legal action if

[64] *Environmental Liability* article in 2008 entitled *"Landmark judgment concerning pesticide crop-spraying"*.
[65] These quotes appeared in various articles in May 2009 including Farmers Weekly.
[66] The CRD receives approximately 60% of its funding from the agrochemical industry, which is broken down into the fees charged to companies for applications, and a charge on the UK turnover of pesticides companies, see further paras 5.4 to 5.10 below under the sub-heading *"Chemicals Regulation Directorate (CRD)."*

pesticides the Government had previously approved (and that were subject to long approvals, for example, many pesticides are approved for 10 years) were no longer able to be used. *(NB. Such legal cases have been taken previously in the EU by companies challenging the EU Commission for no longer including their pesticides in Annex 1).*

3.48 In fact, the Government's concern over the financial impacts on the industry was clear to see in the two Witness Statements submitted on behalf of DEFRA by the then PSD (now CRD) Chief Executive, Kerr Wilson, to the Court of Appeal, regarding DEFRA's renewed application for a stay of the High Court Judgment and Order of Collins J. Both Mr. Wilson's Witness Statements cited various reasons for *preserving the status quo* that were **all** notably related to *alleged* financial and economic impacts on manufacturers, farmers and distributors, or the impact on agricultural productivity, if there were any changes to the current UK policy and approach for pesticides and the related approvals system. Therefore despite such a significant and landmark High Court ruling, that had found the Government failing in its legal obligation to protect human health, (particularly rural residents), the two Witness Statements submitted on behalf of DEFRA did not display ***any*** concern whatsoever in relation to the protection of public health, nor any genuine desire to rectify the policy and approach as had been ordered by the High Court, as the ***only*** concern displayed was with the protection of industry and business interests rather than the protection of the public.[67] For example, notable statements in the first Witness Statement of Kerr Wilson on behalf of DEFRA dated 9th January 2009 include, [68] amongst others, at paragraph 6: *"The annual market value of pesticide sales is approximately £490m* [69] *which delivers benefits to farmers, significantly improving agricultural productivity";* at para 8: *"If, as a result of the Declaration, new approvals could not be granted, there would be important ramifications,"* (the paragraph then goes on to list at points a to e, a number of concerns relating to the impacts on pesticide approvals (including on evaluations of new products; re-registration of existing products etc.) and the *alleged* financial and economic disadvantages for UK industry and farmers as a result, eg. para 8e that states that, *"…due to the seasonal nature of the use of plant protection products, the coming months are critically important for approval holders and*

[67] This was pointed out in my fourth Witness Statement involved in the legal case *Georgina Downs v DEFRA* which is available at:- http://www.pesticidescampaign.co.uk/documents/Downs%204.pdf
[68] I am not sure whether I am allowed to publish any of DEFRA's Witness Statements from the legal case, but the quotes of Kerr Wilson's cited in paragraphs 3.48 and 3.49 above can all, in any event, be seen cited in my fourth Witness Statement involved in the legal case *Georgina Downs v DEFRA* available at:- http://www.pesticidescampaign.co.uk/documents/Downs%204.pdf
[69] This figure is now higher, see further paragraph 5.3 below.

farmers, as not gaining approval before the growing season can result in a sales being lost for a whole year"); at para 10: *"Without a stay PSD will have no option but to suspend activity on new approval applications, which will have commensurate financial and significant agricultural impacts on approval holders, distributors and farmers."*

3.49 In paragraph 10 Kerr Wilson also stated, *"DEFRA and PSD have an* ***obligation*** *to consider the need for certainty amongst its stakeholders,* ***particularly applicants for approval*** *and the wider agricultural community, and wishes to continue to discharge its* ***duties*** *to* ***them*** *pending the outcome of the appeal."* [70] The PSD's concern regarding its "*obligation*" and "*duties*" to the industry yet again confirmed that its primary concern was for the protection of industry interests, particularly applicants for approval (ie. the manufacturers' of pesticides, such as the agro chemical companies). Notably, there was no mention anywhere in Mr. Wilson's Witness Statement of the PSD's **obligations** and **duties** to protect the health of those exposed to pesticides, particularly to that of residents.

3.50 Therefore for all the reasons set out in the above paras it is clear why the Government would have needed to get the landmark High Court ruling overturned no matter what.

The Government's current policy review

3.51 Following Lord Justice Sullivan's refusal at the oral hearing in March 2009 of the Government's third application for a "*stay*" and his order that the Government should get on with its review as ordered by the High Court ruling in Nov. 2008, DEFRA Ministers requested the regulators initiate a review of the Government's policy and approach regarding human health, particularly re. residents and bystanders.[71] The Ministers request for a policy review was therefore taken **only *after***, and as a direct result of, that March 2009 Court of Appeal ruling, and which the Government **publicly committed** to continuing with irrespective of the subsequent Court of Appeal judgment in July 2009. [72]

3.52 As part of the Government's policy review there are 2 Working Group's co-ordinated by the Advisory Committee on Pesticides (ACP) that are reviewing the exposure, risks,

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[70] See footnote 68.

[71] Letter from Dave Bench (CRD) to the COT Chairman, Professor David Coggon, dated 11th March 2009, and which can be seen on pages 7 and 8 of the document at:- http://cot.food.gov.uk/pdfs/tox200909.pdf

[72] Letter from Dave Bench (CRD) to the COT Chairman, Professor David Coggon, dated 1st September 2009, and which can be seen in the document at:- http://cot.food.gov.uk/pdfs/tox200928addendum.pdf

and adverse health effects to residents and other members of the public exposed, (which is as a direct result of the evidence and arguments I presented in my legal challenge).

3.53 One of the Working Groups entitled *"Pesticides Adverse Health Effect Surveillance Scheme Working Group (PAHES)"* is in the process of finalising its report. Although I have not seen the final report, the *draft* PAHES report concluded that there are *"obvious problems"* with the current surveillance and monitoring systems in the UK and stressed the fact that systems are required that *"deal with both chronic and acute effects of pesticides"* (as, as detailed earlier, there is currently no specific monitoring or collection of data in the Government's existing monitoring system in relation to the chronic effects, illnesses and diseases reported by residents in rural areas, which is something that I have continued to point out when detailing the failings of the UK monitoring system, including in great detail in the second Witness Statement).

3.54 The other Working Group, which is a joint Working Group of the ACP and the Committee on Toxicity (COT), entitled *"Bystander Risk Assessment Working Group (BRAWG)"* is also in the process of finalising its report. Although BRAWG has *finally* acknowledged that the current approach for assessing the exposures and risks to public health (the so-called *bystander* risk assessment) is inadequate, and has thus *finally* agreed with a number of the critical arguments that I have been highlighting over the last 11 years, the BRAWG report does not address *the extent* of the *very serious flaws* in the Government's existing approach to exposure and risk assessment (as set out in full detail in my second Witness Statement and which I briefly summarised in earlier paras above).

3.55 The BRAWG report does now recommend that there should be separate exposure and risk assessments for residents and bystanders (which again is what I have been arguing for the last 11 years since the outset of the campaign). However, the approach proposed regarding residents still **excludes** many of the exposure factors and exposure routes summarized in para 3.9 above, and in full detail at para 56 of the second Witness Statement), and which are **all** relevant to include for the specific exposure scenario of residents.

3.56 The main changes in approach that are now recommended by BRAWG are as follows

- **Both acute (short-term) and longer-term exposure assessments are required for residents,** (however, the way this has been proposed by BRAWG is still inadequate);

- **That a 2 metre distance between the sprayer and a resident or bystander should be assumed in all the acute and chronic risk assessments,** as BRAWG considered that the current distance assumed in the risk assessment of 8 metres between the spray boom and an individual is inadequate, (however, although this is an improvement from the current 8 metre approach, it is again still inadequate, as it should be closer);

- **Estimates of exposure through each pathway and route should be aggregated (combined)**, (again, the way this has been proposed by BRAWG is still inadequate, as firstly, as said above, the approach regarding residents still excludes many of the exposure factors and routes that need to be included; and secondly, for assessment of total potential systemic exposure, the group recommends that estimates of exposure from different sources and by different routes should *not* simply be summed as a matter of routine, and yet they would need to be, otherwise a complete and accurate assessment of the overall realistic exposure and risk for residents cannot be reached);

- **That separate risk assessments should be considered for children and adults exposed as residents and bystanders;** (although again, the way this has been proposed by BRAWG is still inadequate, and further, there will still be no consideration whatsoever to the exposure of babies and young children with a bodyweight lower than 15kg, and some parts of the assessments still based on 60kg).

3.57 An additional important recognition in the BRAWG report and which again would not have even been considered if it was not for the arguments and evidence presented in the campaign I run and related legal case, is that BRAWG "*notes a concern that some individuals may become sensitised to pesticides (or indeed other substances), possibly following apparently low exposures relative to the sensitising dose in animals, **and that risk factors for sensitisation are not well understood, either for pesticides or for other substances**. The group considers that it is important to identify the extent to which current or new formulations may change the ability of chemicals to act as sensitisers.*" [73]

3.58 The BRAWG report also notes concern that sensitisation could have longer term consequences as the report states, *"An individual can become sensitised as a result of exposure to a substance that can induce a specific immunological reaction ("induction"), such that the individual then reacts to much lower concentrations on further exposure ("elicitation"). On initial contact with a skin sensitiser, the exposed person may experience no obvious symptoms, yet further contact with the same substance may result in clinical manifestations (either skin or respiratory)."* [74]

[73] Taken from the latest published version of the *draft* BRAWG report which is available at:- http://cot.food.gov.uk/pdfs/tox201232.pdf
[74] Ibid.

3.59 As a result BRAWG recommends that research be conducted on the extent to which current or new formulations may change the ability of chemicals to act as sensitisers. The reason why this is an important admittance is because of the continued assertions of Government advisors, such as the ACP, over many years that chemical sensitivity does not exist, and that pesticides will not result in pesticide (or other chemical) sensitivity in humans. Yet the UK Pesticides Campaign has continued to receive reports from people who not only have suffered acute and/or chronic health impacts as a result of exposure to pesticides, but a number of reports where people having developed chemical sensitivity.

3.60 The BRAWG report is due to be finalised and passed to Ministers shortly as the recommendations of both the Advisory Committee on Pesticides (ACP) and Committee on Toxicity (COT) on a revised policy approach to assessing the risk from pesticides to residents and bystanders. It is therefore not yet known at the time of writing this whether DEFRA Ministers will follow the advice recommended in the BRAWG report. However, the fact that BRAWG will now be advising Ministers for a few *limited* changes to the exposure and risk assessment approach (as a result of the evidence and arguments I have continued to present in relation to the residents and bystanders issue), and which is thus a sign of admittance from the Government's advisors of some of the inadequacies of the current approach, as said earlier, BRAWG still does not address *the extent* of the *very serious flaws* in the Government's existing approach to exposure and risk assessment. Therefore BRAWG has not in any way recommended all the changes that are necessary, and most importantly, the ACP *still* has **<u>not</u>** recommended the introduction of any measures to be introduced into the statutory conditions of use for the necessary protection of the health of residents and others exposed, such as the prohibition of the use of pesticides in the locality of residents' homes, as well as schools, children's playgrounds, hospitals etc.

<u>4. Related questions regarding the Government's approach to risk assessment for bees</u>

4.1 As can be seen from what is set out above, the failings in the Government's approach to exposure and risk assessment regarding human health is also comparable to the serious concerns that have been raised regarding the Government's approach to exposure and risk assessment in relation to other species, such as bees. It is absolutely clear that if there are fundamental flaws in the exposure assessments for pesticides, whether it be for humans, bees or any other species, then there will inevitably be flaws in the risk assessments from the outset. Although I have not examined the exposure and risk assessments currently carried out by the UK Government for bees in the same way as I have for human health, it is highly like that there will be similar flaws in the way the Government carries out the assessments regarding the risks to bees. For example, is the Government including in the exposure assessment for bees all the different exposure factors that bees will be subjected to, such as exposure to pesticides via the air (including droplets, particles and vapours), exposure to pesticides in pollen, exposure to pesticide treated seeds? Does it consider the overall total exposure that bees will be getting both in the short term and the long term? Also the critical point about the mixtures of different pesticides that bees could come into direct contact with and the fact that if a bee is regularly situated in amongst pesticide sprayed fields then it could be coming into direct contact with mixtures of pesticides on a daily basis, including not only in any particular crop field itself, but also in flight when travelling from one field to the next as a result of exposure to mixtures of pesticides in air.

4.2 In relation to the risk of harm to bees from pesticide mixtures, a US study in 2010[75] highlighted the potential synergistic effects on bee health from mixtures and combinations of different pesticides as the researchers found 121 **<u>different</u>** pesticides and metabolites within 887 wax, pollen, bee and associated hive samples. Therefore aside from the **individual products** that carry warnings of a risk to bees on the product label and safety data sheet information (such as *'harmful'*, *'dangerous'*, *'extremely dangerous' or 'high risk'* to bees), **there will also be the risk of adverse impacts on bee health <u>from the cumulative effects of multiple exposures to mixtures of different pesticides</u>**.

4.3 This point was further supported by the recent study in the journal *"Nature"* which was reported in the media[76] as being the first to look at the effect of a combination of chemicals and at the sort of levels typically seen in the countryside. It was reported that the *"worst effects were seen in the colonies **<u>exposed to the combination of chemicals</u>**."* [77]

4.4 Researcher Nigel Raine was quoted as pointing out that *"pesticide usage was currently approved on tests which examine **<u>single pesticides</u>** **over a period of days, rather than***

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[75] *"High levels of miticides and agrochemicals in North American apiaries: implications for honey bee health,"* Abstract can be seen at:- http://www.ncbi.nlm.nih.gov/pubmed/20333298

[76] http://www.dailymail.co.uk/sciencetech/article-2221223/Is-cocktail-pesticides-wiping-bees-Insects-left-confused-chemicals.html?ito=feeds-newsxml

[77] Ibid.

***weeks*"** and that *"our evidence shows that the risk of **exposure to multiple pesticides** needs to be considered, as this can seriously affect colony success."* [78]

4.5 In the same media article Professor David Goulson of the University of Stirling, was quoted as saying that, *"This new study also highlights the threat posed by exposing beneficial insects **to mixtures of toxic chemicals**, something which all bees face in agricultural environments, but the effects of which are rather poorly understood."* [79]

4.6 In view of such studies, and considering the **reality of crop spraying in the countryside** is not merely related to exposure to one individual pesticide or to one single group of pesticides, as agricultural pesticides are commonly sprayed in mixtures (cocktails), then it would not be adequate to assess the impacts of pesticides on bees *solely* in relation to one group of pesticides such as the neonicotinoids. As said earlier, quite often one pesticide application will consist of 4 or 5 different products mixed together. Each product formulation in itself can contain a number of different active ingredients, as well as other chemicals, such as solvents, surfactants and other co-formulants (some of which could have adverse effects in their own right, whether to humans or bees, even before considering any potential synergistic effects in a mixture(s)). Therefore bees and other species, just like residents and other humans, could be exposed to innumerable *mixtures* of pesticides, repeatedly, throughout every year, and for years.

4.7 In relation to this it is important to stress the fact that farmers cannot control pesticides once they are airborne (either at the time of application or subsequently) and so the exposure that residents and other species receive is as a result of the authorised/permitted use of these substances under the Government's existing policy. (The pesticides used in the locality of resident's homes will contaminate both outdoor and indoor environment).

4.8 It is therefore important that the Environmental Audit Committee enquiry is not limited to assessing the impacts of pesticides on bees and other insects *solely* in relation to one group of pesticides such as the neonicotinoids. Clearly that would miss the wider issue of pesticide spraying in the countryside *in general* and the impacts on bees, as well as importantly on humans, and the very serious failure of the current UK policy and approvals system to adequately assess the risks of such exposure (ie. to **mixtures** of

[78] Ibid.

[79] Ibid.

pesticides regularly sprayed), as well as the Government's failure to act on known risks and adverse impacts. The **reality** of pesticide spraying in the countryside is not reflected in any of the risk assessments the Government does, whether it be for humans or bees!

5. Reasons behind the Government's complacency and inaction on pesticides

5.1 To reiterate, to date, the Government, its advisors, and regulators, have fundamentally failed to protect people in the countryside from pesticides, and have also knowingly allowed residents to continue to suffer from adverse health effects without taking any action to prevent the exposure, risks and adverse health impacts occurring. The evidence really is quite clear that, to date, the Government has knowingly failed to act, has continued to shift the goalposts, cherry picked the science to suit the desired outcome and has misled the public, especially rural residents, over the safety of agricultural pesticides sprayed on crop fields throughout the country. The Government's continued line that there is no evidence of harm from pesticides, as well as no risk of harm, is just untenable and inexcusable. The evidence is there and has been there for a considerable time, the Government is just determined not to act on it. The Government's response to this issue has been, to date, of the utmost complacency, is completely irresponsible and is definitely not *"evidence-based policy-making"*. As I have always maintained from the outset of my campaign this is definitely one of biggest public health scandals of our time.

5.2 The principal aim of pesticide policy is supposed to be the protection of public health and environment. This is meant to be the number one priority and take absolute precedence over any financial, economic or other considerations. However, the Government has been absolutely determined at all costs to maintain the status quo and to appease the interests of the industry (at least this has been the case re. human health), as the Government has continued to put chemical/industry interests over and above protecting public health. To highlight just a few further reasons (to those set out in paras 3.46 to 3.50) as to why successive Governments' have continued to allow industry to set the agenda on pesticides

5.3 Considering that sales of pesticides in the UK *alone* for 2011/12 was £627 million[80] and reports have put the value of the world pesticides industry at around a staggering $52 billion[81] then this is obviously very big business indeed. However, there are also clear

[80] Taken from an email from the CRD finance department on 25th September 2012 confirming this figure.
[81] Source:- http://www.thedailygreen.com/environmental-news/latest/pesticides-47120102

conflicts of interests at play in relation to those advising DEFRA Ministers over the pesticides policy agenda, especially in relation to the Chemicals Regulation Directorate.

i) The Chemicals Regulation Directorate (CRD)

5.4 The Chemicals Regulation Directorate (CRD), the delivery body for DEFRA's responsibility on pesticides and the key officials advising Ministers on the safety of pesticides, is also the evaluator/assessor in the UK for the authorization of pesticide products. The CRD receives approximately 60% of its funding from the agrochemical industry, which is broken down into the fees charged to companies for applications, and a charge on the UK turnover of pesticides companies.[82] For a number of years now this has resulted in the CRD receiving around £7 million or more per year from the agro-chemical industry.[83] In the CRD's annual reports and accounts in relation to the CRD's business operations, the CRD's reliance on full cost recovery from the industry for CRD's *"services"*, [84] including evaluating applications for product approvals is repeatedly stated. **<u>This has always been a completely inappropriate structure, and it means that the CRD has a financial interest in any policy decisions under consideration.</u>**

5.5 Further, by CRD carrying out all the Government Consultations' on pesticides, and also being the main Government agency that assesses the adequacy of the UK's policy and approach, is really effectively just asking the regulator to be judge and jury of itself, which further compounds the inappropriateness of the UK structure.

5.6 **As the UK Pesticides Campaign has continued to argue, even though CRD's main priority is supposed to be to protect public health and the environment from pesticides this <u>obviously conflicts</u> with the fact that the CRD's main customers/clients are its approval holders, (predominantly made up of the agro-chemical companies), and the fact that the CRD is required to meet full cost**

[82] Source para 3.1 of the 2011 DEFRA document at:- http://www.defra.gov.uk/consult/files/110210-pesticides2011-condoc.pdf

[83] For example, see para 3.1 of the 2011 DEFRA document at:- http://www.defra.gov.uk/consult/files/110210-pesticides2011-condoc-ia.pdf in relation to the figure for 2009/2010 which was **<u>£7.4 million</u>**, and in relation to examples for earlier years see page 16 of the CRD's "Annual Report and Accounts 2008/09" for the figures for 2007/08 and 2008/09 available at: http://www.pesticides.gov.uk/Resources/CRD/Migrated-Resources/Documents/A/Annual_report_and_accounts_final.pdf

[84] Also see for example, DEFRA's response to the consultation last year on the draft legislative text of two UK Regulations to support the European Regulation regarding the authorisation of pesticides (at:- http://www.defra.gov.uk/consult/files/plant-protection-products-consult-response.pdf) that states, "*The Department does not consider it reasonable for the Exchequer to fund the entire operation of this regulatory regime.* ***It is appropriate for the industry to continue to meet the costs of the <u>services</u> they receive."***

recovery for its operations, including from product applications and approvals. **The CRD's very structure seems to make health and environmental considerations subordinate to pest control.** (NB. As detailed earlier at paras 3.48 and 3.49 this conflict of interests was clearly apparent during the legal case). The CRD's (formerly PSD's) primary concern and focus on the protection of industry interests as opposed to people's health really has been very clear through all the 11 years that I have been campaigning.

5.7 Therefore, as detailed, the UK's pesticide policy and control regime is based on a wholly inappropriate structure and goes some way to explaining why the pesticide industry has for many years (decades even) had such control over successive Governments' policy decisions on pesticides, particularly in relation to the use of pesticides in agriculture. If the pesticide industry is effectively the ones who are *"paying"* for what controls are or are not in place for the protection of public health and the environment then the industry will of course only be willing to pay the minimum amount possible <u>**for the least controls possible**</u>, **and will preferably want to just continue relying on voluntary measures only. Successive Governments' have continued to reflect the position of the pesticides industry** <u>**in all policy decisions taken to date on pesticides**</u>**, (at least since the UK Pesticides Campaign has been in existence since early 2001) and it is quite clear that part of the reason for this can be explained by the fact that** <u>**the industry are the ones who provide the majority of the funds to finance the control regime**</u>**. As the UK Pesticides Campaign has pointed out previously, this would appear to be a case of *"whoever pays the piper calls the tune."***

5.8 Therefore as long as the Government's control regime is being funded by (and thus relies upon) the pesticides industry with the majority percentage then there will inherently continue to be reluctance on the part of the industry and the Government to introduce mandatory measures/statutory controls for the protection of public health and safety. The current approach clearly creates an inherent conflict of interests with, in particular, the CRD, having a financial interest in any policy decisions under consideration, and would appear to be one of the reasons why there is this current perverse system of placing the interests of business and industry over and above that of the protection of public health.

5.9 It is clear from the text of both the former EU Directive 91/414 and the new EU legislation consisting of the PPP Regulation, and Sustainable Use Directive (SUD), <u>**that there should be no balancing of interests when it comes to public health protection**</u>.

5.10 **Therefore the primary concern of Government and CRD should definitely not be on ensuring the *minimum cost* to the industry and business, it should be on ensuring the <u>maximum protection for human and animal health and the environment</u>**.

ii) The Advisory Committee on Pesticides (ACP)

5.11 The Government, DEFRA, PSD (now CRD), have always stated that the ACP is *"independent"* of Government. However, the UK Pesticides Campaign would argue that whilst this may have been the aim in theory, it is not necessarily borne out in practice. For example, the ACP Secretariat is made up of PSD/CRD employees. Also, the ACP bases its decisions on summary information that is provided by PSD/CRD employees and to my knowledge the ACP does not go through the full dossiers of information that are provided by applicants. Thus, as said, the ACP's decisions are predominantly based on the summary information and advice and recommendations that are provided by the PSD/CRD. The ACP will then often just concur with the PSD's/CRD's position and does not very often make contrary conclusions to those of the PSD/CRD. Further, the ACP's *"Advice to Ministers"* has not always been passed on by the regulators (then PSD now CRD) to Ministers'[85] which again undermines the ACP's so-called *"independent"* status if the regulators (PSD/CRD) have been able to seemingly deliberately prevent the ACP's *"Advice to Ministers"* from being passed on to the very Ministers it is intended for.

5.12 In relation to the ACP it is important to note the following.

5.13 Paragraph 1.2 of the 2012 DEFRA consultation letter regarding the consultation on the options for the future of the Advisory Committee on Pesticides[86] stated,

"The ACP was established under Section 16(7) of the Food and Environment Protection Act 1985 (FEPA). The Advisory Committee on Pesticides was established by the Control of Pesticides (Advisory Committee on Pesticides) Order 1985 and the Advisory Committee on Pesticides for Northern Ireland by the Control of Pesticides (Advisory Committee) Order (Northern Ireland) 1987. The terms of reference are to provide Ministers with advice, either when requested to do so or otherwise, on any matters relating to the control of pests in furthering the general purposes of Part III of the Act.

The general purposes of Part III of FEPA are that the provisions of that part of the Act shall have effect:

**With a view to the continuous development of means*

[85] It came to light in 2005 that the then PSD had not passed on to DEFRA Ministers the ACP's formal written advice regarding the residents and bystander issue, (advice nos. 297 and 301) labelled as *"Advice to Ministers."*
[86] Available at:- http://www.defra.gov.uk/consult/files/pesticides-condoc-120308.pdf

**to protect the health of human beings, creatures and plants;*
**to safeguard the environment; and*
**to secure safe, efficient and humane methods of controlling pests; and*

**With a view to making information about pesticides available to the public."*

5.14 The 2012 DEFRA consultation letter regarding the consultation on the options for the future of the ACP[87] went on to state,

"Under Section 16(9), Ministers ***are required to consult the Advisory Committee****:*

**as to regulations which they contemplate making;*
*****as to approvals of pesticides which they contemplate giving, revoking or suspending; and***
*****as to conditions to which they contemplate making approvals subject****."*

5.15 In a conversation with a representative of DEFRA (David Williams) in May 2012, I asked whether **all** products that are considered for approval in the UK go before the (so-called "*independent*") ACP. He said that he did not think they did, as it would be too much work for the ACP, and therefore that some are just considered by the CRD. In a subsequent email on 14th May 2012 to David Williams and copied to Dave Bench of CRD I requested further information on this, as considering Section 16(9) of FEPA clearly states that *"Ministers* ***are required to consult the Advisory Committee*** **as to approvals of pesticides which they contemplate giving, revoking or suspending; and *as to conditions to which they contemplate making approvals subject"* then to not actually do so when it is **required** would appear to not be in compliance with FEPA Section 16(9)

5.16 The specific questions I asked in my email of 14th May were: 1) How many product applications have not been before the ACP? 2) Whether this has always been the situation since the outset of Section 16(9) being in place? 3) Or whether it started off as every product applications but then subsequently changed thereafter to not being all product applications? 4) Also what else does not go before the ACP but is dealt with by CRD? And I requested examples as to any other instances in which the ACP is not consulted *"as to approvals of pesticides which Ministers contemplate giving, revoking or suspending"* and *"as to conditions to which Ministers contemplate making approvals subject."*

5.17 Despite repeated reminder emails over the subsequent weeks and months and assurances from DEFRA officials that a *"substantive response"* was coming, I did not

[87] Ibid.

actually receive any response to these questions until 19th October 2012 in an email from David Williams of DEFRA that stated that, *"CRD currently receive on average 1,300 plant protection product applications per year. This figure covers the range of applications from new active substances to changes of approval to reflect a change of company name.* ***Only a small minority are directly put before the ACP. We do not hold the statistical information that you requested."***

5.18 I am currently awaiting a response to some further questions I have sent DEFRA and CRD in relation to this to establish exactly how many new product applications, as well as any new active substances, may not have been before the ACP **at all** in relation to each year since FEPA (and most importantly Section 16(9)) has been in existence since 1985.

5.19 This is important information to obtain considering the specific requirements in FEPA Section 16(9), and in order to establish any non-compliance, and breach, of Section 16(9).

5.20 As said earlier at para 3.60, the ACP *still* has **not** recommended to Ministers any measures to be introduced into the statutory conditions of use for the necessary protection of the health of residents and others exposed from agricultural spraying, such as advising Ministers to prohibit of the use of pesticides in the locality of residents' homes, as well as schools, children's playgrounds, hospitals etc. This is despite the evidence that the ACP has received over the last 11 years, since early 2001, regarding the fundamental failings of the existing policy and approvals system in protecting residents' health. There are many examples of the ACP's inaction when faced with evidence of actual harm, as well as the risk of harm, to human health, as a result of pesticide exposure (see for example the many examples included in the second Witness Statement produced for the legal case).

5.21 Therefore, the ACP has, to date, failed to act over the adverse health impacts of pesticides in exactly the same way as DEFRA and CRD (formerly PSD). Further, when PSD found in 2003, on its own estimates, 82 examples of exceedances of the AOEL, in some cases an *order of magnitude higher*, the ACP **did not** advise Ministers for action.

5.22 Furthermore, it is important to point out that a number of members of the ACP have links to the pesticides industry. For example, some members may undertake consultancy work, have shares in and/or receive funding for research support. This has always been an inappropriate structure, as so-called *"independent"* Government advisors cannot possibly be classified as independent if they have financial or other links with the very industries they are overseeing in relation to the hazards to human health. (NB. The declarations of interest of ACP members in the latest ACP report published (2011) is available at:- http://www.pesticides.gov.uk/Resources/CRD/ACP/Annual_Report_2011.pdf, see Annex 3 entitled *"Independent members declaration of interest in the pesticides industry 2011"*).

iii) The Pesticides Forum

5.23 There are a number of very important points to make regarding the Pesticides Forum.

5.24 The *draft* UK pesticides National Action Plan (NAP), that was recently subject to a Government Consultation, in Annex 2[88] entitled *"The Pesticides Forum – brief description and role"* it states, *"The Pesticides Forum has the following terms of reference: To bring together the views of those concerned with the use and effects of pesticides; To identify their common interests; To assist the effective dissemination of best practice, advances in technology, and research and development results.* ***To advise Government on the development, promotion and implementation of its policy relating to the responsible use of pesticides****."* [89] Thus one of its remits is to advise Ministers on pesticides policy and use.

5.25 Paras 6.1 and 6.2 of the *draft* UK National Action Plan (NAP) pointed out that the Government/DEFRA/CRD intends to rely on the Pesticides Forum for the monitoring and review of the UK National Action Plan.[90] This can also be seen in other paras of the *draft* UK NAP such as at para 7.1 which refers to the Pesticides Forum's *"suite of indicators to monitor how pesticides are being used* ***and the impact they are having****"*,[91] para 8.3, and para 8.4 that states, *"Progress in the priority areas will be looked for over the five years of the Plan. Indicators will be examined annually in the Pesticides Forum report to provide the quantitative measure of this progress,"* [92] as well as in various other places.

5.26 Firstly, it is important to stress the fact that the Pesticides Forum does **not** involve ***all*** stakeholders, as there is **no** representative on the Pesticides Forum on behalf of those

[88] The *draft* UK National Action Plan (NAP) consultation document is available at:- http://www.defra.gov.uk/consult/files/consult-nap-pesticides-document-20120730.pdf
[89] Para 13 of the Impact Assessment for the *"The Plant Protection Products (Sustainable Use) Regulations 2012"* also points out the Pesticides Forum is a body "***which advises Ministers generally on the use of PPPs.***"
[90] The *draft* UK National Action Plan (NAP) consultation document is available at:- http://www.defra.gov.uk/consult/files/consult-nap-pesticides-document-20120730.pdf
[91] Ibid.
[92] Ibid.

directly affected and adversely impacted from exposure to pesticides and this is something that has always been of great concern to the UK Pesticides Campaign.

5.27 Secondly, as can be seen from the letter I sent to the Chairman of the Pesticides Forum on 18th June 2012 (and which I have previously provided to the clerks of the Environmental Audit Committee and which is available at:- http://www.pesticidescampaign.co.uk/documents/Letter%20to%20the%20Pesticides%20Forum%2018th%20June%202012.pdf) there are some serious issues with the Pesticides Forum annual reports, including the inclusion of a number of grossly inaccurate statements within the annual reports. These include such statements as that in the Executive Summary of the current 2011 report that states, *"The work of the UK Pesticides Forum in 2011 confirms that the use of pesticides is **not** adversely impacting on the health of UK citizens or the environment."* **This is simply not factually correct, and in fact even just going by the UK Government's *own monitoring system* it shows cases of acute effects recorded in members of the public each yea**r. As said this inaccurate statement is just one of a number of inaccurate statements contained within the Pesticides Forum annual reports each year.

5.28 Having recently investigated this issue it was confirmed by the Pesticides Forum Secretariat (which is provided by the CRD) that **no** Pesticides Forum member had dissented, or objected, to such statements prior to the publication of the 2011 annual report, and this included organisations that are supposed to be on the Pesticides Forum as organisations concerned about the adverse impacts of pesticides on human health and the environment (eg. the Pesticide Action Network UK (PAN UK), the Wildlife and Countryside Link and Sustain). The various members of the Pesticides Forum had plenty of time to raise any concerns seeing as the 2011 *draft* report was circulated to the Pesticides Forum members in February and yet was not actually published until May.

5.29 Further, the current 2011 report is not an isolated case, as this non-dissenting, and thus agreeing with and signing up to, the contents and inaccurate statements in the Pesticides Forum annual reports has actually been going on **for years,** as according to conversations that I have had with the Pesticides Forum Secretariat there was **no** dissenting to any of the same sort of statements from any of the Pesticides Forum members in relation to the 2008, 2009 and 2010 reports either. This means that UK Ministers are highly likely to have been informed by the regulators, the CRD, when highlighting the various Forum reports to those Ministers, that the reports had been agreed by **all members** of the Forum, including the various NGOs and purported and supposed environmental and consumer organisations that are members of the Forum.

5.30 It is of course absolutely imperative that any organisation that is involved in a Forum that provides advice to Ministers, (which is one of the main objectives of the Pesticides Forum as stated in each one of the Pesticides Forum annual reports), must know what it is signing up to and agreeing with, especially when that organisation purports to be representing a *link* of other organisations as well, as it could then look as if all those other organisations are also agreeing with the content of the Pesticides Forum reports.

5.31 It is, as said above, most certainly **not** correct for the Pesticides Forum reports to have maintained, since at least 2008, that "*the use of pesticides is **not** adversely impacting on the health of UK citizens or the environment*" and if I had not spotted this then who knows how many more years all the members of the Forum would have carried on non-dissenting, and thus agreeing with and signing up to, the same and/or similar grossly inaccurate statements within the contents of the subsequent Pesticides Forum reports.

5.32 It is also important to point out that the Pesticides Forum has always been dominated by industry based organisations. Therefore there is simply no proper, robust, **independent** consideration and evaluation in the UK of the various indicators and schemes that are in place regarding the health and environmental impacts of pesticides.

5.33 **Therefore, as said, there is serious concern regarding the Pesticides Forum as DEFRA Ministers have been receiving advice from the Pesticides Forum for many years, and yet year after year the Forum has wrongly asserted that, *"the use of pesticides is not adversely impacting on the health of UK citizens or the environment."* Considering the grossly inaccurate statements that the Pesticides Forum has continued to make year after year, effectively denying the adverse health and environmental impacts of pesticide use, then it is of *further* serious concern that it is intended that the Pesticides Forum be responsible for the monitoring and review of the UK's National Action Plan (NAP) on pesticides after it has been adopted.**

6. Conclusion

6.1 As pointed out earlier, the evidence I produced for the legal case clearly showed that the Government, DEFRA, PSD (now CRD), and ACP, have all continued to base decisions in relation to pesticides on the protection of industry interests as opposed to what is absolutely required as the number one priority of pesticide policy and regulation – **to protect public health**. Yet in the UK, DEFRA has previously stated[93] that there is not supposed to be a trade off when it comes to the risks to health from pesticides with the benefits and that if there is scientific evidence that use of a pesticide *may* harm human health that is to be considered unacceptable, and that approval for use would be refused, whatever the benefits. However, paragraphs 195 to 206 of my second Witness Statement from the legal case detailed the evidence to show that the Government has continued to adopt the improper approach of *balancing* harm to human health against the (supposed) benefits of pesticide use, in which the Government is accepting a degree of damage to human health on the basis that *it believes* it is outweighed by other benefits (eg cost/economic benefits for farmers and the industry), <u>rather than adopting the absolute protective approach that is required under EU law for the protection of human health.</u>

6.2 As said earlier, it is absolutely clear from the text of both the former EU Directive 91/414, and the new EU legislation consisting of the PPP Regulation, and the SUD, **that there should be no balancing of interests when it comes to public health protection**.

6.3 It is important that the Environmental Audit Committee enquiry also looks into what is going on behind the scenes and the inappropriateness of the UK structure and regime for assessing the safety of pesticides, as it does not matter how much unarguable and indisputable evidence exists regarding the adverse impacts of pesticides, successive Governments' have been absolutely determined at all costs to maintain the status quo and to appease the interests of the industry, at least this has been the case re. human health.

7. Recommendations for Action

Options for the protection of residents in the EU legislation (PPP Regulation and SUD)

7.1 As a direct result of the work of the campaign I run, the UK Pesticides Campaign, the new EU legislation consisting of the PPP Regulation, and the Sustainable Use Directive,

[93] Joint Memorandum *"Progress on Pesticides"* submitted by DEFRA and HM Treasury to enquiry by the Environment, Food and Rural Affairs Committee (20.10.2004).

contains a number of critical measures for the protection of residents, including a new legal obligation for farmers and other pesticide users to provide information to residents and others on the pesticides they use (Article 67 of the PPP Regulation); [94] and the option for a new legal requirement in the statutory conditions of use for residents to be provided with prior notification before spraying (Article 31 para 4(b) of the PPP Regulation).[95]

7.2 However, most importantly, Article 12 of the Sustainable Use Directive (SUD) includes the option for the prohibition of pesticide use in areas used by the general public, or by *"vulnerable groups"*, a term which is clearly defined in Article 3, paragraph 14 of the new EU PPP Regulation as including **residents *"subject to high pesticide exposure over the long term"*** as a result of living in the locality of pesticide sprayed fields.[96] Article 12 is a vital clause. Considering that the majority of poisoning incidents and acute adverse health effects that are recorded annually in the UK Government's *own monitoring system* are from crop-spraying, then as said earlier, the prohibition of the use of pesticides in the locality of residents' homes, as well as schools, children's playgrounds, hospitals, and public areas is absolutely crucial for public health protection, especially that of vulnerable groups, as pesticides should never have been approved for use in the first place for spraying in the locality of any of these areas. Considering the risks, and acute and chronic adverse health impacts of pesticide use, then a preventative approach must be utilized, especially in relation to the protection of vulnerable groups including residents, babies, children, pregnant women, and those already ill. As said earlier, considering that studies have shown that pesticides can travel in the air for **miles** then the distance of the area where the use of pesticides is prohibited needs to be **substantial**. The areas where the use of pesticides is prohibited can of course still be managed/farmed using non-chemical farming methods. This would include rotation, physical and mechanical control and natural predator management. See below *"The Prioritisation of Non-Chemical Methods."*

7.3 These aforementioned measures are all measures that the UK Pesticides Campaign has been calling for since the outset of the campaign at the beginning of 2001 and it is critical that all these measures are **<u>mandatory</u>** and must be introduced into the statutory

[94] Article 67 of the European PPP Regulation 1107/2009 can be seen at:- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0001:01:EN:HTML
[95] Article 31 para 4(b) of the European PPP Regulation 1107/2009 can be seen at:- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0001:01:EN:HTML
[96] The new definition for *"vulnerable groups"* in Article 3, para 14 of the European PPP Regulation 1107/2009 can be seen at:- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0001:01:EN:HTML

conditions of use for the authorization/approval of *any* pesticide to *finally* protect the health of residents and other members of the public from exposure to pesticides.

7.4 Article 31 of the European PPP Regulation under *"Contents of authorisations"* states at para 4(a) that *"The requirements referred to in paragraph 2 may include the following: (a)* ***a restriction*** *with respect to the distribution and use of the plant protection product* ***in order to protect the health of*** *the distributors, users, bystanders,* ***residents****, consumers or workers concerned or the environment, taking into consideration requirements imposed by other Community provisions; such restriction shall be indicated on the label."* [97]

7.5 Therefore the EU legislation includes provisions that Member States can adopt regarding requirements for specific restrictions of use for the protection of residents' health.

7.6 It is of great concern among residents in the UK that certain measures within the EU SUD and EU PPP Regulation are not currently being implemented correctly by the Government, as DEFRA's response has been to, as ever, effectively maintain the status quo and not to bring in any mandatory measures to protect rural residents from exposure to pesticides, and to just continue to rely on industry-led voluntary measures only. Yet reliance on existing or enhanced voluntary approaches will not change anything and thus will not provide any public health protection, as voluntary measures have existed for decades, have not worked, however many times they are repackaged, and are completely unacceptable in this situation. Most importantly of all, DEFRA officials previously advised DEFRA Ministers in June 2006 that, ***"…voluntary measures can only be used where there is no health risk to residents and bystanders…"***[98] Therefore DEFRA Ministers and officials are well aware that in the situation where the health risks and adverse effects are already accepted, (including in the Government's own monitoring system), then **voluntary measures are not an option and thus should never have been relied upon in the first place in a situation where public health is at stake**.

7.7 Members of the public have continued to raise their concerns and/or report adverse health impacts to decision makers, Ministers, MPs, other politicians, over the use of pesticides, particularly in relation to agricultural pesticide spraying, and the lack of any measures in

[97] Article 31 para 4(a) of the European PPP Regulation 1107/2009 can be seen at:- http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0001:01:EN:HTML
[98] Taken from paragraph 94 of a document formulated for Ministers consideration by DEFRA's *Chemicals and Nanotechnology Division"* in June 2006.

the Government's existing policy to protect public health, especially rural residents and communities exposed to pesticides from living in the locality of pesticide sprayed fields.

7.8 The factual evidence clearly confirms the fact that in relation to the exposure of residents **more than enough evidence already exists** (evidence of AOEL exceedances; harm to the health of residents and others exposed, including in the UK Government's *own monitoring system* etc.) **for action to be taken now** with the introduction of mandatory measures for the protection of residents health, and that are very long overdue.

7.9 **Therefore DEFRA needs to urgently amend its policy and approach regarding pesticides, and must urgently implement all the aforementioned specific requirements for the protection of residents (at paras 7.1 to 7.5). Ministers must finally put the protection of the health of UK citizens first and foremost in its policy**.

The Prioritisation of Non-chemical Methods

7.10 There is no doubt that the widespread use of pesticides in farming is causing serious damage to the environment, wildlife and, above all, human health. A long-term approach is needed, rather than inadequate measures aimed at addressing problems only in the short-term. This problem is not going to be solved by simply *papering over the cracks* as the whole core foundations and structure on which the current UK policy and approvals system operates is inherently flawed. For example, it would **not** solve the very deep seated and fundamental problems that exist by merely ***reducing*** the use of pesticides **as just one single exposure could lead to damage to the health of humans, bees or other species**; nor will the problems be solved by merely substituting one pesticide for another.

7.11 The only real solution to **eliminate** the adverse health and environmental impacts of pesticides is to take a **preventative approach** and avoid exposure altogether with the widespread adoption of truly sustainable **non-chemical farming methods**. This would obviously be more in line with the objectives for sustainable crop production, as the reliance on complex chemicals designed to kill plants, insects or other forms of life, cannot be classified as sustainable.

7.12 Considering the health and environmental costs of using pesticides it makes clear economic sense to switch to non-chemical farming methods. **It is a complete paradigm**

<u>shift that is needed, as no toxic chemicals that have related risks and adverse effects for any species (whether humans, bees or other) should be used to grow food</u>.

7.13 In 2003 the then DEFRA Minister for Food and Farming, Lord Whitty, stated that, *"**Reducing reliance on pesticides <u>is a priority</u>, and we want to find alternative, more environment-friendly pest controls for farmers and growers."*** However, this statement has never been backed up by **<u>any</u> real action** by either the previous Government, or the current coalition, to move away from chemical dependency and the strong ties with the agro-chemical industry to the development of sustainable non-chemical farming methods.

7.14 One of the main objectives/aims of the new EU legislation is to shift policy towards the utilisation of **non-chemical farming methods** in order to reduce dependency on pesticides. **<u>Therefore the Government needs to prioritise as a matter of urgency the promotion and encouragement of the use of non-chemical methods in the UK.</u>**

7.15 Incidentally, it is important to stress the fact that the system called **Integrated Pest Management (IPM)** is **<u>not</u>** the same as non-chemical methods. IPM is a system **<u>that still uses pesticides to some degree</u>** (whichever definition one goes by). To give an example of my own experiences of IPM in the UK, the farmers that were farming the fields next to our property insisted they used IPM, and yet they were known to spray 30 times in 6 months with mixtures of different pesticides! Therefore in *reality*, and in practice, IPM does not necessarily involve lower pesticide use. IPM is a weaker and a far more compromised system compared to utilising complete **<u>non-chemical</u> farming systems**.

7.16 To give a further example of the differences between IPM and non-chemical methods see the article at:- http://www.enewspf.com/latest-news/science-a-environmental/31034-connecticuts-historic-pesticide-legislation-threatened-by-ipm-bill.html. Although the article is largely related to the use of pesticides on lawns (and in Connecticut) note it says,

*"In the years since the original bill was introduced by state senator Ed Meyer, a robust natural lawn industry has sprung forth in an around Connecticut. Numerous groundskeepers have adapted practices that allow for the maintenance of excellent playing fields — **yet the synthetic chemical industry has never stopped lobbying the legislature to roll back the protection to include "integrated pest management." <u>IPM allows for synthetic chemical pesticides at the discretion of the licensed applicators.</u>"***

"The pro-pesticide strategy is to call the elimination of the pesticide ban 'Integrated Pest Management,' <u>but what it really stands for is business as usual,</u>" *said Dr. Jerome Silbert, a* *pathologist from Connecticut.* ***"If this bill (5155) passes it will be a major setback for the protection of young children from involuntary exposure to toxic lawn pesticides."***

"This was well thought out and well explored law by all parties," said Alderman. ***"The state should not roll this law back because industry and SOME grounds keepers would like to use pesticides again under the guise of Integrated Pest Management. <u>When IPM has been mandated in other states it has proven to be unenforceable — because it allows pesticides — and once pesticides are allowed one cannot tell how much or how many times they are used. IPM has not proven to be a workable method when mandated for schools</u>."***

7.17 Therefore, as said above, IPM is **<u>not</u>** the same as non-chemical methods. The problems with pesticides will not be solved by IPM. As said, it is a complete paradigm shift that is needed to shift policy away from the dependence on pesticides altogether.

7.18 The adoption of the new European legislation, with the key objective and aim of utilizing non-chemical methods to reduce dependency on pesticides, gives the coalition Government the chance to overhaul the existing policy and approach in order to make the protection of public health the number one priority of the UK Government's policy and regulations. A different approach is urgently needed and is very, very long overdue.

7.19 Please note that any comments made by me are, of course, **<u>Without Prejudice</u>** to the position taken by me, and the evidence and arguments advanced by me, in my legal case, both through the domestic courts, and before the European Court of Human Rights.

9 November 2012

Written evidence submitted by Professor Graham Stone, University of Edinburgh

Summary points:
1. The value of the pollination ecosystem service to UK agriculture and biodiversity is enormous.
2. Pollination services require healthy pollinator populations of suitable species that are both growing (or at least stable), and functioning efficiently.
3. Pesticides, including neonicotinoids, have been designed to target fundamental insect systems. Our default expectation must be that, even at sub-lethal doses, their impacts on beneficial insects will never be good.
4. Impacts on pollinators can be complex and delayed.
5. There is reason to expect that combinations of pesticides could have synergistic effects on insect health.
6. We know neonicotinoids reduce UK bee performance, but we don't really know why.
7. Impacts of pesticides are very likely to vary among pollinator groups.

Conclusions.
1. We know too little about non-target impacts of neonicotinoids to assume that there is little or no risk to UK pollinators under current application regimes.
2. Given the value of pollination services, there is an urgent need to invest in the research necessary to address the 'known unknowns'.
3. It would probably be unwise to extrapolate from research on bees to behavioural and population effects on non-bee pollinators.

Each summary point, expanded.
1. The value of the pollination ecosystem service to UK agriculture and biodiversity is enormous, and could not be achieved without insect pollinators (POST 2010; Breeze et al 2012). It is prudent therefore to know about non-target effects before deploying any pesticides. **History shows** that failure to understand impacts of toxins on non-target species and natural communities only ever has an unhappy ending.

2. Pollination services require healthy pollinator populations of suitable species that are both growing (or at least stable), and functioning efficiently (healthy) (Breeze et al 2012).

3. Pesticides, including neonicotinoids, have been designed to target fundamental insect systems (Nauen and Denholm 2005; Aliouane et al 2009). Our default expectation for such toxins must be that, even at sub-lethal doses, their impacts on beneficial insects will never be good (Desneux et al 2007). That they do not cause harm should be based on evidence, rather than absence of evidence – and there are a lot of important things we don't know very much about.

4. Impacts on pollinators can be complex and delayed. Beyond rapid killing of insects, neonicotinoids are known to have complex and longer-term effects on individual and colony performance. In social bees, exposure to neonicotinoids reduces pollen collecting ability and ability to return safely to the nest from foraging trips (Gill et al 2012; Henry et al 2012). Reduced pollen-collecting ability may explain why neonicotinoid-exposed bumblebee colonies are less able to invest resources in queens for the next generation (Whitehorn et al 2012). While argument continues over the magnitude of these effects in fully natural situations, these effects can only ever have negative impacts on the quality of pollination service delivered, and the status of bee (and other pollinator) populations.

5. There is reason to expect that combinations of pesticides could have synergistic effects on insect health because different pesticide groups target different fundamental systems. Neonicotinoids target systems using one type of nerve transmission (cholinergic), while phenylpyrazoles such as Fipronil target another (glutamergic) (Pfluger and Duch 2011). These nervous systems fulfil different roles in the body: for example, cholinergic nerves are involved in collection of information and processing by the insect brain (Pfluger and Duch 2011), while glutamergic nerves are involved in operation of the main flight muscles (which in social bees are also associated with generation of heat for nest incubation, and in solitary bees, large hoverflies and some butterflies are required for essential pre-flight warm-up) (Heinrich 1993). Because foraging and other pollinator behaviours often involve both information processing and flight, we should explore the extent to which different pesticide combinations interfere with them.
Recommendation: impacts of combined pesticide exposure should be studied as a matter of urgency.

6. We know neonicotinoids reduce UK bee performance, but we don't really know why. Though some of the impacts of neonicotinoid pesticides on insect physiology are known, we still cannot explain the observed effects on honeybee and bumblebee behaviour.

We know which physiological systems are most likely to be targeted by neonicotinoids (see evidence submission from Dr. Chris Connolly, Dundee University; Desneux et al 2007), and we also know about some impacts on individual bee behaviour (e.g. Gill et al 2012). Neonicotinoid exposure is associated with longer foraging trips, lower rates of pollen harvesting, and higher forager mortality through non-return to the nest (Henry et al. 2012). These changes reduce the resources flowing into a bee colony, and result in reduced queen production in bumblebees (Whitehorn et al 2012).

The decline in foraging success could be attributable to collapse of a key metabolic system (such as the flight muscles, whose ability to generate internal heat is essential for flight and warming of the nest) or to neural processing of information (ability to recognise flowers and rewards, ability to communicate information to nest mates, and to navigate home safely) (Desneux et al 2007; Henry et al 2012), or any combination of these and other systems. We urgently need more research on the organ-system and whole animal level impacts of pesticides on bees and other pollinators.
Recommendation: System-level effects of neonicotinoids singly and in combination with other pesticides should be explicitly studied.

7. Impacts of pesticides are very likely to vary among pollinator groups. We should not extrapolate to other groups from known impacts on social bees. Pollinator groups (e.g. social bees, solitary bees, hoverflies, butterflies) differ in how individual foraging success is linked to reproductive success, and face different routes of pesticide exposure.

(a) Social bees versus solitary bees. To date, almost all work on the effects of neonicotinoids has been carried out on honeybees and bumblebees (see DEFRA research programs at http://randd.defra.gov.uk/). These social species can respond to challenging conditions by altering the proportion of workers doing different jobs, and how much resource they invest in making workers versus making reproductive adults (e.g. Whitehorn et al 2012 and Gill et al 2012 for bumblebees). However, solitary bee females are required to carry out all of these roles, building and stocking each cell with collected provisions before laying their egg (Stone 1994). They cannot make the same resource allocation decisions as social bees, or benefit from warmth/nectar gathered by nestmates, and may be more vulnerable to non-lethal pesticide effects. We also need to know how neonicotinoids impact on the courtship and mating behaviours of male solitary bees, which are far more diverse than those seen in social species, and directly linked to successful reproduction.

Recommendation: neonicotinoid impacts on solitary bees should be explicitly investigated using model systems such as the red mason bee, *Osmia bicornis* (= *O. rufa*).

(b) Bees versus other pollinators. Bees differ from other pollinators in that their reproductive output depends directly on how much pollen the adult females can collect. Any factor that reduces a bee's ability to recognise, harvest or carry pollen back to its nest will influence its reproductive rate. Exposure to pesticides through food is via nectar (adults) and pollen (larvae).

Other pollinators have different links between the food they harvest from flowers and their reproductive rate. For example, adult female hoverflies feed on pollen and/or to mature their eggs (and so are exposed to systemic pesticides in pollen/nectar) (Gilbert 1981), but this is not directly linked to how many offspring they have. The larvae of many hoverflies feed on other insects, and have additional potential routes of pesticide intake (for example, from aphids feeding on a sprayed or seed-dressed plant). Butterflies are different again, and do not need the nectar they feed on to mature their eggs. They are exposed as adults to pesticides in nectar, and as larvae to any pesticides in their food plant.

Recommendation: this simple overview suggests that it would be unwise to extrapolate from research on bees to behavioural and population effects on non-bee pollinators.

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20 November 2012

Written evidence submitted by the Department for Environment, Food and Rural Affairs

Summary

- Defra is pleased to have the opportunity to present its thoughts on this issue and to set out some of the work we are doing.

- Bees and other insect species are an essential facet of the natural world and play a very important economic role as pollinators. We therefore carry out a considerable amount of work to conserve important insect groups and some of that work is outlined in this memorandum.

- Some insects, however, are a problem for economic activity in several areas, including agricultural production and food hygiene. Insecticides are therefore valuable tools and farmers and others should be able to use them when this can be done without putting people or the environment at risk. Defra therefore supports and maintains strict regulation of insecticides and other pesticides. The basis of the regulatory system is the assessment and management of risks to human health and the environment.

- Published studies have indicated that neonicotinoid insecticides could have sub-lethal effects on bees which are sufficiently disruptive of their normal functions to have adverse consequences for populations. Some stakeholders have pressed us to respond to this by banning neonicotinoids, others have argued against such a course. Defra’s role in this case is to assemble all the evidence, consider it carefully and fully and to reach a decision on the best course. We have consistently made it clear that we will restrict or withdraw authorisations of pesticides containing neonicotinoids if the evidence calls for this.

- We therefore ensure that new research is assessed alongside the existing evidence. The most recent such assessment was completed in September, under the direction of Defra’s former Chief Scientific Adviser, Professor Sir Bob Watson. The work was carried out by Government scientists and independent experts, taking full account of parallel work by the European Food Safety Authority. Their findings were considered by Professor Watson. His successor, Professor Ian Boyd, was sighted on this final stage and was content with the approach taken and overall conclusions drawn. Following Professor Watson’s recommendations, the Government drew three key conclusions.

- First, it was time to update the process for assessing the risks of pesticides to bees in the light of developments in the science - including the latest research. This exercise should include the development of a new risk assessment for bumble bees and solitary bees, alongside an updated risk assessment for honey bees. This work is being taken forward in Europe and

UK experts are active in this. The aim is to complete this highly complex task by the end of 2012.

- Second, further research was needed to fill identified evidence gaps, including the questions raised about the relevance of the recent studies to field conditions. The Government had already put new research in place to explore further the impacts of neonicotinoids on bumble bees in field conditions and to understand what levels of pesticide residues and disease in bees are normal.

- Third, the studies considered did not justify changing existing regulation. However, the research that we had put in hand and the on-going work in Europe to develop the risk assessment could change the picture and it would always be possible that further new evidence may emerge. As our knowledge developed, we would continue to consider the need for further research and for any changes to the regulation of pesticides containing neonicotinoids.

- Contrary to some reports, the action we have taken to date and the conclusions we drew from the September review are in step with most of the other regulatory bodies in Europe.

- Further research under the Insect Pollinators Initiative, which is part-funded by Defra, was published online on 21 October (Gill et al, Combined pesticide exposure severely affects individual- and colony- level traits in bees, doi:10.1038/nature11585). Defra has taken the views of the independent Advisory Committee on Pesticides on this study. The Committee advises that the study reinforces existing knowledge that sub-lethal effects with potential implications for colony survival are found in the conditions applied in laboratory studies. However, it does not fill gaps in knowledge about exposure in the field and about evidence of actual damage in the field.

- Defra has work in place to address these points. We have asked the researchers to complete their work as quickly as possible without jeopardising its quality. We expect this to be done by the turn of the year. In the meantime, we are examining the human health, environmental and economic consequences of possible options for regulatory action.

- This issue is not closed and we do not regard all the questions as answered. We recognise that there are real concerns which need to be addressed as fully and rapidly as possible. We are bringing forward our own research and will consider its results and implications for the assessment of risk as soon as they are available. We are also ensuring we have clear view of which options for regulatory action might prove effective and proportionate.

Introduction

1. In announcing its Inquiry into the impact of insecticides on bees and other insects, the Committee said that it would examine the analysis published by Defra on 18 September on the effects of neonicotinoid insecticides on bees. Under this heading, the Committee highlighted several issues: the basis on which Defra decided not to change existing regulations at this stage, whether this decision is justified by the available evidence, and why the Government decided not to follow other European countries in temporarily suspending the use of insecticides linked to bee decline. The Committee also identified other specific issues for particular examination:

- The application of real-world – "field" – data. What monitoring there is of actual – rather than recommended - levels of pesticide usage, and the extent to which that influences policy on pesticides

- Any potential impacts of systemic neonicotinoid insecticides on human health

- What alternative pest-control measures should be used, such as natural predators and plant breeding for insect-resistance, in a bid to make UK farming more insect- and bee-friendly

2. This Memorandum sets out:

(a) relevant background information on the regulatory system for pesticides;

(b) the current regulation of neonicotinoids in the EU, UK and other Member States;

(c) the Defra review published in September;

(d) the further work we have carried out since September, including examination of the Gill *et al* paper in Nature, and our future plans;

(e) the use of real-world monitoring data;

(f) potential impacts of neonicotinoids on human health;

(g) the scope for making UK farming more insect-friendly, including the use of alternative pest-control methods.

A. The regulatory system for pesticides

3. Pesticides have been regulated in the UK for 25 years, regulation replacing an earlier non-statutory scheme. Over the past 20 years, they have increasingly been subject to EU rules. These rules distinguish between two types of pesticides: plant protection products (PPPs, which include most pesticides used in agriculture and horticulture) and biocidal products (intended to destroy or control organisms in a

range of non-agricultural situations). Some insecticides are biocides, for example products for controlling house flies or ants. However, the main concerns related to exposure of bees have been in relation to plant protection products and so this is the system described in this memorandum.

4. Under Regulation (EC) No 1107/2009, plant protection product active substances are approved at EU level. Active substance approvals are normally for ten years and are then subject to complete reassessment according to current standards. Both the EU and individual Member States are able to carry out an earlier reassessment if new information of concern comes to light.

5. If an active substance meets EU safety requirements, products containing that active substance can be authorised at Member State level. This authorisation is carried out according to common rules set by EU regulation, but there is a degree of discretion to take account of national circumstances.

6. Regulation 1107/2009 sets out the circumstances in which Member States may review authorisations and may withdraw or amend authorisations. The Regulation also sets out the circumstances in which it is possible to prohibit the use of treated seeds.

(a) Risk assessment

7. Authorisation or approval is only granted following assessment of scientific data on risks. This risk assessment covers:

- risks to human health through all routes of exposure, including air, water and food

- risks to the environment – taking account of the pesticide's fate and distribution in the environment (including water, air and soil), its impact on non-target species and its impact on biodiversity and the ecosystem

- the efficacy of the product. This part of the assessment considers whether the product is effective in controlling agronomically significant pests. Approval will be refused if the product is not sufficiently effective or if the target pest is not a significant economic threat.

8. The human health assessment is outlined at paragraphs 59 to 64 below. The environmental risk assessment evaluates risks to honey bees and to two other non-target arthropods as representative species (this part of the risk assessment is outlined in **Annex 1**) but not, separately or specifically, risks to other bee species.

9. It is recognised that risk assessment cannot fully reflect what will happen in real life situations. For example, it is not considered appropriate to carry out tests of the toxicity of pesticides on people and so careful use is made of animal tests with an additional factor built in to take account of inter-species variation. In the case of environmental risk assessment, it is clearly not possible to take full account of every variable. Uncertainty factors and conservative assumptions are therefore used with the aim of achieving a high degree of confidence that decisions are sufficiently protective.

(b) The approvals procedure for active substances

10. It is the job of the company which wishes to gain approval to put together the necessary scientific data to support its application. To this end, companies commission and fund the studies that are submitted to the pesticides regulatory authorities. The studies must be conducted to internationally recognised guidelines and have verified Good Laboratory Practice and quality assurance certification.

11. The studies commissioned in support of an approval application are sometimes described as secret, but that is not an accurate portrayal. These studies carry data protection rights under EU legislation, which means that they cannot be used by other companies to gain authorisation. However the data is accessible through access to information arrangements such as those under the Freedom of Information Act and Environmental Information Regulations. These access rights to the regulatory studies have been used in respect of neonicotinoids.

12. In addition the Government recognises the value of having the data more readily available for wider review and has suggested to the pesticide manufacturers that it would be a good idea to publish their studies. Syngenta tell us that their long-term over-wintering bee field trial data has been submitted for publication to a scientific journal and is currently going through the peer review process.

13. The applicant submits all of the information including study methodology and data generated, together with their own conclusions, in the form of a Dossier. The Dossier need not consist only of studies commissioned by the applicant for regulatory purposes. It will also include published data, including academic studies where these exist and are relevant. There is a specific requirement for this in article 8(5) of Regulation 1107/2009, which states:

> "Scientific peer-reviewed open literature, as determined by the Authority [meaning the European Food Safety Authority], on the active substance and its relevant metabolites dealing with side-effects on health, the environment and non-target species and published within the last 10 years before the date of submission of the dossier shall be added by the applicant to the dossier."

14. The Dossier is scrutinised and assessed by a regulatory authority's experts in all of the various scientific disciplines involved. The regulatory authority's opinion - which may or may not coincide with that of the company – is set out in a Draft Assessment Report (DAR). The DAR produced by the regulatory authority of a Member State is then submitted to the European Food Safety Authority (EFSA), which organises a further scrutiny (known as peer review) by experts from all of the EU Member States. Following this peer review, EFSA sends its conclusions to the Commission. This is used as the basis for a proposal from the Commission for approval or not of the substance and any associated conditions. This proposal is adopted (or not) by qualified majority vote of Member States. The DARs and EFSA conclusions are published on the EFSA website (http://www.efsa.europa.eu). Commission decisions are published in the Official Journal of the European Union and on their website.

(c) The role of EFSA

15. EFSA was set up in January 2002, as an independent source of scientific advice and communication on risks associated with the food chain. For pesticides work, EFSA deals with risk assessment issues, including for the environment, and the European Commission is responsible for the risk management decision. EFSA is responsible for the peer review of active substances used in pesticides. It also gives scientific advice on broader issues that cannot be resolved within the peer review of active substances and provides scientific guidance on more generic issues, commonly in the fields of toxicology, eco-toxicology or the fate and behaviour of pesticides. The EU rules for the authorisation of pesticides allow the Commission to seek EFSA's views on new evidence on the safety of a pesticide or active substance; it is this provision that the Commission used in asking EFSA to review the recent studies on neonicotinoids and bees.

(d) The overall picture on approvals

16. Since the European system came into force in the early 1990s, the number of active substances approved for use in PPPs has reduced from over 900 to around 400. Some new active substances have been approved, but many more existing active substances have had their approvals withdrawn. In some cases this was because concerns were identified. In others, companies have taken the view that the costs of taking a substance through review are not justified by the likely future income from sales.

17. The picture is similar for product authorisations. In particular, the costs of authorisation have seen a steady reduction in the range of products available to tackle pests, weeds and diseases in the horticulture sector. This has implications for the ability of growers to produce crops and there are ongoing initiatives (both nationally and at EU level) to tackle the issue.

(e) PPP authorisations in the UK

18. In the UK, Defra has lead responsibility for plant protection products. The regulatory system is run, under our direction, by the Chemicals Regulation Directorate of the Health and Safety Executive (CRD). Plant protection products can only be sold or used if they are authorised and conditions are routinely attached to authorisation (for example specifying crops, dose rates, timing and protective equipment) to ensure protection of human health and the environment (including wildlife). The Advisory Committee on Pesticides (ACP) provides independent, impartial and expert advice on pesticides and the control of pests.

B. The regulation of neonicotinoids

(a) EU approvals for neonicotinoids

19. Five neonicotinoids have been approved by the EU according to the process set out in section A above. EU legislation agreed in 2010 sets specific provisions relating to the use as seed treatments of three neonicotinoids (clothianidin, imidacloprid and thiamethoxam) and a non-neonicotinoid pesticide called fipronil which has some similar properties. These provisions relate to labelling of pesticide-treated seed, a requirement for professional application of seed treatments to seed,

and monitoring for possible impacts on bees. These requirements were not applied to acetamiprid and thiacloprid, which are little used as seed treatments (and not at all in the UK) and show acute toxicity to bees several orders of magnitude less than the other three neonicotinoids (acetamiprid and thiacloprid are cyano-substituted neonicotinoids while the others are nitroguanidine-substituted).

(b) Authorisations of neonicotinoids in the UK and other individual EU countries

20. The UK has authorised products containing each of the five neonicotinoid active substances approved by the EU. It is often reported that neonicotinoids have been banned in a number of EU countries and that the UK is thus out of line. The facts are rather different. All 27 EU member states allow the use of neonicotinoids. Four of these countries currently restrict particular uses and our understanding of their position is as follows:

- France. Imidacloprid suspended for seed treatments on sunflower (since 1999) and maize (since 2004). One seed treatment for oilseed rape (Cruiser OSR, containing thiamethoxam) was banned earlier this year.

- Germany. Clothianidin, imidacloprid and thiamethoxam suspended as seed treatments for maize since 2008. Some emergency authorisations (allowing short term use to address particular pest pressures) have since been granted for this use.

- Italy. Clothianidin, imidacloprid and thiamethoxam suspended as seed treatments for maize since 2008. Suspensions reviewed annually.

- Slovenia. Clothianidin and thiamethoxam suspended as seed treatments for maize.

21. The suspensions in Germany, Italy and Slovenia followed particular incidents in which poor practice in treating and sowing seed led to bee kills due to the creation of excessive dust contaminated with neonicotinoids. Our assessment is that the risk of similar incidents in the UK is negligible. There are several reasons for that conclusion. First, the dose rates used in the seed treatment in Germany were almost double those which would be used in the UK. Second, the problems related to maize and drilling was taking place at an unusual time of year when adjacent crops were in flower. Third, seed treatments in the UK are carried out by professional contractors, which minimises the risk of a sticker not being applied (stickers help the pesticide adhere to the treated surface). Fourth, drilling equipment in the UK is either built differently or has been adapted so that it directs dust towards the ground, thus minimising the risk of drift.

22. The issues raised by the German, Italian and Slovenian incidents have been addressed by the additional controls set out in the EU legislation outlined at paragraph 19 above).

23. The basis for the recent French action is not entirely clear. The statement made cites a review by the French agency ANSES. However, ANSES did not call for a ban and its review (which covers similar ground to our work and that of EFSA) does not appear to justify the action. France asked the Commission to take action to

apply across the EU (this being a necessary step before national action can be taken). The Commission and most Member States were not in favour of EU wide action at this time. They noted that EFSA were carrying out the urgent consideration of the bee risk assessment process and were revisiting the current risk assessments for neonicotinoids.

24. Restrictions on neonicotinoids in other EU countries could provide an opportunity to study the benefits for pollinators (although any improvement in bee health could not simply be read across to the UK situation since the actions taken were in the most part related to problems that do not apply here). Italy has collected information through the APENET monitoring and research project. This was reviewed by EFSA (their statement is at http://www.efsa.europa.eu/en/efsajournal/pub/2792.htm). EFSA concluded that there were deficiencies in the study designs, weakness in the statistical analysis and incompleteness in the reporting of results. It was therefore not possible to draw a definitive conclusion. However, potential concerns were identified (including effects from dust exposure, sub-lethal effects and interactions with pathogens). These are being carried forward into the updating of the risk assessment procedure for bees.

C. The Government's analysis of the evidence and the conclusions drawn in September 2012

(a) The evidence considered

25. Insecticides by their nature are toxic to insects. The regulatory process seeks to establish whether the likely exposure of key species to insecticides is less than the amount that will cause harm. Over recent years, a number of academic studies have been published that suggest that neonicotinoids may have adverse effects on bees and – by implication – on other pollinator species. The suggestion is that these effects are sub-lethal but cause sufficient disruption to the normal functioning of bees to be a threat at the colony level.

26. Most of the studies have looked at the effect of a specific neonicotinoid on a specific species, normally honey bees or the buff-tailed bumblebee, Bombus terrestris. However, some have looked at combinations of pesticides or at the possible interaction of pesticides and diseases of bees.

27. A number of the studies were summarised in the Defra document published online on 18 September. These studies – which are not all of those that have been considered – are listed at **Annex 2**. The two most widely publicised studies, both published in Sciencexpress on 29 March 2012, are:

- Henry *et al* "A common pesticide decreases foraging success and survival in honey bees"

- Whitehorn *et al* "Neonicotinoid pesticide reduces bumble bee colony growth and queen production"

(b) Defra's use of the evidence

28. The regulatory controls on pesticides, explained in section A above are strong. However, the Government is not complacent and takes very seriously any threat to bees and other pollinators. Defra therefore looked very closely at the developing evidence with the aim of:

(a) identifying what is known about the various risks identified and their implications;

(b) what is not known and requires further investigation. Defra has funded a range of research on these issues in recent years;

(c) whether regulatory action is required. This could include restricting or withdrawing product authorisations; such measures have been taken in previous cases when found to be necessary.

29. Accordingly, the recent studies were assessed, along with the existing evidence (including Defra-funded research and the regulatory studies), by: the Chemicals Regulation Directorate (CRD) of HSE; bee experts in Defra's Food and Environment Research Agency (Fera); and the independent expert Advisory Committee on Pesticides (ACP). The ACP drew on the advice of CRD and Fera. Defra's Science Advisory Council (SAC) also reviewed ACP's use of some of the evidence; whilst SAC did not seek to reach conclusions on the evidence, it did identify a number of issues which the ACP took into account in drawing its own conclusions. The outcomes of the ACP's work are reported at paragraphs 30 to 33 below. UK experts have also been involved in work carried out by the European Food Safety Authority (EFSA) (paragraph 40 below) and drew on this in their own consideration. Alongside the consideration of the new studies, work has also been put in hand (see paragraphs 37 to 39) to fill several evidence gaps that have been identified.

The ACP's assessment

30. The ACP considered the issue at its meetings on 15 May and 3 July. The recommendations agreed following the 3 July meeting are set out in full at **Annex 3**. In summary, the ACP concluded that the current UK risk assessments are secure and recommended that there is no justification for regulatory action at present. Furthermore, there is no evidence as yet of neonicotinoid impacts on bees in the UK. However, the ACP will consider any new information as it arises and keep the situation under close review. The Committee supports the evidence gathering and development of the risk assessment that is in hand here and in Europe.

31. The ACP's conclusion was based on reconsideration of studies supporting the current authorisations for thiamethoxam products and on detailed examination of the recent publications in the scientific literature, with one of the ACP's environmental experts carrying out a careful examination of the raw data.

32. The regulatory field studies comply fully with current rules and also cover some additional aspects, such as over-wintering. The power of the studies to detect statistically significant changes is not established and they would not specifically detect all of the individual sub-lethal effects suggested by academic studies. However, hives exposed to treated crops did not show any gross effects on a wide

range of important endpoints when compared to control hives exposed to untreated crops.

33. While noting questions concerning aspects of the published studies by Henry et al and Whitehorn et al, the ACP does not discount their findings. The Committee believe these studies should be considered in the development of future regulatory guidance. Further research is merited to clarify the findings and their relevance to the UK field situation. The ACP noted that relevant work is already being taken forward with urgency. The Committee will keep this research, and its potential implications for authorisations, under review.

Defra's conclusions

34. Defra's conclusions, as set out in the 18 September published document, were:

"The new research has been considered alongside existing knowledge, including the studies submitted to support current regulatory approvals for the neonicotinoids. This work has been carried out by Government and independent experts, taking account of parallel work in Europe. The broad conclusions of this work are as follows:

- Some of the new studies provide evidence of sub-lethal effects of neonicotinoids in the conditions applied in the research.

- However, none of the studies gives unequivocal evidence that sub-lethal effects with serious implications for colonies are likely to arise from current uses of neonicotinoids.

- Existing studies submitted in support of the present regulatory approvals fully meet current standards. They do not explicitly address all the sub-lethal effects suggested by the academic research. However, they do cover a wide range of important endpoints and, in these studies, hives exposed to treated crops did not show any gross effects when compared to control hives exposed to untreated crops.

"Based on these findings, Defra has concluded that:

- It is appropriate to update the process for assessing the risks of pesticides to bees in the light of developments in the science - including the latest research. This exercise should include the development of a new risk assessment for bumble bees and solitary bees, alongside an updated risk assessment for honey bees. This work is being taken forward in Europe and UK experts are active in this. The aim is to complete this highly complex task by the end of 2012.

- Further research will be carried out to fill identified evidence gaps, including the questions raised about the relevance of the recent studies to field conditions. The Government has already put new research in place to explore further the impacts of neonicotinoids on bumble bees in field conditions and to understand what levels of pesticide residues and disease in bees are normal.

- The recent studies do not justify changing existing regulation. However, the research that we have put in hand and the on-going work in Europe to develop the risk assessment could change the picture and it is always possible that further new evidence may emerge. As our knowledge develops, we will continue to consider the need for further research and for any changes to the regulation of neonicotinoids."

The precautionary principle

35. The precautionary principle is normally taken from the text of the Rio Declaration on Environment and Development 1992. Principle 15 of the Declaration states "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

36. Defra fully accepts that the precautionary principle is applicable to considering the appropriate response to the potential effects of pesticides. In the present instance, it has a clear bearing on the issue of neonicotinoids and bees. Defra does not accept the suggestion that has been made that the application of the precautionary principle must lead inevitably to a decision to ban neonicotinoids. The precautionary principle guides decision-making when a serious potential risk has been identified and where, following the best possible risk assessment, there remains scientific uncertainty. It does not dictate the appropriate decision.

(c) Continuing to fill the evidence gaps

37. Defra has carried out research and development (R&D) around these issues over a number of years. The most recent completed projects include:

- PS2366 "Assessing the impact of guttation on non-target arthropods, design of extended lab and field studies". The aim of this project was determine whether the current methodology for risk assessment for sprayed applications can be adapted to include the residues present on the surface of leaves following systemic pesticide applications. Previous research indicated that the exposure of honey bees to pesticide residues in guttation fluid was unlikely to be a problem but it may be a problem to other non-target arthropods.

- PS2367 "Assessing the impact of pesticides on honeybee brood – evaluation of effects" was a literature review undertaken to identify the potential effects of pesticides on honeybee brood, for example mortality, reduced lifespan and their implications at the colony level. The report makes some recommendations for changes in the honeybee brood study design and concluded that the greatest determinant of over-winter survival is the health/age of the queen. The findings of this research were incorporated into the EFSA scientific opinion and will be used in designing future honey bee brood studies.

- PS2368 "Potential impacts of synergism between systemic seed treatments and sprayed fungicides in crops". This found, in certain cases, a degree of synergy between an insecticide and a fungicide in terms of acute lethal effects.

38.   All these reports have been sent to EFSA. Two further projects have been commissioned from Defra's Food and Environment Research Agency (Fera), both due to be completed and published by March 2013. Fuller project details can be found on the Defra website. In brief:

- PS2370 is focusing on the interpretation of pesticide residues and disease in honey bees. Dead bees are sometimes submitted under the Wildlife Incident Investigation Scheme. These are routinely screened for pesticides and low levels of pesticides are often found (an outline of recent data is at **Annex 4**). These residues are unlikely to have been the cause of death, but there is little scientific information on their significance. This new research will help us interpret the wildlife incident results by obtaining some apparently "healthy" bee samples from the bee inspectors own bee hives in both urban and rural environments and analysing them for pesticide residues and for disease levels. The hives will be inspected in summer, autumn and again early in 2013 to ensure that the bees survived the winter. For the major pesticide classes detected, the half life of the parent pesticides in live bees will be assessed to assist in interpretation of residues in live bees.

- PS2371 is designed to explore the findings of the Whitehorn *et al* study, using more realistic conditions. It is looking at real life edge-of-field exposure of bumble bees to neonicotinoid treated flowering oilseed rape (both spring sown and winter sown). The key objectives are:
    - To assess exposure of bumble bee colonies in clothianidin and imidacloprid treated oilseed rape
    - To assess the effects of exposure on colony development and production of drones and queens
    - To determine whether the effects reported following laboratory exposure of bumble bee colonies to neonicotinoid treated sucrose and pollen are observed following field exposure to flowering oilseed rape grown from neonicotinoid treated seed

39.   We have just commissioned some new research from Professor Goulson's team at Stirling University. PS2372 "Quantifying exposure of bumblebees to neonicotinoids and mixtures of agrochemicals" is due to start in February 2013 and will run for three years. The aim of this research is to quantify the actual exposure of wild bumblebees to sub-lethal doses of neonicotinoid insecticides in UK landscapes. Specifically the objectives are to:

(a)   determine levels of neonicotinoids in the nectar and pollen of the main UK flowering crops and in a selection of field margin/hedgerow wildflowers favoured by bumble bees (information on this is currently limited and this has been an issue in interpreting the findings of some of the recent academic research);

(b)   quantify the doses of neonicotinoids to which bumblebee colonies are exposed when naturally foraging in UK farmland;

(c)   quantify and compare exposure of wild bumblebee species.

(d) Developments in Europe

40. As pesticide regulation is harmonised across Europe, the EU dimension to consideration of this issue is important. The European Food Safety Authority (EFSA) is carrying out a number of pieces of work (in which UK experts are involved) including:

- EFSA's Panel on Plant Protection Products and their Residues published a Scientific Opinion on the science behind the development of a pesticide risk assessment for honey bees, bumble bees and solitary bees on 23 May. This is available at http://www.efsa.europa.eu/en/efsajournal/doc/2668.pdf and is a very substantial and significant review and analysis of the state of the science.

- The Opinion will be the basis for a Guidance Document for applicant companies and regulatory authorities in the context of the review of Plant Protection Products (PPPs) and their active substances under EU law. This guidance is due to be drawn up by the end of December and the draft issued for public consultation on 20 September is at http://www.efsa.europa.eu/en/consultations/call/120920.htm

- EFSA published a Statement on 1 June addressing the significance of the Henry *et al* and Whitehorn *et al* studies. This Statement is available at: http://www.efsa.europa.eu/en/efsajournal/doc/2752.pdf. In brief, their findings were:

  Comparing the Henry *et al* study with possible real life exposures, EFSA conclude that sub-lethal effects cannot be fully excluded in worst case situations. However, they note several uncertainties regarding the results**.** In particular, in the study, bees consumed the total amount of active substance within a relatively short period rather than during the course of a day. Depending on the substance properties and how fast the substance can be metabolised by the bees, this method of exposure could lead to more severe effects than may occur when bees are foraging.

  The concentrations tested on bumblebees by Whitehorn *et al*. were in the range of the maximum plausible exposure levels from imidacloprid in pollen and nectar. However, it is uncertain as to what extent the exposure situation in the study is representative of field conditions since bumblebees would need to forage for two weeks exclusively on imidacloprid-treated crops in order to be exposed to the same extent as in the study. Further consideration would be necessary to understand whether this situation may occur in intensive monoculture landscapes.

  The Defra research project PS2371, referred to in paragraph 39 above, will help to address the issues raised by EFSA on the Henry et al and Whitehorn et al studies.

- EFSA are reviewing the bees risk assessment for the three neonicotinoid active substances that have high acute toxicity to bees; this work is due to be completed by the end of 2012.
- A scientific report on “Interaction between pesticides and other factors in effects on bees” was published on the EFSA website in September. The report (by Fera) is at: http://www.efsa.europa.eu/en/supporting/pub/340e.htm

D. Defra’s further work following the publication of the Gill et al paper in Nature in October 2012

(a) The Nature paper

41. A paper by Gill et al “Combined pesticides exposure severely impacts individual- and colony-level traits in bees” was published in Nature on 21 October (doi:10.1038/nature11585). The study reported in the paper was funded under the Insect Pollinators Initiative (IPI), which was set up in 2009 to help to identify the main threats to bees and other insect pollinators. Defra provides about 25% of the funding for the IPI. The study is part of an IPI project looking at the impact of sub-lethal exposure to chemicals on the learning capacity and performance of bees.

42. The study considered the potential effects of exposing bumble bees (*Bombus terrestris*) to lambda-cyhalothrin (a pyrethroid insecticide) and to imidacloprid (a neonicotinoid insecticide). Early stage bumble bee colonies received long-term (4-week) exposure to imidacloprid and lambda-cyhalothrin, both individually and in combination. There were ten control colonies, ten colonies exposed to imidacloprid only, ten to lambda-cyhalothrin only and ten to a combination of imidacloprid and lambda-cyhalothrin. Bees from all colonies were able to forage outdoors. Foraging behaviour of individual workers was recorded using radio frequency identification tags (RFID).

43. The authors report that effects were seen on the behaviour of individual bees in the colonies treated with imidacloprid (either alone or in combination with lambda cyhalothrin). Effects at the colony level were seen in all the treated colonies (including those treated only with lambda-cyhalothrin) and these were most pronounced for the colonies treated with both pesticides. The observed effects for each treatment group are summarised in the table below.

Effect level	Effect type	Imidacloprid	Lambda Cyhalothrin	Mixture
Effects on individual behaviour	Number of foragers	+	ND	+
	Foraging bout frequency	ND	ND	-
	Amount of pollen collected	-	ND	-
	Duration of pollen foraging bouts	+	ND	+
Effects at colony level	Worker production	-	ND	-
	Brood number	-	ND	-
	Nest structure mass	ND	ND	ND
	Worker mortality	ND	+	+
	Worker loss	+	-	+
	Worker mortality and loss	ND	+	+

	Colony loss (n lost/n survived)	0/10	0/10	2/8
Significant increase (+) significant decrease (-) and no detected effect (ND) at the 5% significance level				

(b) The issues raised by the study

44. Dr Raine, one of the study authors, commented in the press release accompanying its publication:

"Policymakers need to consider the evidence and work together with regulatory bodies to minimize the risk to all bees caused by pesticides, not just honeybees. Currently pesticide usage is approved based on tests looking at single pesticides. However, our evidence shows that the risk of exposure to multiple pesticides needs to be considered, as this can seriously affect colony success".

45. This raises three issues:

(a) policy makers need to consider the evidence and work together with regulatory bodies. Defra completely agrees and this is very much our approach, as outlined in paragraphs 28 and 29 above;

(b) addressing the risk to all bees, not just honey bees. Again, Defra agrees that this is important. The fact that the current pesticides risk assessment only explicitly addresses the risks to honey bees and not to other types of bees is being addressed by the review being carried out by EFSA (see paragraphs 34 and 40);

(c) exposure of bees to multiple pesticides. Foraging bees may indeed be exposed to crops treated with different pesticides. The regulatory system does not look at every possible combination effect of multiple active substances – which would clearly be impractical with several hundred active substances and many more products. Risks are considered when multiple active substances are combined in the same product. The regulatory risk assessment builds in uncertainty factors and conservative assumptions, with the aim of ensuring that individual pesticides carry a very low risk of adverse effects.

(c) Defra's consideration of the Nature paper

46. The research which Defra has put in hand will produce results early in 2013 and should give greater clarity about the effects of neonicotinoids on bumble bees in field conditions. However, we have made it very clear that we will continue to assess any new substantial evidence that emerges. We have therefore carried out an urgent assessment of the Gill *et al* paper, informed by the views of CRD and the advice of the Advisory Committee on Pesticides.

47. The advice of the ACP is as follows.

"Recent research published in Nature by Gill et al was agreed to be well conducted. It adds additional information in suggesting a possible mechanism by which neonicotinoids may have an effect at population level. As such it reinforces the concerns already identified on the basis of the previously considered evidence.

"However it does not change the balance of evidence sufficiently to lead the ACP to recommend regulatory action on neonicotinoids in the absence of the additional work identified by the committee in July. The Committee advises that there are three key 'tests' required to assess the balance of evidence; toxicity, exposure, and evidence of effects occurring in the field.

"There is now a good body of evidence that enables an understanding of the toxicity of the neonicotinoids to bees. Critically, there is still a need to address the current gaps in knowledge about the extent to which the laboratory exposures in the current published data reflect the exposures experienced in the field. Ideally there is also a need to establish whether there have been any impacts on UK bee populations. The field work undertaken earlier this year and data on the health of UK bee colonies over the period during which the neonicotinoids have been used in UK agriculture will help to address these knowledge gaps. Results are awaited in early January.

"The Committee expects to be in a position to consider these data in January, and have noted that this short delay would not prevent effective regulatory action if the data indicate that this is required. The ACP noted that treated seed had already been sown this autumn, and that the much smaller proportion of spring sown seed would already be in the supply chain for the 2013 harvest. Any regulatory action on treated seed would thus mainly impact from the 2013 autumn sowings onwards.

"The ACP also considered a range of possible approaches that could be applied if restrictions on neonicotinoid use are required. The Committee asked the Chemicals Regulation Directorate to develop some more detailed scenarios taking into account a range of relevant factors."

(d) <u>The next steps</u>

48. There is good evidence of potentially serious sub-lethal effects on bees in the conditions applied in several studies. However, there still remains very little evidence in two crucial areas:

- First, the likelihood that effects seen in the laboratory would be seen in the field. Further information on this crucial issue will be provided by the Fera study PS2371 outlined at paragraph 38 above and the researchers are pulling out all the stops to get this completed quickly. There is still a degree of uncertainty as to how rapidly some of the analytical work can be completed, but the aim is to have a complete set of results for consideration at the turn of the year.

- Second, there is a lack of evidence of actual damage caused to bees by neonicotinoids in UK field conditions. This is also being tackled through Fera work to examine historic trends in neonicotinoid usage and honey bee health. This work will be carried through on the same timescale as the bumble bee study.

49. We have consistently said that we are fully prepared to act if the evidence on neonicotinoids shows a need. However, it currently remains the case that the main field data we have available for honey bees suggests an absence of effects, while field data on bumble bees is lacking. This is why PS2371 is important.

50. If and when the evidence indicates that action was needed, it would be important that careful consideration is given to several issues. It would clearly be necessary to ensure that any action taken was likely to be effective in removing unacceptable risks to bees from neonicotinoids. It would also be important to ensure that action did not have undesirable consequences for the environment or human health. Further, it should be proportionate. For example a blanket ban should not be imposed if more limited and targeted action would be effective. Defra has instructed CRD to put work in hand to enable us to understand better the likely consequences of possible regulatory options including the implications of alternative pesticides or pest control measures being taken. This work will be completed by the end of the year, so that the results are available for consideration alongside the results of the Fera bumble bee study.

51. The ACP has considered CRD's initial analysis of relevant issues when considering potential restrictions on the use of neonicotinoids. The Committee offered views on the further work needed. As part of the exercise, CRD are approaching several parties who may have useful information about the agronomic and economic implications. In doing so, CRD are making it clear that no decision has been taken and that their approach is not about the merits of taking regulatory action but about understanding its consequences.

52. We will move quickly to consider the new scientific and technical information when it is available. The Fera data is designed to address the absence of field evidence and, in line with our consistent stance, we will be ready to act if this research gives cause.

E. <u>The use of real-world data and monitoring of actual levels of pesticide usage</u>

53. There is a considerable body of monitoring work carried out. This looks at the quantities of pesticides used, how they are used, where they are found and the effects they have on people, wildlife and the wider environment. The main elements of this monitoring (the key schemes are described in more detail at **<u>Annex 5</u>**) include:

- Monitoring of pesticides residues in food.
- Pesticides Usage Surveys.
- Wildlife Incident Investigation Scheme.

- A variety of schemes monitoring human health, including the National Poisons Information Scheme (NPIS), Human Health Enquiry & Incident Survey (HHEIS) and Pesticides Incidents Appraisal Panel (PIAP).

- Tests of pesticide formulations – to see whether the pesticide products being sold are formulated in accordance with their authorisations,

- Monitoring of pesticides in surface and ground water undertaken by the Environment Agency for England and Wales and equivalent bodies in Scotland and Northern Ireland.

- Cross-compliance checks. Pesticides rules are covered in one of the Statutory Management Requirements which farmers need to meet in order to qualify for the full single payment and other direct payments.

54. The various current schemes for human health monitoring are being reviewed by the Pesticides Adverse Health Effect Surveillance Scheme Working Group (PAHES), a sub-group of the ACP. PAHES aims to define the strengths and weaknesses of existing systems for reporting of adverse health effects related to pesticides exposure and to assess the feasibility of developing an integrated system for the reporting, investigation and evaluation of exposure to pesticides in relation to human health. The PAHES report is currently being finalised.

55. The current suite of monitoring serves several purposes. The most important are:

- To allow the Government to verify that pesticides are being used according to their approvals; and
- To provide a check on the effectiveness of the regulatory risk assessment. When a pesticide is used in accordance with the terms of its approval, are the consequences as expected?

56. Information on usage is particularly valuable as a trigger for consideration of the reasons for change. Increases and decreases in use can result from changing pest pressures, the development of pest resistance or changes in user preferences between types of product and classes of chemicals.

57. Monitoring results are considered by CRD, the ACP and the Pesticides Forum. The Forum brings together a wide range of organisations representing those who make, use or advise on pesticides as well as environmental, conservation and consumer interests. It provides a mechanism for exchanging ideas and for encouraging joint initiatives to address particular issues. It also provides advice to Government on pesticide usage matters. In particular, it advises Ministers and others on how best to monitor the impacts arising from the use of pesticides (including the use of indicators).

58. Two examples of changes of approach to particular pesticides arising from monitoring are:

- the revocation of herbicides containing isoproturon (IPU) which was highlighted as a problem in water through monitoring as well as through risk assessment. In this case there was clear evidence on the effects of IPU on aquatic organisms, the standard risk assessment identified an unacceptable risk and water monitoring data indicated that IPU was found in UK waters at levels that would be expected to impact on aquatic organisms.

- stewardship measures introduced by industry for the potato sprout suppressant chloropropham following residues monitoring findings.

F. Potential impacts of systemic neonicotinoid insecticides on human health

59. Before any pesticides are authorised there is an extensive range of safety tests including investigations of acute toxicity, long term toxicity, carcinogenicity, reproductive toxicity, genotoxicity and neurotoxicity (most insecticides are neurotoxins). Safe exposures for people are usually determined using a 100 fold factor on no effect doses in experimental animals. In some specific cases higher factors are used. These factors are to take account of inter-species variation and variation in the response of different individuals (intra-species variation). Products are not authorised if the exposure estimates are above the safe levels.

60. There are two very broad circumstances in which people may be exposed to pesticides. First, they may be in or close to the treated area – as the person applying the pesticide, as a farm worker harvesting or handling a treated crop, as a bystander or as a local resident. Second, they may eat treated food. The pesticides risk assessment for human health considers the risks in these two main parts.

61. For ‘occupational’ exposures, no observed adverse effect levels derived from appropriate in vitro and in vivo animal studies are compared with estimates of exposure for users, bystanders and other workers, derived from models, or in some cases, from exposure studies.

62. The consumer risk assessment is based on exposure estimates developed from an understanding of the residues of the active substance and relevant metabolites that might occur in foodstuffs (including those of animal origin) that are derived from treated crops. This draws on data on actual worst case residue samples, and from surveys of the national diet. The resultant estimates are compared to relevant no effect levels from animal studies. Both acute and chronic dietary risk assessments are carried out.

63. The impacts of neonicotinoids on insects are largely the result of strong binding of the compounds to nicotinic receptors. The available data strongly suggests that the binding of neonicotinoids to mammalian nicotinic receptors is much weaker than to insect receptors. In addition, scientific studies show that neonicotinoids are not as potent in vertebrates (including humans) as they are in insects. Although this does not mean there are no effects in mammals, there is a higher margin between doses required to kill insects and doses of potential concern for people than is the case for some of the older insecticide active substances such as organophosphate compounds.

64. For each of the neonicotinoids clothianidin, imidacloprid and thiamethoxam, the table below illustrates the following three human health exposure scenarios:

(a) ADI - Acceptable Daily Intake. The ADI is the amount of a substance which can be ingested every day of an individual's entire lifetime without harm. The ADI is expressed as milligrams (mg) of chemical per kg body weight of the consumer. The ADI is derived from the most appropriate No Observed Adverse Effect Level (NOAEL) by applying an assessment factor, normally 100.

(b) ARfD - Acute Reference Dose. This is the quantity of a substance in food or water, expressed on a bodyweight basis, that can be ingested over a short period of time (usually one meal or one day) without appreciable health risk to the consumer.

(c) AOEL - Acceptable Operator Exposure Limit. This is the maximum amount of active substance to which the operator may be exposed without any adverse health effects. The AOEL is expressed in mg of the chemical per kg body weight of the operator per day. The AOEL is usually derived in terms of a systemic dose and is based on the most appropriate NOAEL by applying an assessment factor, normally 100, and any necessary correction for the extent of oral absorption.

		ADI (lifetime dietary)	ARfD (acute dietary)	AOEL (Operator or Bystander)
Clothianidin	mg/kg bodyweight	0.097	0.1	0.1
	% used *	<1	1.0	<1
Imidacloprid	mg/kg bodyweight	0.06	0.08	0.08
	% used *	10	20	6
	% used #	0.5	32	-
Thiamethoxam	mg/kg bodyweight	0.026	0.5	0.08
	% used *	5.0	‘no risk’	<1

* based on exposure estimates made as part of the regulatory risk assessment
# EFSA monitoring of pesticide residues in food for 2009 (only imidacloprid cited)

G. Scope for using alternative pest-control methods to make UK farming more insect-friendly

65. Insects face a number of threats. These include the loss, fragmentation and degradation of habitats, pressures from non-native species and diseases, climate

change and pollution. Defra has a number of activities that aim to counter some of these threats. Some of these are outlined in **Annex 6**.

66. There is a need to control insect damage to agricultural crops. The significant role currently played by neonicotinoids in this is summarised in **Annex 7**.

67. The UK has a longstanding policy of minimising the impacts of pesticide use. This begins with the regulatory system but also includes a number of additional non-regulatory actions to develop and encourage best practice. This work is drawn together in the UK Pesticides Strategy. The Voluntary Initiative (VI) has played a significant role in this work. It was set up in 2001 to promote and ensure best practice in the use of pesticides, with a focus on benefits for water protection and biodiversity. Working in collaboration with crop assurance schemes and wider stakeholders, the VI has achieved a number of successes, in particular the establishment of training systems for users and testing programmes for pesticide application equipment.

68. The EU has now set out a similar approach in Directive 2009/128/EC on the sustainable use of pesticides. It includes a number of the measures that already feature in the UK Strategy. The Directive requires the UK and other Member States to draw up and publish a National Action Plan setting out our proposals to reduce risks and impacts of pesticide use on human health and the environment. A public consultation on the draft plan has just closed and the plan will be published in late November.

69. The Directive includes provisions on Integrated Pest Management (IPM). IPM sets a framework to minimise the use of pesticides and encourage the use of alternatives. Our approach to IPM and to the development of alternatives is set out below.

(a) Integrated Pest Management

70. Integrated Pest Management (IPM) describes a broad approach to plant protection that discourages the development of populations of harmful organisms, keeps the use of pesticides other forms of intervention to levels that are economically and ecologically justified and reduces or minimises risks to human health and the environment. IPM emphasises the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms;

71. IPM is well established in the UK and many farmers and growers adopt practices which are in line with IPM principles, particularly due to the requirements of farm assurance schemes, retailer requirements or other national or international production standards. The promotion of IPM principles is a key feature of the EU Directive on the sustainable use of pesticides and the summary of IPM principles set out in the Directive is at **Annex 8**. Member States are required to implement the provisions on IPM by 1 January 2014.

72. National legislation (The Plant Protection Products (Sustainable Use) Regulations 2012) requires all users to be trained. Only courses for users and advisors which provide training on integrated approaches will receive accreditation.

73. Non-regulatory schemes such as Assured Food Standards Schemes require growers to adopt practices consistent with the general principles of IPM. Specific standards are set for individual crops. Work is underway with the key industry stakeholders to develop an IPM self-assessment tool for farmers (an IPM Plan) to encourage the use of IPM tools and techniques such as decision support systems and pest and disease monitoring systems.

74. In woodland, initiatives such as the UK Woodland Assurance Scheme and the Forestry Commission's practical Guide to Reducing Pesticide Use in Forestry promote practices consistent with the aims of the Directive and national policy, but specifically require owners/managers to implement effective IPM strategies.

75. Government also provides support to farmers wishing to convert to organic methods of production under the Organic Entry Level Scheme. The production of organic food must be done in accordance with Council Regulation 834/2007 and enforced under national legislation (the Organic Products Regulations 2009). Growers are inspected by private Defra-licensed Organic Inspection Bodies each year.

76. There is also extensive research into alternative methods of pest, weed and disease control, outlined at paragraphs 81 to 91 below. Government-funded pesticides work includes a significant programme of work to reduce reliance on chemical pesticides by developing novel alternative technologies that do not pose unacceptable risks to human health, non-target organisms, and the environment. This provides the scientific basis to enable companies to develop further measures for integrated or biological control in arable and horticultural commodities, thereby encouraging sustainable crop protection and potentially also benefitting other production systems such as organic production.

IPM and seed treatments

77. Treated seeds are sown before the onset and extent of the developing pest population can be known. In other words, the treated seed is sown in anticipation of a problem. It is sometimes suggested that the use of seed treatments is prophylactic and often unnecessary and that it is therefore inconsistent with Integrated Pest Management.

78. The regulatory system does consider whether a seed treatment is appropriate and consistent with the principle of minimising pesticide use. Proposed seed treatment uses are refused if the pest does not occur frequently enough to warrant it, and where a foliar spray would be more appropriate. Assessment is based on:

- whether the target consistently occurs each season or is only a sporadic pest.
- whether the target is highly localised or is wide ranging on the particular crop.
- whether the target, if present, causes economic damage that would warrant treatment.

- where the target requires early/immediate measures – controlling aphids which are virus vectors is one example because of the speed with which viruses can be transmitted.

79. Current uses of the neonicotinoid seed treatments (and indeed other insecticide seed treatments) are considered appropriate. The principal uses are for autumn control of cereal aphids (vectors of BYDV), aphids on sugar beet or OSR (vectors of virus yellows), and assisting crop establishment at sowing by controlling/reducing soil pests. The degree of protection afforded by seed treatments also means that the number of subsequent foliar sprays required is reduced.

80. Due to the long established problems of *Myzus persicae* resistance to pirimicarb, growers rely completely on neonicotinoid seed treatments in sugar beet to prevent virus infection. There is also the developing new situation of pyrethroid resistance in cereal aphids which means, again, that autumn sown cereals will rely heavily on neonicotinoid seed treatments for BYDV control.

(b) <u>Development of alternatives to chemical insecticides</u>

81. Defra funds research to develop alternative approaches to reduce reliance on chemical pesticides. There is close collaboration with industry and other stakeholders in carrying out the research and in carrying through the subsequent knowledge transfer. For those insect pests against which neonicotinoids are currently used in the UK (principally aphids, beetles and moths), the main approaches can be summarised as follows:

Biopesticides

82. The three main groups of biopesticide products are semiochemicals, microorganisms/fungi, and natural chemicals, such as plant extracts. Semiochemicals include biologically active compounds produced by pests to communicate with each other, such as sex or aggregation pheromones. Synthetic versions disrupt pest feeding and other behaviours in the case of aphids, and also attract their natural enemies. Aphid pests in arable crops (cereals, oil seed rape and beans) have been the main targets of Defra research, but the more promising outcomes have yet to be translated into commercial practice.

83. In terms of microorganisms and fungi, entomopathogenic fungi have shown the best prospects for aphids, and also some beetle pests including vine weevil against which neonicotinoids are used. Defra is currently supporting work to help bring this work to commercialisation. Specific promising examples include using artificial vine weevil refugia to spread a highly effective fungal disease of the beetle, and enhancing biopesticide usage for the control of aphids - especially in horticultural crops, through better understanding of combinations of biopesticides and chemical pesticides, including neonicotinoids.

Enhancing natural plant defences

84. Crop plants produce compounds to defend themselves against pests. This process can be enhanced by treating crops with synthetic versions of these compounds. These same chemicals often also attract natural enemies of the pests. The alternatives programme has funded research on jasmonic acid and related compounds. The main targets to date have been aphids and to a lesser extent

beetle pests in cereals (winter wheat), summer beans and oilseed rape. Some work has also been done in intensive horticulture, mostly with aphids. This work has led to jasmonic acid seed treatments being commercialised, and this could provide an alternative to neonicotinoid seed treatments.

Development of new modes of action for insecticides

85. Most of the major insecticides used worldwide, including neonicotinoids, are neurotoxins, and the number available for use in agriculture is decreasing with stricter regulation. The Defra-funded work is still at the development stage but offers promise of insect pest control that will provide alternatives and thereby help reduce reliance on neurotoxins.

86. One element of this work has been particularly promising is to disrupt the immune system of insects, thereby reducing their resistance to diseases, including the world's most widely used biopesticide, *Bacillus thuringiensis (Bt)*, and insect pathogenic fungi. In other research, fusion proteins as carriers for biologically derived toxins are being developed as delivery systems to target key pests; commercial partners have already been involved in this work.

87. A second major part of this research on new insecticides has been to develop options that interfere with the pests' internal systems that regulate feeding, moulting, reproduction and other biological processes. Insect feeding is of obvious interest, given that it is feeding by a pest that causes the damage to crop plants. Advanced molecular biology (genomics) has permitted greater understanding of the processes involved in feeding, thereby exposing weak-spots where these processes might be disrupted. The compounds involved have been characterized with support from the Defra alternatives programme, and preliminary work has yielded promising results. Target pests include aphids and beetles, again from pest groups against which neonicotinoids are used.

88. Lastly, Defra is supporting new research to help address the issue of insect pest resistance to neonicotinoids which is increasing in the UK and elsewhere in Europe. Examples include several major UK aphid pests. A pilot trial will evaluate certain naturally-derived compounds that may prevent resistance mechanisms in the pests from operating, and therefore when used in combination with neonicotinoids will permit lower levels of the latter being used.

(c) Bringing alternative products to the market

89. Bio-pesticides cover a range of products. It is generally the case that they offer various benefits over conventional chemical pesticides such as reduced environmental impact, shorter harvest intervals, minimal residues. However, they also tend to be fairly narrow in their spectrum of activity, are slower to act and may have limited shelf life and specific storage requirements. They therefore require much more knowledge and management input to work effectively and, as a result, they tend to be most used in higher value horticultural crops.

90. Biopesticides and other alternative products may be developed for relatively niche purposes, may be produced by companies that do not deal frequently with pesticide regulation, and may make different demands of the regulatory risk

assessment. To tackle these issues, CRD has for several years run a scheme to help biopesticide producers gain approvals for their products. The scheme includes:

- A 'Biopesticide Champion' to provide initial contact for product innovators or manufacturers, and help them through the approval process.
- Provision of specific guidance to applicants (via free pre-submission meetings) identifying the best way forward. Potential applicants are encouraged to make contact at the earliest possible stages of product development.

- Reduced costs for evaluations.

91. Since the biopesticides scheme was introduced the number of authorisations for these products has increased significantly. Numbers now compare favourably with other EU countries, given the size of the horticulture sector in the UK. The scheme is currently being reviewed to make the approach simpler, although the EU regulatory requirements cannot be avoided.

Annex 1

Honey bee risk assessment under EU pesticide regulations

For pesticides that are applied as a *spray*

1. Data on the acute oral and contact toxicity of the pesticide is always submitted when foraging honey bees are likely to be exposed. Exposure could result from honey bees foraging the crop that is being sprayed or foraging weeds in the crop.

2. These data are generated via the use of internationally agreed test guidelines[1]. The endpoints from these studies are LD50, i.e. the median lethal dose that results in 50% mortality of the test population. Two separate studies are conducted: acute contact toxicity is determined by placing a dose of the pesticide on to the thorax of the bee; – acute oral toxicity is determined by feeding bees treated sucrose. These are laboratory based studies that are carried out under controlled conditions and use either the active substance or the formulated pesticide product.

3. The LD50 is then used to derive a 'hazard quotient' – the application rate of the pesticide in g/ha divided by the LD50 in µg/bee. If the resulting ratio is less than a trigger value of 50[2], it is considered that an unacceptable level of mortalities are unlikely to occur and the pesticide can be authorised without any restrictions regarding the risk to honey bees. If the ratio is greater than 50 then the product is either restricted to a time when honey bees are not foraging or further data are requested to enable a decision to be made on authorisation.

4. If a restriction is imposed, the UK product label will state:

> *Dangerous to bees. To protect bees and pollinating insects do not apply to crop plants when in flower. Do not use where bees are actively foraging. Do not apply when flowering weeds are present.*

5. If further data are requested, these take the form of either semi-field studies (sometimes referred to as cage studies) or field studies. Semi-field studies use a small colony of about 5,000 bees, which is placed inside the enclosure a few days before the crop is sprayed. The crop is sprayed once the bees have become accustomed to the enclosure and are actively foraging the crop. The following endpoints are considered – mortality, foraging activity and survival of the colony. Semi-field studies usually last only a few days. There is always a control enclosure and there should be sufficient replication to permit statistical analysis.

6. Field studies are large scale and involve an unenclosed crop where honey bee colonies are placed adjacent to the crop. If a study was being conducted on oilseed rape then a plot of approximately 1 ha would be used. Colonies are used that contain at least 10,000 bees and each colony should cover at least 10–12 frames, including at least 5–6 brood frames. The crop is sprayed once the bees

[1] See Organisation for Economic Cooperation and Development guideline for the testing of Chemicals – honey bees, acute oral toxicity test (OECD 213) and acute contact test (OECD 214).

[2] This value of 50 has been validated see Aldridge, C. A., and A.D.M. Hart. 1993. Validation of the EPPO/CoE risk assessment scheme for honeybees, Appendix 5. Proceedings of the 5th International Symposium on the Hazard of Pesticides to Bees, 26Ð28 October 1993, Plant Protection Service, Wageningen, The Netherlands.

have become accustomed to the crop and are actively foraging. The major effects that are monitored as part of a field study are effects on mortality, foraging activity and survival of the colony. Further details regarding how these studies are carried out is provided in internationally developed guidance[3].

7. The effects observed in the semi-field or field study will determine whether the pesticide is authorised and whether restrictions are applied.

For pesticides that are applied as *seed treatments* or as a *solid* formulation

8. Some pesticides are applied directly to seed prior to drilling in order to protect them from soil pests and soil borne diseases. If the pesticide is systemic (i.e. it can move into the plant and hence occur in the flower) then honey bees may be exposed to it. If this is considered likely, then a risk assessment is carried out. The above 'hazard quotient' approach is not appropriate for assessing this risk and so reliance is currently placed on semi-field and field studies, similar design in design to those outlined above. A similar approach is used for pesticides formulated as granules or pellets. The effects observed in the semi-field or field study will determine whether the pesticide is authorised and whether restrictions are applied.

Development of the risk assessment

9. The risk assessment continues to be developed. Applicant's will in future need to submit additional data covering: effects on honey bee brood development and other honey bee life stages (this information will enable an assessment of any effects on the development of the brood); and potential chronic effects on adult bees.

10. An EFSA review (http://www.efsa.europa.eu/en/efsajournal/pub/2668.htm) examines the science behind the development of a risk assessment of plant protection products on bees (honey bees, bumble bees and solitary bees). Following the review, EFSA, the Commission and Member States have been developing guidance to be used in the authorisation process. UK experts are actively involved in this work. A draft guidance document was put to public consultation on 20 September (http://www.efsa.europa.eu/en/consultations/call/120920.htm) and is due to be revised and completed by the end of 2012.

Risk assessment for other non-target arthropods

11. The risk to non-target arthropods is assessed using laboratory data on two standard species – *Aphidius rhopalosiphi* and *Typhlodromus pyri*. The endpoints from these studies (expressed as g/ha) are compared to exposure data (also expressed as g/ha). The risk assessment covers both in and off-field assessments and, depending on the results, data on additional species may be requested. These additional data may be in the form of extended laboratory, semi-field and/or field studies. In addition to data on additional species, risk mitigation may be used to enable the population to recover from within the crop itself as well as protecting off-crop species. This risk assessment, as set out in the Terrestrial Guidance Document, is being revised following the ESCORT 3 workshop, in which UK regulatory scientists participated.

[3] See European and Mediterranean Plant Protection Organisation (EPPO) Side effects on honey bees PP 1/170(4).

Annex 2

Recently published research listed in the Defra document "Neonicotinoid insecticides and bees: The state of the science and the regulatory response"

1. Mickaël Henry, Maxime Beguin, Fabrice Requier, Orianne Rollin, Jean François Odoux, Pierrick Aupinel, Jean Aptel, Sylvie Tchamitchian and Axel Decourtye (2012). A common pesticide decreases foraging success and survival in honey bees. Sciencexpress/29 March 2012/Page 10.1126/science.1215039

2. Penelope R. Whitehorn, Stephanie O'Connor, Felix L. Wackers, Dave Goulson (2012). Neonicotinoid pesticide reduces bumble bee colony growth and queen production. Sciencexpress/ 29 March 2012/Page1/10.1126/science.1215025

3. Pettis J S, van Engelsdorp D, John J and Dively G. Pesticide exposure in honey bees results in increased levels of the gut pathogen *Nosema* (2012). Naturwissenschaften, 2012 Feb; 99(2): 153-8 Epub 2012 Jan 13.

4. Lu C., Warchol K.M. and Callahan R.A (2012). *In situ* replication of honey bee colony collapse disorder. Bulletin of Insectology 65 (1): 99-106, 2012 ISSN 1721-8861.

5. Vidau C., Diogon M., Aufauvre J., Fontbonne R., Vigues B., Brunet J-L., Texier C., Biron D.G., Blot N., El Alaoui H., Belzunces L.P., Delbac F (2011). Exposure to sub-lethal doses of fipronil and thiacloprid highly increases mortality of honey bees previously infected by *Nosema ceranae*. PloS ONE 6(6): e21550. Doi 10.1371/journal.pone.0021550.

6. Cresswell J.E., Desneux N and van Engelsdorp (2012). Dietary traces of neonicotinoid pesticides as a cause of population declines in honey bees: an evaluation by Hill's epidemiological criteria. Pest Management Science (2012), Vol. 68, Issue 6, pp 819-827.

7. Wu J.Y., Smart M.D., Anelli C.M., Sheppard W.S (2012). Honey bees (*Apis mellifera*) reared in brood combs containing high levels of pesticide residues exhibit increased susceptibility to *Nosema* (Microsporidia) infection. Journal of Invertebrate Pathology 109 (2012) 326-329.

8. Mommaerts V., Reynders S., Boulet J., Besard L., Sterk and Smagghe G (2010). Risk assessment for side-effects of neonicotinoids against bumblebees with and without impairing foraging behaviour. Ecotoxicology (2010) 19:207-215 Doi 10.1007/s10646-009-0406-2

9. Tapparo A., Marton D., Gioio C., Zanella A., Solda L., Marzaro M., Vivan L. and Girolami V (2012). Assessment of the environmental exposure of honey bees to particulate matter containing neonicotinoid insecticides coming from corn coated seeds. Environmental science and technology ACS dx.doi.org/10.1021/es2035152 Envion Sci Technol.

10. Johnson R.M., Mao W., Pollock H.S., Guodong N., Schuler M.A., Bernbaum M.R (2012). Ecological appropriate xenobiotics induce cytochrome P450s in *Apis mellifera*. PLoS ONE 7(2): e31051. Doi:10.1371/journal.pone.0031051.

11. Schneider C.W., Tautz J., Grunewald B., Fuchs S (2012). RFID Tracking of Sub-lethal Effects of Two Neonicotinoid Insecticides on the Foraging Behavior of *Apis mellifera*. PLoS ONE 7(1): e30023. Doi:10.1371/journal.pone.0030023.

12. Brittain C., and Potts S.G (2011). The potential impacts of insecticides on the life history traits of bees and the consequences for pollination. Basic and applied ecology 12 (2011) 321-331

13. Teeters B.S., Johnson R.M., Ellis M.D. and Siegfried B.D (2012). Using video-tracking to assess sub-lethal effects of pesticides on honey bees (Apis mellifera L.) Environmental Toxicology and Chemistry, Vol. 31, Issue 6, pp 1349-54.

14. Aufauvre J., Biron D.G., Vidau C., Fontbonne R., Roudel M., Diogon M., Vigues B., Belzunces L.P., Delbac F., & Blot N (2012). Parasite-insecticide interactions: a case study of *Nosema ceranae* and fipronil synergy on honey bee. Sci. Rep. 2, 326; DOI:10.1038/srep00326 (2012).

15. Blacquiere T., Smagghe G., van Gestel C.A.M and Mommaerts V (2012). Neonicotinoids in bees: a review on concentrations, side-effects and risk assessment. Ecotoxicology (2012) 21:973–992 DOI 10.1007/s10646-012-0863-x

Annex 3

ACP advice on neonicotinoids and bees issued July 2012

Overall, the ACP were agreed that the current risk assessments are secure and have concluded that there is no justification to take regulatory action at present. Furthermore, there is no evidence as yet of neonicotinoid impacts on bees in the UK. However, the ACP will consider any new information as it arises and keep the situation under close review. An explanation of the work leading to this advice is set out below.

1. The ACP has examined in detail the recent publications in the scientific literature. They identified a number of points at a first discussion of this topic at the May 2012 meeting which have now been followed up.

2. Members have carefully reconsidered the data (including an examination of the raw data) supporting the current authorisations for thiamethoxam products in the light of findings from recent published data (specifically the paper by Henry et al) and EFSA discussions. The field studies submitted by the applicants are fully compliant with current regulatory guidance and additionally cover some aspects not required by the current guidance (e.g. over-wintering). In line with current guidance the regulatory studies were not designed with detailed statistical analysis in mind, and their power to detect statistically significant changes is not established. Also, they would not show some of the specific sub-lethal effects suggested by academic studies, such as disorientation over distances. However hives exposed to treated crops did not show any gross effects on a wide range of important endpoints when compared to control hives exposed to untreated crops.

3. While noting there were some questions concerning aspects of the two published studies (by Henry et al and Whitehorn et al), the ACP cannot discount their findings. The Committee believe these studies provide interesting information that should be considered in the development of future regulatory guidance. Some further research is merited in the light of these papers and others to clarify the findings and their relevance to the UK field situation. The ACP is pleased to note that relevant work is already underway.

4. This further work will need time to be completed. In particular the ACP is aware that the study on bumble bees (Defra project PS 2371) is currently in its field phase and it is expected results will be reported in March 2013. The ACP has asked for preliminary information to be made available as soon as possible following the field phase this autumn/winter. The study examining residues in honey bees (Defra project PS2370) to assist in the interpretation of the relationship between pesticides residues and disease in bees is also expected to report in March 2013. A preliminary examination of bee health statistics following the introduction of the neonicotinoids is expected to become available later this summer. Finally the EFSA work re-evaluating all of the neonicotinoid insecticides in the light of the latest research and the development of the revised guidance on assessing risk to bees are both due

by the end of this year. The ACP will keep this work and its potential impact on authorisations under review

5. The ACP also identified a number of other possible areas for research into the possible impacts of neonicotinoid insecticides. These include some work on bee toxicokinetics to examine factors related to dose and exposure period, a true field study looking at disorientation (while recognising the very real practical difficulties might make this impossible to do). The ACP also asked their Environmental Panel to look at work on guttation as a potential source of exposure to other non-target arthropods.

6. Although the ACP has considered thiamethoxam in detail, the Committee agreed that the conclusions reached can be applied broadly to the authorisations of other neonicotinoid insecticides because:

   - The acute toxicity of thiamethoxam, clothianidin and imidacloprid are all of a similar order of magnitude, with similar extent of use. Acetamiprid and thiacloprid are significantly less acutely toxic and are used on a significantly smaller area.
   - The chemical properties of all of the neonicotinoid insecticides are very similar and the mode of insecticidal action is identical for them all.

Annex 4

Pesticide detection in dead bees submitted under the Wildlife Incident Investigation Scheme

1. The Wildlife Incident Investigation Scheme (WIIS) examines incidents in which it is suspected that animals may have been poisoned by pesticides. Carcases submitted are routinely analysed for a range of pesticides. A total of 51 cases involving bees have been reported in the past four years (out of an overall total of 745 cases). Of these, two cases appeared to have been a result of the use of a pesticide in accordance with its approval; neither of these involved neonicotinoids. There were two instances of abuse (use of pesticides to deliberately poison bees) and three of misuse (careless incorrect use leading to poisoning). One of the misuse cases involved a neonicotinoid (imidacloprid) along with three other pesticides.

2. Analysis of dead bees submitted in WIIS cases has brought 100 detections of pesticides (and the full list is in the table below). Of these, 10 are neonicotinoids (7 detections of thiacloprid and 3 of imidacloprid). It is notable that many of the pesticides detected most frequently are biocidal products (for example, products authorised for control of feral bees) rather than plant protection products used in agriculture and horticulture. In the majority of cases, the pesticides detected were not clearly the cause of death.

Active substance	Number of detections
Bendiocarb	14
Propiconazole	12
Permethrin	9
Chlorpyrifos, fluvalinate and thiacloprid	7
Tebuconazole	5
Boscalid	4
Dieldrin, dimethoate, imidacloprid	3
Azoxystrobin, carbendazim, diazinon, fipronil, gamma-HCH, lambda-cyhalothrin	2
Bifenthrin, cypermethrin, DDE, DDT-pp, deltamethrin, glyphosate, MCPA, mecoprop-p, methomyl, myclobutanil, penconazole, pirimicarb, pirimiphos-methyl, prothioconazole	1

Annex 5

Monitoring schemes for pesticides

Pesticide residues in food

1. Responsibility for monitoring residues in food rests with the Committee on Pesticide Residues in Food (PRiF). Its terms of reference are to:

- provide independent advice to the Health and Safety Executive and the Food Standards Agency (FSA), and UK Ministers on:
  - the planning of surveillance programmes for pesticide residues in the UK food supply;
  - the evaluation of the results; and
  - procedures for sampling, sample processing and new methods of analysis.

- make its findings and recommendations available to Government, consumers and the food and farming industries in a way which aims to be comprehensive, understandable and timely.

2. The full 2012 monitoring programme can be found at: http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/PRiF/PRiF-archive/2012/2012_programme.htm

3. Monitoring results are compared against Maximum Residue Levels (MRLs). MRLs are the maximum concentration of plant protection product residues legally permitted in food and animal feeds. The prescribed levels are based on good agricultural practice (GAP); if the user follows the GAP the level of plant protection product in the crop at harvest should not exceed the MRLs. MRL exceedances are followed up with the suppliers.

4. MRLs are intended primarily as a check that the GAP is being followed and to assist international trade in treated produce. The GAP (and hence the MRL) are always set in such a way that adherence to the GAP will not lead to dangerous residue levels. But MRLs are not safety limits in themselves and are usually set well below what would be a “safe” level. It thus follows that residues in excess of an MRL are not necessarily a risk to health, and the Acceptable Daily Intake (ADI) and Acute Reference Dose (ARfD) are used to assess in a precautionary manner appropriate long and short term exposure to residues in foodstuffs.

5. MRLs are set through a long-term EC programme establishing individual limits for different active substance/food commodity combinations. The aim is to establish an MRL reflecting all the authorised uses of pesticides within the Community as well as MRLs that are required to take account of imports into the Community. If a specific MRL is not established then a default level of residue (which is effectively zero) is the statutory maximum permitted.

Wildlife Incident Investigation Scheme

6. The Wildlife Incident Investigation Scheme (WIIS) makes enquiries into the death or illness of wildlife, pets and beneficial invertebrates that may have resulted from pesticide poisoning. The scheme has two objectives:

- To provide information to the regulator on hazards to wildlife and companion animals and beneficial invertebrates from pesticides; and
- To enforce the correct use of pesticides, identifying and penalising those who deliberately or recklessly misuse and abuse pesticides.

7. In practice "companion animals" usually refers to cats and dogs, and "beneficial invertebrates" refers to honeybees, bumble bees and earthworms. Also included in the Scheme are suspect baits, where it is thought that pesticides have been inappropriately applied or used, and spillages of pesticides where this poses a risk to wildlife or companion animals.

8. WIIS monitors the unwanted effects on wildlife through misuse, abuse or approved use of pesticides. The scheme helps monitor the way pesticides are used and their effect. It allows us to assess how people use pesticides and how well they understand the laws relating to these chemicals and protecting wildlife. WIIS also helps us assess whether pesticides are behaving as predicted once released into the environment. So it shows how well the risk assessment and approval process is working.

9. The Scheme is essentially a monitoring tool to inform the pesticide approval process. However, where there is clear evidence of a breach of pesticide law enforcement action may be taken.

10. If the information collected on an incident indicates that pesticide laws may have been broken, a range of regulatory action is considered. If there seems to be enough evidence of illegal activity, cases are referred to be investigated and court action may be taken. Any fines and costs that have to be paid, together with the publicity such cases attract, encourage others to use pesticides safely.

11. Even if there is not enough evidence for a formal investigation or prosecution, other action (for example, using enforcement notices or sending out warning letters) may be taken. Also, it may sometimes be appropriate to refer an incident to another authority, such as the police. In these circumstances, Defra will offer help and advice to that authority.

12. Where suspected pesticide poisoning is reported, a combination of field work, veterinary examination and chemical analysis is used to try to determine the cause of death. Cases accepted for further investigation usually fall into one of the following categories:

- **Approved use -** a pesticide is used in accordance with its conditions of authorisation.

- **Misuse** – the product has not been used according to the conditions of its authorisation, but the breach is careless or accidental, without the intention of harming animals.

- **Abuse** – a pesticide has been deliberately used in an illegal manner to poison, or to try to poison animals.

13. In some cases pesticides may be found but the origin of the substance is unclear and the cause of death will be unknown or unspecified.

14. WIIS is supported by targeted publicity that aims to reach countryside users and influencers, for example veterinary practitioners. The campaign explains how to identify and report potential incidents. It also makes clear that those who deliberately abuse or misuse pesticides in a way which could harm birds, mammals and bees will be prosecuted.

Pesticides Usage Survey

15. The Pesticide Usage Survey (PUS) collects quantitative and qualitative data on pesticides used in agriculture, horticulture and food storage. This data has been collected in the UK for the last 40 years. Since the entry into force of the EU Statistics Regulation (1185/2009/EC), PUS data are now collected as part of the requirement for the collection of data on sales and usage of pesticides. The sampling and data gathering approaches uses fully meet the requirements of the UKSA Code of Practice for Official Statistics.

16. Surveys currently collect data on pesticides used on arable crops, vegetables, glasshouse crops, soft fruit, top fruit, fodder and forage, stored top fruit and potatoes. The surveys provide accurate information concerning regional and national pesticide usage including: the range of chemicals used, the amount of active ingredients applied, the total treated area, the proportion of crops treated, and the methods and timing of application.

17. The data collected provide essential information for a number of purposes including:

- Informing the pesticide risk assessment (approval) process, including the UK and EU review programmes of older pesticide active substances.

- Policy, including assessing the economic and/or environmental implications of introduction of new active substances and the withdrawal/non-approval of pesticide products (the data reported to organisations such as the OECD and EU enabling the UK to honour international agreements); evaluating changes in growing methods and Integrated Pest Management where this has an impact on pesticide usage.

- Informing the targeting of monitoring programmes for residues in food and the environment.

- Contributing to assessing the impact of pesticide use, principally as part of the Pesticide Forum’s Annual Report.

- Providing information to assist research projects which can support all of the above activities.

- Training/teaching programmes which are designed to improve practice in the use of pesticides by the farming/training industries.

- Informing the Wildlife Incident Investigation Scheme (WIIS) programme to help identify potential misuse of pesticides.

18. Surveys in England and Wales are carried out by the Food and Environment Research Agency (Fera) and GfK Kynetec, with parallel surveys being carried out in Scotland by the Science and Advice for Scottish Agriculture (SASA) and in Northern Ireland by the Agri-Food & Biosciences Institute (AFBI). Since 2011, published reports cover usage throughout the United Kingdom.

National Poisons Information Service (NPIS)

19. The primary function of the NPIS is to give information to enquiries from health professionals. All health care providers have free access to the UK on-line poisons database TOXBASE and the number of TOXBASE accesses can be counted. Should this not be immediately available (e.g. unregistered NHS user) or be insufficient for their needs enquirers will ring the NPIS help line. All telephone enquiry data are entered into a confidential national database collection system, the UK Poisons Inquiry Database (UKPID). This includes agent, patient demographics, symptoms, where available clinical laboratory results, treatment advice and, generally in more severe cases, follow up (although follow up of cases is not funded routinely).

20. The NPIS also is associated with the UK Teratology Information Service (UK TIS) and this service will receive specific enquiries about exposures in pregnancy, either directly or be referred them by the NPIS. Data on these cases are also collected in a dedicated database. In the case of pregnancy enquiries the NPIS follows up all pregnancies where it is possible to ascertain the pregnancy outcome but these are few in number for data protection reasons.

21. Regular reports are produced which provide an overview of accidental and deliberate exposures, the agents involved, and outcomes. Severity gradings are consistent with standardised international criteria, the WHO Poisoning Severity Score and symptom details are also collected. These datasets thus allow analysis of the symptoms and severity of accidental and deliberate exposures to individual agents and comparative toxicity to be assessed between agents of the same type, for example herbicides or insecticides. In 2010-11, NPIS systems collected information on approximately 1,300 pesticide and biocide exposures out of a total of 500,000 enquiries for all poisonings.

22. NPIS primarily answers questions on acute exposure, but will collect information on chronic effects of poisoning when enquiries are received from concerned medical practitioners wishing to ascertain whether or not a patient’s symptoms may be related to previous pesticide exposures.

Human Health Enquiry & Incident Survey (HHEIS)

23. This system was initiated in 2002. It is largely the work of pesticide approval holders. The approval holders keep records of contacts and enquiries they receive usually from users following product label contact advice. These records are required to be submitted annually to CRD. It has several positive features but reports on only a fairly small number of incidents each year.

Pesticides Incidents Appraisal Panel (PIAP)

24. Post-approval surveillance of pesticide products is essential to detect any health effects that may not have been identified by the initial screening process. PIAP forms part of the post-approval surveillance of pesticide products. It is set up within the HSE and collects information mostly from the public and occasionally employees as they occur continuously through the year. Information is assessed by a committee consisting of experts in this area from both within and without the HSE. Data are analysed and published as an annual report.

25. PIAP considers all incidents of ill health reported to the HSE which are alleged to have been caused by exposure to pesticides used at work/in a work activity. Each report is assessed by a suitably trained member of HSE staff who will investigate each report where appropriate and if necessary seek extra information about the event, especially details of exposure and short and medium term follow up. The PIAP committee is informed of these incidents only when the investigation has been completed, at which time it is supplied with copies of the investigation/follow up reports.

26. PIAP itself does not carry out any further enquiries or investigation and relies entirely on the information collected by HSE staff. PIAP considers each incident report, not to establish causation or blame, but to judge the strength of association between the alleged exposure and alleged ill health. The final decision is based on the balance of probabilities. This enables PIAP to detect any patterns or trends of ill health associated with either individual pesticides or particular groups of pesticides and to assess the reliability of such trends. PIAP reports its findings to the ACP.

Annex 6

What Defra is doing to protect insects

Honey bees

1. Honey bees differ from other insects in that they are essentially a managed species. Defra has a role in helping bee keepers to succeed. The Healthy Bees Plan was launched in March 2009 by Defra and the Welsh Government following publication of the National Audit Office's report on 'The Health of Livestock and Honeybees in England'. The overall aim of the Plan is to achieve a sustainable and healthy population of honey bees for pollination and honey production in England and Wales. It provides a fresh impetus for government, beekeepers and other stakeholders to work together to respond effectively to pest and disease threats and to sustain honey bees and beekeeping for the future. Defra funding (£4.6m since 2009) currently runs until 2015.

2. A key priority of the Healthy Bees Plan is to deliver an enhanced training and education programme for beekeepers, driving up husbandry standards and the management of pests and diseases. Defra (Fera) has so far co-funded education and training initiatives with beekeeping associations e.g., 400 new beekeeper trainers and a suite of new training materials and courses. Jointly funded programmes will be a key feature of the work going forward.

3. Defra also provides £1.3m each year to Fera's National Bee Unit's (NBU) to deliver its bee health programme. The programme includes the provision of a free apiary inspection and diagnostic service for statutory diseases and pests, and a free training and education programme to enable beekeepers to become more self-reliant in combating disease through improved bee husbandry. The programme aims to control the spread of endemic notifiable diseases of honey bees and to identify and manage the risk associated with new exotic pests and diseases that may be introduced. The NBU manages BeeBase (www.nationalbeeunit.com), the voluntary national database of beekeepers which also serves as a management tool for planning and executing the inspection programme.

4. There are approx. 28,300 beekeepers currently registered on BeeBase. Increasing the number of beekeepers registered is a key objective of the Healthy Bees Plan. The Plan includes a number of actions to increase registrations including enhanced communications activities and collaboration with beekeeping associations to encourage their members to register. So far this year, there have been 4,081 new registrations of which 1989 have self-registered.

Bumble bees and other pollinators

5. Bees and other pollinators are an essential part of our natural ecosystems, and their conservation has become part of biodiversity conservation efforts. Declines in pollinator numbers have significant economic impact, estimated of the order of £500 million, as the crops they pollinate – such as oilseed rape, orchard fruit and beans – support our agricultural systems.

6. Since 1900, the UK has lost 20 species of bee, 62 species of moth, and several butterflies including the mazarine blue and the black-veined white. A further

35 bee species (out of 251) are considered to be under threat of extinction. There has been a severe decline in the diversity of wild bees in the countryside.

7. Wild pollinators require a range of habitats and food sources throughout the year – not just flowers. They need places to nest, feed and forage during the various stages of their life cycle. Over the last 50 years there have been dramatic changes in our countryside due to agricultural intensification, commercial forestry and urban development. These have caused widespread habitat losses. Flowers planted in high streets, parks, gardens, etc are often selected to be low maintenance, long-lasting and pest and disease free. They are also devoid of nectar and pollen which creates extensive areas where wild pollinators cannot survive.

8. Defra is working to protect pollinators and wildlife in general through *Biodioversity 2020: A strategy for England's wildlife and ecosystem services.* In particular, Outcome 3 of the strategy states that "by 2020 we will see an overall improvement in the status of our wildlife and will have prevented further human induced extinctions of known threatened species". The species of principal conservation importance (listed on s41 of the NERC Act 2006) currently includes 17 species of bee, of which 16 species currently occur in England, as well as many other wild pollinators.

9. Natural England promotes the conservation of wild pollinators though Environmental Stewardship, which advises and supports farmers to provide the habitats these animals need, for example flower-rich meadows and buffer strips. It runs conservation projects to support *Biodiversity 2020* and other priority species, including pollinators such as bumble bees. For example the short haired bumble bee, extinct in the UK, was recently reintroduced from New Zealand.

Pollinating Insects and Environmental Stewardship

10. The need to address declines in pollinating insect populations was recognised when Environmental Stewardship was designed. There are relatively few opportunities to do this within modern, intensive arable and grassland management systems, so attention turned to providing habitat for these insects around the margins of fields.

11. Entry Level Stewardship (ELS) therefore pays for the establishment of nectar flower mix in blocks or strips. The design is intended to provide a large quantity of nectar from a small area, to mimic some of the nectar-bearing crops that were once a feature of more traditional agricultural systems and to limit the genetic impact on native wild flower species of the widespread sowing of commercial seed. The sown mixes should be actively managed and re-established as necessary to maintain the nectar supply over the five years of the ELS agreement. Within Higher Level Stewardship, a wider range of options is available, including floristically enhanced grass margins and conservation headlands.

12. ELS nectar flower strips or blocks provide additional nectar sources, particularly for long-tongued species of bumblebees. However, retaining healthy populations of pollinating insects requires a variety of habitats across the farm. For example, tall grass buffer strips provide protection for over-wintering insects.

13. Uptake of ELS nectar flower strips or blocks has been lower than expected. Natural England and the Campaign for the Farmed Environment have therefore been specifically promoting the selection of options of benefit for pollinating insects.

14. Within livestock farming, a new ES option for legume- and herb-rich swards will be available from 1 January 2013. The new option is intended to provide habitat and food for invertebrates including crop pollinators, benefit soil structure, mitigate climate change by reducing nitrogen fertiliser use and provide productive high quality forage for livestock. It is one of a number of changes to ES to improve its delivery and to better meet its environmental objectives.

Campaign for the Farmed Environment

15. The Campaign for the Farmed Environment is an industry-led voluntary approach. It encourages arable farmers to take up key in-field Environmental Stewardship (ES) options and deliver voluntary environmental action. The key objective of the Campaign is to retain and exceed the environmental benefits that were provided by the previous set-aside scheme. The Campaign was proposed by farming organisations as an industry-level alternative to regulation. The Campaign was launched in November 2009 and is currently funded until the end of 2012.

16. The Campaign promotes a range of in-field ES options. It also encourages farmers to leave 3-4% of their least productive land uncropped and provides a range of voluntary environmental management measures which can deliver similar benefits to ES on this land. The options and measures aim to deliver benefits in line with the three campaign themes of farmland birds, farm wildlife and resource protection. Among the many options that contribute to wider biodiversity and farm wildlife (which includes insects) are grass buffers, managed field corners, pollen and nectar flower mixes, sown wildflower headlands and beetle banks.

17. There is general agreement that, while environmental benefits are not being maximised, farmers participating in the Campaign are delivering benefits for the environment. Discussions are taking place on whether and how the Campaign might evolve beyond the current delivery approach to continue the good work by the industry, extend to link with other industry-led initiatives (such as the Voluntary Initiative for pesticides) and provide a transition period until CAP reform. Defra will take a view on these questions shortly.

The review of advice, incentives and voluntary initiatives

18. Farmers need clear advice to help them improve farm practices, get the most from their land and understand environmental issues. Following a commitment made in the Natural Environment White Paper, Defra is undertaking a review to understand best practice in relation to advice provision and voluntary initiatives. The aim is to publish, by March 2013, plans for a streamlined framework of advice, incentives and voluntary initiatives to enable farmers and land managers to be more competitive and yield better environmental results.

Annex 7

The role of neonicotinoids in controlling crop damage by insects

1. Neonicotinoids are widely used in UK agricultural and horticultural crops, with seed treatments, soil treatments and foliar treatments available. They prevent damage and yield losses by controlling a range of pests, such as aphids. When aphids feed on the crop they transmit viruses which cause diseases such as barley yellow dwarf virus (affecting cereals) and beet yellow virus (affecting sugar beet). These diseases can have serious effects on crop yields and quality.

2. Neonicotinoid seed treatments are used extensively in cereals, oilseed rape, and sugar beet where they provide protection against a range of foliar and soil dwelling pests, assisting crop establishment at the time of sowing. Where seed treatments have been used they generally reduce the need for subsequent insecticide foliar treatments. They are also very targeted. Neonicotinoids are also important because they provide an alternative mode of action in the overall insecticide treatment programme, particularly to the pyrethroid and organophosphate insecticides. They therefore play a key role helping to prevent the build up of resistance in the pests concerned.

3. The last decade has seen a significant reduction in the number of available insecticide active substances with different modes of action, particularly those with very broad activity controlling a wide range of insect species. There are a variety of factors behind this, but principal ones are the impact of the EU programme for regular review of pesticides approvals and the development of resistance in some key insect pests to the older established chemistry, including pyrethroids, organophosphates and carbamates. (The approval of new active substances has provided replacements for some uses, but they tend to be more specialised with a narrower range of activity). In many situations insect control is reliant on one or two modes of action, with neonicotinoids being a key component in the overall treatment programme.

4. As an example, widespread pyrethroid resistance in pollen beetle has emerged across Europe leading to wide scale significant economic losses. In the UK there has been a slower, but continuing, shift in sensitivity and the development of fully resistant populations. The first populations were identified in small pockets of Eastern England but have now been recorded in the Midlands and Scotland, and neonicotinoids have played a major role in for containing resistant communities.

5. Proactive resistance management strategies have been put in place, including restrictions on use in certain crops, to promote the sustainable use of neonicotinoids. These have been developed in close partnership between CRD and the other members of the Insecticides Resistance Action Group (IRAG), which includes industry, growers and independent academic researchers.

Annex 8

General principles of integrated pest management (as set out in the EU Directive on the sustainable use of pesticides)

1. The prevention and/or suppression of harmful organisms should be achieved or supported among other options especially by:

- crop rotation,
- use of adequate cultivation techniques (e.g. stale seedbed technique, sowing dates and densities, under-sowing, conservation tillage, pruning and direct sowing),
- use, where appropriate, of resistant/tolerant cultivars and standard/certified seed and planting material,
- use of balanced fertilisation, liming and irrigation/drainage practices,
- preventing the spreading of harmful organisms by hygiene measures (e.g. by regular cleansing of machinery and equipment),
- protection and enhancement of important beneficial organisms, e.g. by adequate plant protection measures or the utilisation of ecological infrastructures inside and outside production sites.

2. Harmful organisms must be monitored by adequate methods and tools, where available. Such adequate tools should include observations in the field as well as scientifically sound warning, forecasting and early diagnosis systems, where feasible, as well as the use of advice from professionally qualified advisors.

3. Based on the results of the monitoring the professional user has to decide whether and when to apply plant protection measures. Robust and scientifically sound threshold values are essential components for decision making. For harmful organisms threshold levels defined for the region, specific areas, crops and particular climatic conditions must be taken into account before treatments, where feasible.

4. Sustainable biological, physical and other non-chemical methods must be preferred to chemical methods if they provide satisfactory pest control.

5. The pesticides applied shall be as specific as possible for the target and shall have the least side effects on human health, non-target organisms and the environment.

6. The professional user should keep the use of pesticides and other forms of intervention to levels that are necessary, e.g. by reduced doses, reduced application frequency or partial applications, considering that the level of risk in vegetation is acceptable and they do not increase the risk for development of resistance in populations of harmful organisms.

7. Where the risk of resistance against a plant protection measure is known and where the level of harmful organisms requires repeated application of pesticides to the crops, available anti-resistance strategies should be applied to maintain the effectiveness of the products. This may include the use of multiple pesticides with different modes of action.

7. Based on the records on the use of pesticides and on the monitoring of harmful organisms the professional user should check the success of the applied plant protection measures.

22 November 2012

Written evidence submitted by the Advisory Committee on Pesticides

Executive summary

- The Advisory Committee on Pesticides (ACP) is a statutory independent scientific advisory committee. Members are appointed following open competition and advise Ministers on matters relating to the control of pests and particularly on the approvals of pesticides in the UK. There are clear arrangements in place to manage any potential conflicts of interest to ensure that the advice we provide is independent.
- Effective risk management for pesticides is dependent upon a good understanding of a number of important factors including: the properties of the substance, the way it is applied, the type of exposure experienced in practice, and the dose actually received.
- Risk assessments supporting current UK approvals for neonicotinoids are based on a standard regulatory package defined at EU level. These assessments have proved to be acceptable in relation to the authorised uses of these products in line with the standard requirements. We recognise that the standard requirements do not include some of the specific sub-lethal effects suggested by recent academic studies. However, satisfactory data have been supplied for neonicotinoids based on field studies in honey bees, which indicate that in practice there is no difference between colonies foraging in treated and untreated crops over several years of exposure and considering a number of important end points associated with bee colony sustainability. In addition, surveillance data have not highlighted specific problems occurring in the UK. This is why at present we have not advised any regulatory action.
- Recent academic research, which is being closely monitored by the ACP, has suggested possible effects on bee behaviour which are outwith those measured by the defined regulatory package. Also, behavioural effects have been detected in bumble bees, although risks to bumble bees are not currently assessed by regulatory studies and few data on them are available.
- However, such studies have not established convincingly that the exposures employed experimentally are likely to occur in nature.
- Further field-based work has been commissioned by Defra. Findings are expected early in the New Year and will provide better information on what exposures are actually occurring, and what the effects are in practice on bumble bees. Bumble bees are not currently routinely tested in regulatory studies.
- Should the field data on bumble bees indicate a significant risk that requires managing, we will consider carefully what the appropriate steps should be, and will provide advice to government that is supported by a more secure weight of evidence than exists at present. If use of neonicotinoids were to be restricted, this could result in greater usage of other insecticides known also to be hazardous to bees. Advice will therefore need to reflect risks to bees that could arise from the available alternatives.
- There is currently no evidence of harm to human health in either UK surveillance or the published literature following use of neonicotinoid insecticides in accordance with UK approvals.
- It is clear to us that appropriate risk management based on good scientific data is the way forward in this very complex situation and that important information is expected shortly.

- The ACP is not complacent about the current situation. We will consider any new information as it arises and are keeping the situation under close review.

1. **The Advisory Committee on Pesticides (ACP)**

1.1 At the outset it might be helpful to provide a little background about the ACP and its work. The ACP is a statutory independent advisory committee. Membership is drawn largely (but not entirely) from academia and members' skills reflect the range of expertise necessary to consider the scientific evaluation of studies supporting applications for approval of pesticides. We also have two lay members. Current membership is listed on our website and is attached as Annex 1.

1.2 Appointments are made following open competition and follow the requirements of the Office of the Commissioner for Public Appointments (OCPA). All of our members are independent and are required to declare any interests they might have in the pesticides industry, both on an annual basis and ahead of discussion of each issue we consider. As you are probably aware, university departments are required to seek funding from a variety of sources for their research programmes. Typically some funding comes from government, research councils, non-governmental organisations and industry. All members of the committee comply with the Nolan rules and all declare any interests they may have. The ACP has rules that govern how members might participate in discussion if they have interests to declare. These rules are published on our website here: http://www.pesticides.gov.uk/Resources/CRD/Migrated-Resources/Documents/A/ACP_code_of_practice_rev3.pdf

1.3 Members interests are recorded annually in our annual report and are also recorded in the minutes and detailed record where interests are declared on specific items discussed at our meetings. Indeed, one member, Dr Harris, has declared a personal interest during our discussions on neonicotinoids and bees as she has worked on clothianidin residues in food in the past, and consequently has played no part in the formulation of advice and has left the room for the duration of our discussions on the topic.

1.4 We have provided a short outline of our role and a summary of the approvals process in our annual report and this is attached at annex 2. Our annual reports are on our website here: http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-annual-reports .

1.5 A key consideration in evaluating all of the data submitted in support of applications for approval of pesticide active substances and their products is to determine what dose of a substance causes toxic effects, what these are and what dose causes no observed adverse effects. This 'hazard identification' stage of an evaluation identifies what *potential* effects a substance could cause. The 'risk assessment' stage of the evaluation calculates the exposures (doses) that are *likely to occur* as a result of the proposed use and then assesses the possibility of the potential effects being *realised in practice* (i.e. whether a dose that causes effects may be experienced when the plant protection product is actually applied to crops). The approval of plant protection products requires there to be an acceptable risk assessment as defined by the current EU legislation (Regulation 1107/2009 of the European Parliament and of the Council). The data requirements for active substances are defined in Commission Regulation 544/2011 and those for products in Commission Regulation 545/2011. Furthermore the requirements for evaluation and authorisation of plant protection products which Member States are required to follow are set out in Commission Regulation 546/2011- the ‘Uniform Principles’.

1.6 It is essential when considering information about pesticides to be aware of the material difference between *hazard* (the potential for harm) and *risk* (its likelihood), as outlined above.

1.7 It is fully accepted that the neonicotinoid insecticides (and indeed most other insecticides) are a hazard and are toxic to bees in laboratory studies at identified doses. Whether such toxicity is likely or not to arise in practice, however, will be determined by uses made of these pesticides and the extent of exposure in bees. (i.e. to what dose, if any, are they actually exposed).

2. Neonicotinoids

2.1 Imidacloprid was first authorised for use as an insecticide in the UK in 1993. Since then there have been a number of authorisations for use of insecticides containing neonicotinoids in the UK as follows:

2.2 Plant protection products:
Acetamiprid, clothianidin, imidacloprid, thiacloprid and thiamethoxam are authorised in products for use in plant protection on a wide range of agricultural and horticultural crops in a number of formulations including seed treatments, granules, sprays etc. Products containing neonicotinoids are also available for use in the home garden.

Table 1. Initial UK approvals for the neonicotinoid insecticides in plant protection products were as follows:

Substance	ACP consideration	Initial approval date	First Use
Acetamiprid	(EU annex I listing 2004) ACP 14 (319/2006))	2006	Home garden soil drench based on the EU evaluation
Clothianidin	ACP 6 (293/02) ACP 7(311/05)	2002 beet 2005 cereal	Seed treatment for sugar/fodder beet
Imidacloprid	ACP 67 (226/93) published evaluation doc 73, ACP 18 (257/98) ACP 237 (276/00) ACP 66(283/01)	1993 for sugar beet, for cereals 1998, for oilseed rape 2001	Seed treatments for sugar beet, winter wheat and winter barley, oilseed rape
Thiacloprid	ACP 300 (278/00))	2000	Foliar spray on apples
Thiamethoxam	ACP 6 (319/2006))	2006	Seed treatment on sugar beet

2.3 Biocidal products:
Imidacloprid products have been approved for control of ants, cockroaches and flies; thiacloprid wood preservatives have been authorised. Applications for use of clothianidin, thiamethoxam, acetamiprid and dinotefuran are all under consideration through the EU regulatory system for biocidal products.

2.4 There are also known to be veterinary medicine uses. Veterinary medicines are the responsibility of the Veterinary Products Committee.

2.5 This paper considers the plant protection product uses of the neonicotinoids, as these uses are more likely to result in exposure for bees.

3. The European Food Safety Authority (EFSA)

3.1 EFSA play an important role in Europe as 'guardians' of risk assessment for plant protection products. In addition to their important programme of peer review (of evaluation and risk assessment of all Member States' work as 'Rapporteurs' evaluating data submitted in support of active substances for use in plant protection products), they also draw advice from a number of expert advisory panels with membership of experts drawn from across the EU.

3.2 Members of the Environmental Audit Committee will probably already be aware that EFSA is also currently undertaking a number of specific activities associated with the assessment of risk to bees.

The specific questions to be addressed by the Inquiry.

4. The use (or abuse) of evidence in this particular case, for setting policy and regulations on pesticides

4.1 We should stress that the ACP takes its responsibilities in providing independent advice to Ministers based on sound science very seriously. It considers the potential risks to bees and other non-target insects from the use of insecticides to be an extremely important issue. These potential risks were considered prior to all approvals for use in the UK. Furthermore, *all* approvals undergo regular routine review, but are also subject to review *at any time* should emerging data indicate a need to reconsider the risk assessment.

4.2 In this respect, potential harm to pollinating insects from neonicotinoid insecticides is an area of public and scientific concern and of intense research activity. Recent published literature indicates the possibility that there may be toxicity to honey bees and also to bumble bees considering outcomes such as bee behaviour, which are not required by the current EU regulatory assessments. The ACP has recognised the importance (and urgency) of keeping a close watching brief on this emerging science and its possible impact on current approvals for use, and has devoted considerable attention to developing concerns about risks from neonicotinoid insecticides to bees and other pollinators. Since 2008 the issue has featured in many of its meetings. Annex 3 provides a short summary of our discussions and links to the relevant parts of our website providing records of those discussions. Note that discussions were also held with the public at our open meeting in November 2011, resulting in the views from that meeting being passed to EFSA for further consideration as they develop revised guidance for regulatory testing in this area. Relevant correspondence is in Enclosure 3.

4.3 Our advice to Ministers in July 2012 (at annex 4) was based on a careful review of all of the studies available to us. These included the studies originally submitted by applicants for approval of products as well as studies in the published literature. (We understand Defra has provided detailed information on the regulatory requirements for plant protection products). We re-visited the regulatory studies on bees for thiamethoxam this year, particularly in the light of the studies by Henry *et al* and Whitehorn *et al* in 2012, which we also reviewed in detail, before providing our advice. We had previously re-considered imidacloprid bee studies in developing our advice on the 'buglife' report.

4.4 The regulatory data supplied by the applicants are unpublished. Regulatory data are of considerable commercial value and complex 'data protection' rules in the legislation govern how the data can be used in ways that protect their value. This is why the actual studies are not attached as a part of this evidence. However, the evidence can be made available to the Environmental Audit Committee on request to CRD.

4.5 In the interests of efficiency we have not included all of the work done by ACP and CRD on the neonicotinoids since the early 1990's as the sheer volume is huge. However, if the Environmental Audit Committee wishes to see any more detail of our work we would be happy to provide it. The Environmental Audit Committee should be aware that a dossier supporting a single active substance is very extensive and in hard copy probably amounts to a stack about 1.5-2 metres high of A4 paper printed double sided.[Not published here. Deposited in the Parliamentary Archives].

4.6 As an *example* of an early evaluation of a neonicotinoid (1993) the published evaluation document for imidacloprid is provided as Enclosure 1. .[Not published here. Deposited in the Parliamentary Archives]. It is important to note that this was the evaluation that supported the first approval of imidacloprid in the UK. Subsequent approvals and further considerations in accordance with the EU legislation leading to EU annex I inclusion will have involved the evaluation of additional studies. (We can supply further details if required).

4.7 Our work also takes account of concerns raised by stakeholders. Our response to the 'buglife report' is provided as Enclosure 2, .[Not published here. Deposited in the Parliamentary Archives]. together with the paper we considered in formulating our response, and the further consideration by our Environmental Panel. We also include in Enclosure 3 an example of a response provided to a letter received directly from a stakeholder (ACP 9 (354/2012)).

4.8 The various papers we have considered at our meetings since May 2012 are at Enclosures 3 to 6 .[Not published here. Deposited in the Parliamentary Archives]. – together with the detailed record of our discussion of the papers.

4.9 We did not recommend regulatory action on neonicotinoid insecticides in July 2012 because there remained considerable uncertainty as to whether the adverse effects on bees (both bumble bees and honey bees) reported in the investigative research studies actually occur in real life field conditions. Indeed, the regulatory data made available to us included a well conducted field study using thiamethoxam indicating no difference in a range of relevant endpoints over a period of several years between honey bee hives in both treated and untreated crops. We are aware that EFSA have taken a similar stance to the ACP with respect to the current knowledge of bee safety and neonicotinoids.

4.10 We are also aware that other insecticides that could be used as alternatives to using neonicotinoids themselves pose some risks to bees, and loss of the use of neonicotinoids would be likely to result in an increase in the extent of use of some of these alternative insecticides (see below).

4.11 The ACP is not complacent about the current situation. An important part of our advice to ministers was that 'the ACP will consider any new information as it arises and keep the situation under close review.' We were aware in July 2012, when providing that advice, that key research likely to shed light on some of the uncertainties was expected to be reported early in 2013.

4.12 Since July, the ACP has become aware of a new report by Gill *et al*, published in the journal Nature on 1/11/12, which has been reviewed at the ACP's November meeting for its potential to alter the regulatory climate. This most recent study provides additional information in suggesting a possible mechanism by which neonicotinoids may have an effect at population level. As such it reinforces the concerns already identified on the basis of the previously considered evidence, but still does not provide the clear evidence about field exposure in bumble bees from the UK situation that the Defra study (Defra project PS 2371) is designed to address. We anticipate considering initial results from this work at our January meeting and concluded that this short delay would not prevent effective regulatory action if the data indicate this is required. We noted that seed treated with neonicotinoids had already been sown this autumn, and that the much smaller proportion of spring-sown seed would already be in the supply chain for the 2013 harvest. Any regulatory action on seed treatments would thus mainly impact from the 2013 autumn sowings onwards.

4.13 In addition to considering applications for approval of active substances and plant protection products the ACP also plays an important role in developing regulatory science. For example there is considerable interest in assessing risks to both people and wildlife from mixtures of pesticides. The ACP has on several occasions discussed the issues associated with exposure to mixtures, and has concluded that joint effects are rarely more than additive in nature. For that reason, we have concluded that assessment factors routinely applied in risk assessments should generally be sufficient to account for potential mixture effects, although we do require some more specific consideration (particularly in human risk assessments) where a single product contains more than one active substance with clear potential to interact. There is also a considerable amount of development work in this area looking at the possibilities that might be afforded by probabilistic risk assessment.

5. **<u>The application of real-world – 'field' –data. What monitoring is there of actual – rather than recommended – levels of pesticide usage, and the extent to which that influences policy on pesticides</u>.**

5.1 There is a framework of monitoring schemes considering actual pesticide usage and its consequences for both human and environmental health. We understand that Defra has provided detailed information about the schemes.

5.2 Information from the Wildlife Incident Investigation scheme (WIIS) on bee incidents is perhaps of particular relevance to this Inquiry. Information from WIIS is included in enclosure 2 in ACP 6 (341/2010), and despite specific screening being in place, there had not been any positive detections of neonicotinoids in bees at that time.

5.3 To date we have not seen any data to suggest that UK bee populations have been in decline due to the use of insecticides, or that Colony Collapse Disorder is occurring in the UK. We are also aware that bee diseases such as varroa might be weakening bees to the point where insecticides are able to have a greater effect, but again, we have not seen any data to suggest that this is actually happening.

5.4 The various monitoring schemes feed back information to the regulatory process, often via the ACP. Where findings of monitoring suggest there is a need, these inform further action, whether that is further research to clarify mechanisms of activity recorded, or further regulatory activity.

5.6 One example of such activity is the current stewardship programme for products containing chlorpropham to identify the mechanism leading to occasional peak residues above the Maximum Residue Level (MRL)[1] in order to rectify the position. The ACP is actively monitoring this scheme involving chlorpropham, and has written to the relevant stakeholders indicating that it will take action if the current situation is not resolved to its satisfaction.

6. <u>Any potential impacts of systemic neonicotinoid insecticides on human health.</u>

6.1 Human risk assessment for plant protection products is completed in accordance with the Uniform Principles set out in EU legislation.

6.2 We understand that Defra has provided detailed information about the regulatory risk assessment for humans.

6.3 Given the very large margins of safety required in human risk assessment before an authorisation can be recommended, it is unlikely that use in accordance with the UK conditions of authorisation will result in any impacts on human health. However, as no experimental data are available on humans, in addition to the detailed risk assessment, the ACP also considers reports of suspected ill-health associated with pesticide exposure in the UK, and screens the published literature for reports of adverse health impacts that might be of relevance to UK pesticide use. <u>Enclosure 7</u> .[Not published here. Deposited in the Parliamentary Archives].provides relevant abstracts from the published literature. None relate to approved use in the UK. Most seem to be reports of attempted suicide, mostly in developing nations. It is notable that the recovery from these events was generally within a matter of days with a relatively low level of mortality being reported. This contrasts to literature reports for some other insecticide classes which might be considered alternatives to neonicotinoids.

6.4 The three UK schemes reporting information on human health effects of pesticide exposure, National Poisons Information Service, (NPIS), Pesticides Incidents Appraisal Panel (PIAP) and Human Health Enquiry and Incidents report (HHEIS) have recorded very few reports involving a neonicotinoid insecticide. Details of the incidents reported are not

[1] **Maximum Residue Level (MRL):** The maximum concentration of a pesticide residue (expressed as mg/kg) legally permitted in or on food commodities and animal feeds. MRLs are based on good agricultural practice data and residues in foods derived from commodities that comply with the respective MRLs are intended to be toxicologically acceptable.

included with this evidence to maintain patient confidentiality. Symptomatic reports were associated with not using the product in accordance with its authorisation. Symptoms reported as being associated with exposure to neonicotinoid insecticides were transient and relatively minor, such as skin rashes and eye irritation.

6.5 Overall, therefore, monitoring has not identified reports of ill health in the UK associated with use of the neonicotinoid insecticides in accordance with their authorisations. We recognise that while each of the surveillance schemes has its own strengths and weaknesses, overall these schemes focus on acute ill-health and are not designed to identify long term consequences of pesticide exposure. A recent ACP working group has examined these schemes and made recommendations for future surveillance.

6.6 As with all pesticides, this position is kept under continuous review, and we expect to consider the next reports from the monitoring schemes in January 2013.

7. **What alternative pest-control measures should be used, such as natural predators and plant breeding for insect-resistance, in a bid to make UK farming more insect- and bee-friendly?**

7.1 The ACP is keen to see the development of sustainable approaches to pest management. This is often referred to as 'Integrated pest management' (IPM).

7.2 Nearly 10 years ago we published the report of a sub-group of the ACP that considered the alternatives to conventional pest control techniques in the UK. This report is on our website here. http://www.pesticides.gov.uk/Resources/CRD/Migrated-Resources/Documents/A/ACP_alternatives_web_subgrp_report.pdf It is also available as Enclosure 8.

7.3 Since that report was produced, there have been a number of important initiatives aimed at supporting the development of sustainable agriculture in the UK. Some examples include:

- Introduction of the various levels of environmental stewardship agreements;
- Two projects considering regulatory approaches for biological pesticides (RELU and REBECCA) and an on-going review in association with the Pesticides Forum
- The UK biopesticides scheme
- A draft National Action Plan prepared for consultation (consultation closed on 22 October 2012) setting out many of the ways in which the UK supports development of sustainable approaches to the use of Plant Protection Products.

7.4 Despite these considerable efforts and developments, and the authorisation of more biological pesticides, it remains the case that effective control of important insect pests particularly in arable and some horticultural crops in the UK will continue to rely heavily upon the relatively few authorised insecticidal products for the foreseeable future. Maintaining a crop protection 'armoury' that includes insecticides with different modes of action is also important to minimise the risk of insecticide resistance developing in key pests.

7.7 Specialist growing techniques such as those required in organic production systems currently play an important but 'niche market' role in the overall agricultural production within the UK, and there are significant costs associated with these methods of production –

often including lower yield. The latter is clearly of increasing importance when considering wider food security issues.

7.8 Thus, the main alternatives to use of neonicotinoids currently available to most farmers and growers are other insecticides. Annex 5 provides a short summary of acute toxicity data on honey bees for insecticides currently authorised for use on oilseed rape (OSR) as an example crop that is very attractive to bees. The data demonstrate that most of these insecticides present a potential hazard to bees. Risk management for all of these substances is therefore primarily about management of exposure, so that the risk of actual harm is limited. It is important to note that not all insecticides control the same pests, so the insecticides included in this list would not necessarily be interchangeable alternatives. Recent usage data for the neonicotinoids in the UK is at annex 6 to give a clear context to the Inquiry considerations. We understand that more detailed examination of alternatives has been provided by Defra.

7.9 It is very important that the careful scientific examination of possible impacts of the neonicotinoids is completed to ensure that an appropriate regulatory response is made to manage risk. Action on the neonicotinoids could result in greater usage of other insecticides. Both the neonicotinoids and most other insecticides have fairly low LD50[2] values for honey bees (i.e. are toxic at low concentrations) and it would be quite difficult to identify from these data that there is a class difference in toxicity between the neonicotinoids and other classes of insecticides. We currently have virtually no data on bumble bees for other insecticides as it is not a standard regulatory requirement. The limited data we have seen e.g. in Gill *et al* (2012) indicate that under those experimental conditions exposure to lambda cyhalothrin alone (at a dose which is higher than is used in practice), also resulted in some significant effects on bumble bees.

Enclosures .[Not published here. Deposited in the Parliamentary Archives].

1. Published evaluation document 73 - imidacloprid
2. ACP 6 (341/2010) and ACP 6/1 (341/2010) initial consideration of the ‘buglife’ report and ACP response. Our environmental panel’s consideration of the additional points is ACP 12 (350/2012).
3. ACP 9 (354/2012) response to a stakeholder; ACP 7, 7/1, 7/2, 7/3, 7/4, 7/5, 7/6 (355/2012) papers on bees considered at meeting 355 plus the detailed record of discussion of that item at the May 2012 meeting.
4. ACP 6, 6/1, 6/2, 6/3, 6/4, 6/5, 6/6 (356/2012) and ACP 11 (356/2012) papers on bees considered at meeting 356 plus the detailed record of discussion of those items at the July 2012 meeting.
5. ACP 20, 20/1 (357/2012) additional studies on bees and detailed record of discussion at the September 2012 meeting.
6. ACP 12, 12/1, 12/2, (358/2012) additional studies on bees discussed at the November 2012 meeting and the advice just sent to Ministers.

[2] LD50 the theoretical lethal dose for 50 per cent of a group of animals

7. Abstracts from the published literature on reported human health effects of neonicotinoids
8. ACP Report on alternatives to conventional pest control techniques in the UK

Annex 1

Current ACP membership (as at 16 November 2012)

Chair

Sadly, our current Chair**, Professor Gabrielle Hawksworth** passed away on 30 July 2012. She will be greatly missed by all her friends and colleagues.

Deputy Chairman

Dr Andrew Povey is Reader in molecular epidemiology at the University of Manchester. He was first appointed to the Committee in 2008 to advise on epidemiology and toxicology issues.

Members

Professor Colin Brown is Professor in Environmental Science at the Environment Department of the University of York. This is his sixth year on the Committee.

Dr John Cocker is a Biochemist and Head of Biological Monitoring at the Health and Safety Laboratory, Buxton, Derbyshire. This is his fourth year on the Committee.

Mr Richard Davis is a retired Director of the Chemicals Regulation Directorate, who graduated in plant pathology and followed with a successful career in research in the use of pesticides in horticultural and agricultural crops and in pesticide regulation. He joined the ACP in Autumn 2011.

Ms Jennifer Dean is a Barrister, and is the ACP Committee Lay Member for consumer affairs. This is her third year on the committee

Mr Derek Finnegan is a regulatory compliance and safety specialist, with expertise in delivering technical and regulatory solutions to the food industry. He was appointed to the Committee in January 2012.

Dr Caroline Harris is Principal Scientist and Co-Director of the Centre for Chemical Regulation and Food Safety, Exponent International Ltd, Harrogate, North Yorkshire. This is her fourth year on the Committee.

Dr Martin Hare is Principal Lecturer at Harper Adams University College and Chair of its Research Degrees Standards Committee. He is an active researcher in pesticide efficacy, and joined the Committee in Autumn 2011.

Mr Philip Jackson is a self employed Health and safety Consultant, and is the ACP Lay Member for Environmental Issues. This is his third year on the Committee

Professor Ted Lock is Industrial Professor of Toxicology at the School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University. He was appointed to the Committee in January 2012.

Dr Peter Matthiessen is an independent environmental consultant in ecotoxicology, and is a former member of the Centre for Ecology and Hydrology, Lancaster Environment Centre. This is his sixth year as a Member of the Committee.

Dr Chris Morris is a Senior Lecturer in neurotoxicology at the Medical Toxicology Centre, University of Newcastle. He was appointed to the Committee in January 2012.

Professor Colin Ockleford is Professor in the Department of Medicine at Lancaster University and Visiting Professor in the Laboratory for Developmental Cell Sciences in The Department of Infection, Immunity and Inflammation at Leicester University Medical School. This is his sixth year on the Committee.

Professor Keith Palmer is Professor of Occupational Medicine at the University of Southampton, and Clinical Scientist at the MRC Lifecourse Epidemiology Unit. He is Honorary Consultant Occupational Physician at the Southampton University Hospitals NHS Trust. This is his first year on the Committee.

Dr William Parker is Director of the Horticulture Sector of the Agriculture and Horticulture Development Board. This is his fifth year as a Member of the ACP.

Professor Richard Shore is a vertebrate ecotoxicologist and Head of Site at the Centre for Ecology & Hydrology (CEH) at Lancaster. He is a senior researcher investigating the environmental impacts of contaminants, and has an Honorary Chair at Lancaster University. He joined the ACP in Autumn 2011.

Dr Andrew Smith is Director of the MRC Integrative Toxicology Training Partnership (ITTP), based at the MRC Toxicology Unit, University of Leicester. He joined the ACP in January 2012.

Dr Stephen Waring is Consultant in Acute Medicine and Toxicology, York Hospitals NHS Trust, and Honorary Senior Lecturer in Clinical Pharmacology, Hull/York Medical School. This is his fourth year on the Committee

Dr Simon Wilkinson is a staff scientist at the Medical Toxicology Centre, University of Newcastle Upon Tyne. He researches into routes of exposure to harmful chemicals, concentrating on dermal absorption and cutaneous metabolism. He joined the Committee in Autumn 2011.

Annex 2

The regulatory system

Most people agree that it is very important to control the pests, diseases and weeds that threaten our food supplies. There are a number of techniques to do this which are used by both professional farmers and growers and by home gardeners. These include techniques such as crop rotation, digging or ploughing, weeding and the introduction of predatory insects or mites, nematodes and parasitoids as part of integrated pest management (IPM) approaches.

Pesticides are included in these techniques for both professional farmers and growers and home gardeners. Pesticides are substances, preparations or organisms used to control specific pests, pathogens or diseases or weeds. They include a wide range of different substances, both naturally occurring and synthesised and a range of bacteria, fungi or viruses that can be used in biological control.

Because these are products that are specifically designed to have an effect on a living thing, pesticides, like medicines, are subject to an extensive regulatory system and must demonstrate that they can be used without unacceptable risks before they are allowed to be sold.

This is a short explanation of the regulatory system currently in place for pesticides, specifically designed for the general reader. More detailed technical information (suitable for those seeking to make an application for approval of a pesticide for example) is available on the CRD website [http://www.pesticides.gov.uk/guidance/industries/pesticides].

There is a large volume of work to do in assessing pesticides to ensure they meet the requirements of the regulatory system. Much of this work is now shared between the member states of the EU, with one member state, known as the Rapporteur Member State taking the lead responsibility for assessing the active substances used as pesticides in the EU. An active substance can only be used in a pesticide product anywhere in the EU if it meets the regulatory requirements and has been approved by the member states.

The active substance in a pesticide product is the part of the product that provides the pest control. Most products also include a range of other substances that help to make the product suitable to apply to protect the crops, for example the bait that will attract slugs to eat slug pellets. These other substances are called co-formulants.

Each member state remains responsible for authorising all pesticide products to be used within their member state. This is so that each member state can make a specific assessment of each product taking account of differences in conditions that occur across Europe that will affect how a pesticide can be used.

A number of government departments in the UK have a specific interest in the authorisation of pesticides. The Department for Environment, Food and Rural Affairs (Defra) takes the lead, with important involvement from the Department of Health, the Food Standards Agency, the HSE (HSE), and the devolved authorities in Scotland, Wales and Northern Ireland.

The Chemicals Regulation Directorate (CRD) of the Health and Safety Executive (HSE) prepares a scientific evaluation of applications for pesticide product authorisation in the UK on behalf of all of the departments. They also prepare evaluations of active substances where the UK has been asked to be the Rapporteur Member State for the EU.

The independent Advisory Committee on Pesticides provides expert advice both to CRD and to the responsible ministers and departments on all major issues relating to pesticides in the UK.

The scientific evaluation of a pesticide
This is a complex process involving the detailed consideration of a huge database of scientific studies for each active substance and pesticide product.

For the purposes of this document it is perhaps most straightforward to outline the data that are considered and the way in which information is used to complete the risk assessment needed to meet the regulatory requirements for a new active substance. Such applications must be accompanied by data for a pesticide product as well. Details of data requirements and evaluation times are given on the CRD website for different types of applications for approval [http://www.pesticides.gov.uk/guidance/industries/pesticides/user-areas/applicant-advice].

The main components of the data package that typically would be required for a new pesticide fall into the following seven areas.

1 Physico-chemical properties
The applicant is required to specify the chemical composition of the product, its active substance, and any significant impurities that it may contain. Information must also be supplied on the physicochemical properties of the active substance, for example how soluble it is in water or other solvents, what is its vapour pressure etc and on methods by which it can be detected and measured, for example in foodstuffs and water.

2 Potential toxicity in humans

Data on potential toxicity are required for the active substance, the product as a whole, and also any important metabolites of the active substance to which humans might be exposed. An important objective of the toxicological assessment is to establish ‘no adverse effect levels’ (NOAELs) for any ill-effects that might occur. A NOAEL is the highest dose in an investigation that does not cause ill-effects. Specific data on effects in humans is not usually available, particularly for new active substances. However data are considered on a range of mammalian species in studies that consider effects that might occur over an entire lifetime and over several generations.

On the basis of these data, a decision is made as to whether the product requires labelling as a hazard (eg irritant, harmful, toxic) in accordance with standard international requirements.

Reference doses are also defined for use in the risk assessments. These reference doses are carefully derived from the NOAELs of studies relevant to the type of exposure expected, and always include an assessment factor to take account of the fact the studies are in animals and not in humans. Internationally these are usually set to provide a margin of at least 100 on the key NOAEL, assuming that average humans are at least 10 times more sensitive than animals and that particularly sensitive humans are up to 10 times more sensitive still. Data available from medicines where there are comparable data available on both humans and other mammals suggests that this is more than adequate to take account of these uncertainties as differences in sensitivity are more usually less than 10 in reality. The size of the assessment factor can be increased if considered necessary due to either greater than usual uncertainty in the data package or specific critical irreversible effects seen in the studies.
The reference doses set are:

Acceptable daily intake (ADI)
This is the amount of a chemical which can be consumed every day for a lifetime in the practical certainty, on the basis of all known facts, that no harm will result. It is expressed in milligrams of the chemical per kilogram bodyweight of the consumer.

Acute reference dose (ARfD)
The definition of the ARfD is similar to that of the ADI, but it relates to the amount of a chemical that can be taken in at one meal or on one day.

Acceptable operator exposure level (AOEL)
This is intended to define a level of daily exposure that would not cause adverse effects in operators who work with a pesticide regularly over a period of days, weeks or months.

3 Dietary intake

One of the ways humans might be exposed to a pesticide is through its presence as a residue in food. An obvious route of exposure is residues in food from the treated crop, but residues may also occur in other foods by indirect routes. For example, they might arise in the meat, milk or eggs of animals that have been fed on a treated crop, or from crops grown subsequently to a treated crop if the pesticide is particularly long-lasting in the environment.

Furthermore, the particular product that is being evaluated may not be the only source of the pesticide in the diet. The same chemical may also be a constituent of other products that are already on the market in the UK or in other countries from which we import food.

In assessing the risks from residues of a pesticide in foods, therefore, it is necessary to identify and take account of all foodstuffs in which significant residues might occur, including those resulting from the use of other products that contain the same active substance.

To check whether the proposed use of a pesticide might cause unacceptable long-term dietary exposures, an estimate is made of the maximum intake that an individual would be expected to incur over a prolonged period. This is based on the distribution of measured residues of the pesticide in foods derived (directly or indirectly) from treated crops, and data on the national patterns of consumption for different foods from official surveys, as now commissioned by the Food Standards Agency. These surveys provide specific data on both special diets and variations in diet with age.

The long-term dietary exposure to a pesticide, calculated in this way, is compared with the acceptable daily intake (ADI). If the ADI is exceeded, the proposed use of the pesticide will not be acceptable. The effect of any over-estimation of potential dietary intakes is to err on the side of safety.

Separate calculations are carried out for dietary exposures in infants and children, and other consumer groups, to check that the exposure will be acceptable. Also, if the pesticide has toxic effects that could arise from a single dose, an estimate is made of the maximum dietary exposure that could occur in a single day or from a large portion of that food and this is compared with the acute reference dose (ARfD). If the ARfD is exceeded, again the proposed use will be unacceptable.

Finally, if the use of a pesticide produces significant concentrations of toxic metabolites in food (ie substances formed by its chemical degradation in plants or animals), the acceptability of exposure to each of these metabolites is also assessed.

4 Exposures to operators, other workers, bystanders and residents
The other circumstance in which human exposure to pesticides commonly occurs is in the course of their application or through contact with crops or other materials that have been treated with them. For example, an operator might be exposed when mixing or applying a pesticide; a passer-by or neighbour might be exposed inadvertently to droplets that drift when a pesticide is being sprayed; and a worker harvesting a crop that has been treated might handle foliage that is coated with residues of a pesticide.

Estimating the profile of exposure in operators, other workers and bystanders is complex and must take into account many factors. These include:

- the physical form of the pesticide (eg liquid or granules);
- the way in which it is used (eg sprayed with a vehicle-mounted
- boom sprayer or painted with a brush);
- the circumstances in which exposure occurs (eg during mixing
- and application or through contact with a treated surface);
- the use of any personal protective equipment such as gloves or
- a face mask;
- the extent to which the pesticide penetrates the skin;
- patterns of use (including frequency and duration).

The highest exposures in this group are experienced by operators (people actually applying the pesticide). Sometimes, acceptable operator exposure (ie exposure at or below the AOEL) can only be achieved through the use of personal protective equipment such as gloves, coveralls and face-masks. This may be satisfactory for professional operators but amateurs cannot always be expected to have the knowledge that is required to select and use the appropriate forms of protective equipment. Therefore, amateur uses of pesticides are not generally authorised where exposures would be acceptable only with the use of specialised personal protective equipment.

It is important to note, however, that exposure can be controlled by means other than protective clothing; for example, use of suitable packaging for products can reduce the exposure of users.

Authorisations are not allowed if estimated exposure of bystanders, neighbours or workers handling the treated crop is above the AOEL (and of course it is always assumed these people do not use protective equipment).

5 Environmental fate and behaviour
In order to assess the potential impact of a pesticide on the environment, it is necessary to establish what happens to it once it has been applied – where it gets to; how fast it is degraded and by

what mechanisms; and whether any of its degradation products might occur at levels sufficient to pose a risk. In particular, information is needed about the concentrations of the pesticide and any relevant breakdown products that will occur in soil, water and air, and the persistence of such pollution.

Predicted environmental concentrations (PECs) are derived, and are used to assess:

- exposure of non-target species in soil and water;
- possible contamination of groundwater;
- the potential for effects on, or residues in, following crops.

The distribution and breakdown of pesticides in the environment depends on many factors including the physical and chemical properties of the pesticide, the climatic conditions following use and the pattern of usage.

The rate of breakdown of a pesticide is usually summarised by a half-life value, which represents the time it takes for half of the pesticide to degrade. The ease with which a pesticide can be washed out of the soil is usually termed its mobility and a general impression of this can be gained from a Koc value (organic carbon sorption coefficient), which gives a measure of how well the pesticide adsorbs (sticks) to soil.

The mobility and degradation of a specific pesticide can vary in different soils and can also be influenced by rainfall and temperature.

The application rate, frequency of application and overall pattern of usage can all affect the concentrations of the pesticide present in the environment, and must be taken into account.

6 Ecotoxicology

The other major determinant of a pesticide’s environmental impact is its toxicity to wildlife.

The environmental risk assessment focuses upon possible effects of the pesticide on a range of non-target organisms including: birds, wild mammals, fish, aquatic invertebrates and plants, insects (including bees) and other non-target arthropods, earthworms and soil micro-organisms and non-target plant species.

Acceptable exposure is determined in line with the relevant EU guidance. For many species this involves comparison of the dose causing no effects in experiments with the relevant predicted environmental concentration to form a toxicity:exposure ratio.

If the risk assessment suggests the exposure will cause an unacceptable risk, a range of possible measures can be considered to reduce the exposure. One example of such a 'risk mitigation measure' is a no-spray buffer zone around water courses to reduce the amount of spray that might drift onto surface water. If practical risk mitigation measures cannot be devised, the product will not be authorised.

7 Efficacy and risk to following crops

Consideration of product efficacy is an integral part of the risk assessment process. Authorisation of a pesticide is only recommended if there are discernible benefits from the application of that pesticide. Data must be available to demonstrate the efficacy of the pesticide against target organisms when it is used in accordance with the label instructions. Data are also required to demonstrate that the dose recommended is the minimum necessary to achieve the desired effect.

In addition, the application of pesticides (especially herbicides) to a crop may pose a risk to the crop itself or to immediately adjacent or following crops. Studies are required to examine this.

Like resistance to medicines, resistance to pesticides is also a widespread problem that limits the effectiveness of many pesticides and reduces the options for controlling a range of target organisms. The risk of resistance development is considered for each pesticide. Where there is evidence or information to suggest that the development of resistance is likely, a management strategy designed to minimise the likelihood of resistance or cross resistance developing in target species is required.

The role of the ACP

A draft evaluation covering all of these aspects is prepared by CRD. They then pass this to other government departments and to the ACP for specific advice on the evaluation and whether a product containing the new active substance can be considered for authorisation in the UK. The ACP consider these evaluations in great detail, and often require further studies to clarify aspects of the evaluation. Some examples of this work are outlined in the ACP's annual reports. Only when the ACP are content the product can be used without unacceptable risks do they advise ministers an authorisation can be granted.

Ministers take note of the ACP's advice, and only once all government departments are in agreement that authorisation is acceptable can an authorisation be issued for the agreed use in the UK.

Subsequent requests for authorisations of products containing an approved active substance might require new data in only some of the seven areas above, but all changes, including administrative changes such as a change in the name of the company holding the authorisation, or additions to the crops treated must be specifically authorised.

How are authorisations kept up to date?
All pesticides are subject to review at any time if data come to light that suggest that the risk assessments need significant revision, and there is a regular review programme in Europe to ensure that all data are kept up to date and that information is generated to meet new requirements that apply as scientific knowledge and understanding increases.

Changes to data requirements occur as scientific knowledge and understanding develops. These are usually updated at the routine review rather than each new data requirement being applied straight away across all currently authorised products. This helps to ensure the work load is more evenly spread, both in the laboratories generating the data, and in the regulatory processes.

Impact of changing EU legislation
During 2009 new EU legislation on pesticides was agreed. The Sustainable Use Directive (2009/128/EC) sets out a number of ways in which aspects of pesticide use may be managed in future. A new Plant Protection Products Regulation (EC 1107/2009) was also agreed. This has replaced Directive 91/414/EEC. The Regulation introduces some new aspects to pesticide regulation in the UK. Examples of these include additional restrictions relating to 'hazardous' substances, requirements to consider the substitution of more hazardous products with less hazardous ones, and a more collaborative approach to pesticide regulation by introducing the idea of 'zonal' approvals involving groups of member states.

Annex 3

The ACP and its environmental panel has reviewed both the risk assessment approach and the emerging data regularly since 2008 as follows:

Environmental Panel reports.

1) Environmental panel 103 (Oct 2008) notified of 'restrictions on the use of neonicotinoids pesticides in Germany, Italy and Slovenia' http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-environmental-panel/environmental-panel-103rd-meeting-notes
2) Environmental panel 104 (April 2009) a general update on honeybees outlined R&D responses to concerns about neonicotinoids and possible exposure via guttation and dust created at seed drilling. A new EPPO risk assessment scheme for systemic pesticides was considered. http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-environmental-panel/environmental-panel-104th-meeting-notes
3) Environmental panel 105 (Oct 2009) update on general EU view on risk to bees from guttation. CRD indicated it was reviewing the Buglife report. http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-environmental-panel/environmental-panel-105th-meeting-notes.htm
4) Environmental Panel 106 (March 2010) ACP had referred specific questions on the buglife report http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-environmental-panel/environmental-panel-106th-meeting-notes.htm
5) Environmental Panel 107 (Oct 2010) consideration of issues raised by ACP from the buglife report; new EPPO risk assessment scheme for systemic pesticide; R&D on Guttation; WIIS data on bees; USA data on pesticide residues in beehives. http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-environmental-panel/environmental-panel-107th-meeting-notes.htm
6) Environmental panel 108 (Feb 2011) panel views on the buglife report to go to ACP; SETAC workshop and OECD bees initiative;
7) Environmental panel 111 (Oct 2012) bees update and papers to consider.

(Notes from these meetings not yet on the web because minutes for 108 were only agreed at the Oct 2012 meeting due to a special meeting focusing on aquatic mesocosms that not all members attended and cancellation of a panel meeting. However the buglife report and papers were also considered at the ACP, so the overall view of the ACP is already published.)

ACP

Environmental panel activity is reported back to the ACP. Specific links given here are to additional discussion at the ACP only rather than to each report from the panel.

ACP Links given for individual meetings are to detailed records but shorter minutes drafted to be more accessible to lay readers in line with the Code of Practice for Scientific Advisory Committees are also available here: http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-minutes

1) Meeting 337 (May 2009) Section 16.1 The investigation of the German incident; guttation droplets as a route of exposure for other non-target arthropods; tiered approach to risk assessment for bees; decline in pollinating insects and R&D commissioned.
http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-detailed-record-of-discussion/acp-337-12-may-2009-detailed-record-of-discussion.htm

2) Meeting 340: ACP notified that research on guttation as a potential route of exposure had been commissioned section 9.2
http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-detailed-record-of-discussion/acp-340-10-november-2009-detailed-record-of-discussion.htm

3) Meeting 341 (January 2010) section14. The ACP written response to the buglife report that had been delivered between meetings was referred to the environmental panel for consideration of the additional points raised by the ACP response.
http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-detailed-record-of-discussion/acp-341-26-january-2010-detailed-record-of-discussion.htm

4) Meeting 350 (July 2011) section 10 report from the environmental panel on the further work on non-target arthropods they had taken forward following the buglife report
http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-detailed-record-of-discussion/ACP-350-5-July-2011-Detailed-Record-of-Discussion.htm

5) Annual open meeting 2011 discussion on bees formed one of the workshop streams. Conclusions were sent to EFSA.
http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-open-meetings/Open-ACP-2011/12th-Annual-Open-Meeting-of-the-ACP-Park-Inn-York-Monday-14-November-2011.htm

6) Meeting 355 (May 2012) section 6 discussion of the current concerns about potential risk to bees and consideration of published research.
http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-detailed-record-of-discussion/ACP-355-15-May-2012-Detailed-Record-of-Discussion.htm

7) Meeting 356 (July 2012) section 6 Further consideration of data, questions raised by Defra SAC and work underway in the UK and by EFSA. Advice provided for Ministers following this meeting.

http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/acp/acp-detailed-record-of-discussion/ACP_356_3_July_2012_Detailed_Record_of_Discussion.htm

8) Meeting 357 (Sept 2012) record not yet published as confirmed at the November meeting. Latest published studies provided.

9) Meeting 358 (November 2012) record not yet drafted. Further published research considered and further advice provided.

Annex 4

ADVICE TO MINISTERS:

Overall, the ACP were agreed that the current risk assessments are secure and have concluded that there is no justification to take regulatory action at present. Furthermore, there is no evidence as yet of neonicotinoid impacts on bees in the UK. However, the ACP will consider any new information as it arises and keep the situation under close review. An explanation of the work leading to this advice is set out below.

1. The ACP has examined in detail the recent publications in the scientific literature. They identified a number of points at a first discussion of this topic at the May 2012 meeting which have now been followed up.

2. Members have carefully reconsidered the data (including an examination of the raw data) supporting the current authorisations for thiomethoxam products in the light of findings from recent published data (specifically the paper by Henry et al) and EFSA discussions. The field studies submitted by the applicants are fully compliant with current regulatory guidance and additionally cover some aspects not required by the current guidance (e.g. over-wintering). In line with current guidance the regulatory studies were not designed with detailed statistical analysis in mind, and their power to detect statistically significant changes is not established. Also, they would not show some of the specific sub-lethal effects suggested by academic studies, such as disorientation over distances. However hives exposed to treated crops did not show any gross effects on a wide range of important endpoints when compared to control hives exposed to untreated crops.

3. While noting there were some questions concerning aspects of the two published studies (by Henry et al and Whitehorn et al), the ACP cannot discount their findings. The Committee believe these studies provide interesting information that should be considered in the development of future regulatory guidance. Some further research is merited in the light of these papers and others to clarify the findings and their relevance to the UK field situation. The ACP is pleased to note that relevant work is already underway.

4. This further work will need time to be completed. In particular the ACP is aware that the study on bumble bees (Defra project PS 2371) is currently in its field phase and it is expected results will be reported in March 2013. The ACP has asked for preliminary information to be made available as soon as possible following the field phase this autumn/winter. The study examining residues in honey bees (Defra project PS2370) to assist in the interpretation of the relationship between pesticides residues and disease in bees is also expected to report in March 2013. A preliminary examination of bee health statistics following the introduction of the neonicotinoids is expected to become available later this summer. Finally the EFSA work re-evaluating all of the neonicotinoid insecticides in the light of the latest research and the development of the revised guidance on assessing risk to bees are both due by the end of this year. The ACP will keep this work and its potential impact on authorisations under review

5. The ACP also identified a number of other possible areas for research into the possible impacts of neonicotinoid insecticides. These include some work on bee toxicokinetics to examine factors related to dose and exposure period, a true field study looking at disorientation (while recognising the very real practical difficulties might make this impossible to do). The ACP also asked their Environmental Panel to look at work on guttation as a potential source of exposure to other non-target arthropods.

6. Although the ACP has considered thiamethoxam in detail, the Committee agreed that the conclusions reached can be applied broadly to the authorisations of other neonicotinoid insecticides because:

   - The acute toxicity of thiamethoxam, clothianidin and imidacloprid are all of a similar order of magnitude, with similar extent of use. Acetamiprid and thiacloprid are significantly less acutely toxic and are used on a significantly smaller area.
   - The chemical properties of all of the neonicotinoid insecticides are very similar and the mode of insecticidal action is identical for them all.

Annex 5

Insecticide active substances: Bee toxicity data

Non-neonicotinoids on Oilseed Rape (OSR)			
	acute oral µg/bee	**acute contact µg/bee**	**other data**
Pyrethroids			
Alpha-cypermethrin	0.059	0.033	tunnel and field
Beta-cyfluthrin	0.051	0.0098	cage and field test
Cypermethrin	0.035	0.02	NTA field study considering recovery from effects
Deltamethrin	0.079	0.0015	field tunnel and cage studies. Repellent effect
Lambda cyhalothrin	0.483	0.098	field study repellent effect. Short term foraging suppressant
Taufluvalinate	12.6	12	tent and tunnel tests. Formulated product lower tox
Zeta-cypermethrin	0.044	0.002	cage field and tunnel; repellent, early mortality and no accumulation of reserves but not impact on brood
Carbamates			
Pirimicarb	4	53.1	field studies
Oxadiazines			
Indoxacarb	0.26	0.094	cage test
Azomethines			
Pymetrozine	>117	>200	

	acute oral µg/bee	acute contact µg/bee	other data
Neonicotinoids on OSR			
Acetamiprid	14.53	8.09	tunnel and extended lab
Clothianidin*	0.00379	0.04426	field studies
Imidacloprid	0.0037	0.081	cage tests and field tests
Thiacloprid	17.32	38.82	tent and tunnel tests
Thiamethoxam	0.005	0.024	semi-field and field tests

*Clothianidin data presented here are taken from the EU evaluation and there is a slight difference in values compared to the values originally considered by the ACP in the UK evaluation. UK values were acute oral 24 hour LD50 0.00394 µg/bee and acute contact 24hour LD50 0.04697µg/bee.

N.B. the higher the toxicity to bees, the lower the 'µg/bee' figure
'Oral' is toxicity that occurs following ingestion of the pesticide and is particularly relevant when considering potential exposures via food and drink for example.
'Contact' is measured following application directly to the back of a bee and is particularly relevant when considering potential exposures such as from spray drift for example.

Annex 6

Detailed neonicotinoid usage information

1. Arable crops

Around 5 million hectares of crops received a seed treatment overall, which is similar to the foliar insecticide treatment area. All figures used are area grown and area treated as a percentage of the area grown. Information on the potential yield losses for cereals and OSR have been taken from HGCA fact sheet ‘Pest management in cereals and oilseed rape’, and ‘Controlling aphids and virus diseases in cereals and oilseed rape’. Supplementary information was also taken from the HGCA research review ‘Pesticide availability for cereals and oilseed rape following revision of Directive 91/414: effects of losses and new research priorities’.

1.1 Wheat – approximately 2 million ha grown

Approximately 2 million ha of wheat is grown, 96% of which received a seed treatment, with 4% remaining untreated. (The usage data does not separate spring wheat from winter wheat). Approximately 36% of the crop grown from home-saved seed. The most common seed treatments highlighted in the usage survey report are:

24% received prothioconazole (fungicide)
22% received a neonic/fungicide mix treatment (Clothianidin/prothioconazole)
13% prochloraz (fungicide)
12% silthiofam (fungicide)
8% Fluoxastrobin/prothioconazole (fungicides)

5% clothianidin

3.4% of seed was treated with imidacloprid (2008 data)

30% of the crop was grown from seed treated with a neonicotinoid. Neonicotinoid seed treatments are used to:

a) Control pests such as wireworm and slugs, to assist crop establishment and

b) for the control of aphids in autumn sowings, to reduce/control the potential spread of BYDV (grain aphid and bird cherry-oat aphid). Losses from BYDV may be up to 2.5 t/ha when conditions favour aphid population development. The use of seed treatments provides around 6 weeks protection and reduces the subsequent number (or need) for follow up foliar sprays (currently only pyrethroids available). The number of foliar sprays will depend on how mild the autumn/winter conditions are. NB the pyrethroid tefluthrin is also approved for this use, but was not used in sufficient numbers to be reported in the usage survey. (Treatment for spring sown crops is ineffective because the crop is growing quickly at this point). Cultural control methods are important to reduce the ability for ‘green bridge’ transmission (aphid movement) through the crop.

Neonicotinoid foliar sprays did not appear to be a major component of foliar insecticides used in wheat in the 2010 report. Although some crops received a treatment with acetamiprid or thiacloprid it is not possible to report the area treated. In 2008, 0.1% of wheat received a foliar treatment of thiacloprid. NB the foliar approved use is for a ‘reduction in orange blossom midge’. Neonicotinoids would not be the product of choice as, for example, chlorpyrifos is more effective

1.2 Barley – winter (382,531 ha grown) and spring (538,632 ha grown) Total – 921,163 ha

As described above, seed treatments are used for BYDV control, which is particularly important in barley where it is considered the major disease. Evidence suggests yield losses in winter barley could be 2% (HGCA review).

No neonicotinoid seed treatments listed is listed in the main body of the 2010 survey report, however more complete data available in the report shows 7.4% of winter barley receiving a seed treatment of Clothianidin (either as a straight or in mixture with a fungicide) and less than 1% for spring barley.

Other survey data from 2008 shows 4.8% of winter barley receiving a seed treatment of Clothianidin and 3.7% of winter barley receiving a seed treatment of imidacloprid.

Neonicotinoid sprays do not appear to be a major component of foliar insecticides according to the survey data. (Again they may not be the product of choice).

1.3 Oats – 228,730 ha grown

36% received prothioconazole fungicide
26% - prochloraz/triticonazole fungicide
14% - Clothianidin/prothioconazole neonic insecticide/fungicide
8% fludioxonil
4% - Clothianidin neonic insecticide

A total of 18% of oats received a neonic seed treatment.

1.4 Oilseed Rape – 641, 562 ha grown (97% of which is winter sown)

Less than 1% untreated

22% grown from home-saved seed

Seed treatments
37% received fludioxonil/metalaxyl-M/thiamethoxam
21% - Beta-cyfluthrin/imidacloprid

18% - Beta-cyfluthrin/Clothianidin
16% - prochloraz/thiram
8% - thiram

A total of 76% of oilseed rape received a neonicotinoid seed treatment

Neonicotinoid seed treatments are used to assist in crop establishment and again for the control of Myzus persicae. Seed treatments provide protection for 4-6 weeks, follow up foliar (pyrethroid) sprays may be necessary. The main impact is again as a virus vector of turnip yellows virus in autumn, with yield decreases of 30% in the most susceptible autumn sown seedlings.

Neonicotinoid sprays were not listed in the 2010 report and the 2008 data showed 1% of the OSR area receiving treatment with thiacloprid. However, the approveduse is against pollen beetle – where pyrethroids are also approved and would be product of choice because cheaper. Where pyrethroid resistance has developed then thiacloprid or acetamiprid may be used. More recently flonicamid and pymetrozine have also been approved to give other MOA options where pyrethroid resistance is prevalent. As part of resistance management and to slow down its occurrence, there has been various research refining the pollen beetle thresholds and providing advice emphasising the need only to spray when the threshold is reached. (There was evidence that a significant amount of pyrethroid use occurred even in years when the thresholds weren't reached.

More recently, thiacloprid has also been approved as a foliar spray against Myzus, so use may increase in future years. This is seen as in response to an increasing problem of Myzus, which historically has not reached levels justifying treatment.

For any foliar use, the UK has implemented a statutory restriction of only 1 foliar spray of any neonicotinoid containing product per crop, so usage will always be limited.

HGCA review notes that pests of OSR can have a greater impact on yields than cereal pests. Actual figures on yield losses (rather than from experimental work) were stated to be limited, but levels around 1-6% losses were estimated.

1.5 Linseed – 43, 838 ha grown

8% grown from home-saved seed

50% - prochloraz
50% - Beta-cyfluthrin/imidacloprid

A total of 50% of linseed received a neonic seed treatment according to the 2010 report.

In 2008, 77% of linseed received a seed treatment of imidacloprid.

1.6 Seed Potato – 17, 440 ha grown

It is considered that this should be more accurately defined as potatoes grown for seed as opposed to a seed treatment for potato tubers.

5% of the crop was grown from home-saved seed.

According to the main body of the 2010 report, 41% of the seed potato area received a neonic foliar spray (thiacloprid).

In 2008, 3% of the potato seed crop received a foliar treatment with acetamiprid and 96% with thiacloprid and 13.4% with thiamethoxam.

Foliar sprays are a critical use for potatoes grown for seed because of the need to keep the seed potatoes free of virus – the main transmitter again being Myzus persicae. Multiple foliar applications will be made over the course of the season. There are four MOA available as foliar sprays: pyrethroids, neoncotinoids, pymetrozine and flonicamid. However, producers of seed potatoes use pyrethroids as the product of choice because of its perceived repellent effects. Virus transmission can take place within minutes of aphids starting to feed, so this is seen as a valuable trait. There is significant widespread resistance to pyrethroids, so alternation with other MOA is essential. From the usage data, neonicotinoids are the other principle foliar spray that will be used as part of the overall treatment programme. CRD imposed a maximum of two foliar applications on potato grown for seed,

Foliar applications are also made on ware potatoes, although aphid populations rarely reach significantly damaging levels through direct feeding. Typically only 2 applications may be required, and for this reason CRD imposed a restriction of 1 foliar application on ware potatoes.

Figures taken from the British Potato Council Research report (2009) ‘Pesticide availability for potatoes following revision of Directive 91/414/EEC: Impact assessments and identification of research priorities’ estimated losses (£Million) of 3.2-7.9 for fresh and processed potatoes, and 16.6 for seed potatoes if Myzus persicae was untreated.

1.7 Sugar beet – 118,494 ha grown

No home-saved seed due to the structure of the sugar beet market.

33% received hymexazol
33% thiram
13% thiamethoxam
12% Tefluthrin
7% Beta-cyfluthrin/Clothianidin

A total of 20% of sugar beet seed received a neonicotinoid seed treatment according to the 2010 report.

According to the 2008 data, 53% of the sugar beet received a seed treatment of Clothianidin, 7% with a seed treatment of imidacloprid and 11 % with a seed treatment of thiamethoxam.. This makes a total of 71% of sugar beet seed received a neonicotinoid seed treatment according to the 2008 data.

(According to BBRO Brooms barn, over 70% seed was neonic treated in 2012).

Neonicotinoids are particularly important for crop establishment, by controlling a range of soil pests, and then providing protection against aphids – particularly again Myzus, because it transmits virus yellows. There is no viable foliar option – the only approved product is pirimicarb and resistance to this is widespread (to the point where approval holder no longer recommends it). No neonicotinoid foliar sprays are approved on sugar beet – however twice in the last 5 years CRD has issued an emergency approval for the foliar use of thiacloprid to control aphids where (for various environmental reasons) the neonicotinoid seed treatments did not provide the usual length of control. There are pyrethroid-only seed treatments, but these do not include a claim for aphid control (only soil pests), and it would appear from the usage data to not be widely used.

The British Beet Research Organisation (BBRO) website puts usage of neonicotinoid seed treatments at over 90%, and notes that their effectiveness has reduced the need for further treatments. However, it was also noted that reliance on neonicotinoids alone, combined with the exposure Myzus receives on other crops, means that resistance risk is developing.

1.8 Maize

Used as a seed treatment for soil pests to aid crop establishment and subsequent frit fly infestations. Data from 2009 PUS survey indicate 5% was treated with clothianidin, 2% with imidacloprid, and 0.3% with thiamethoxam – a total of 7.3% ha. Around 160,360 ha were grown.

2. Horticultural uses

Neonicotinoids are also authorised in a wide range of horticultural crops either through on-label uses or off-label (EAMU/SOLA), across vegetable, fruit and ornamental uses. They are used as foliar sprays predominantly, although there are soil incorporation treatments (ornamentals). Whilst the ha treated is small compared to arable crops, they can still represent very important chemical control options, particularly in niche crops. Data from the PUS (2011) and more detailed information on uses and alternatives is available from the ADAS report (funded by DEFRA) on ‘Impact of changing pesticide availability on horticulture’ have been used to illustrate some key uses:

114% (i.e > 1 spray) of protected chrysanthemums (2007) and 61% of iceberg lettuce (2007) being treated with acetamiprid;

96% of mustard (2007) receiving a seed treatment of imidacloprid;

94% of nut trees (2008) receiving a foliar application of thiacloprid

Brassicas are also a major use – for aphid control - only 2007 data available for thiacloprid, but for some of these crops around 50% will have been treated. (around 26,000 ha Brassicas in 2008). This figure is likely to have risen since then, again due to resistance issues with pyrethroids and pirimicarb. Alternatives on Brassicas are pymetrozine, spirotetremat, and indoxacarb.

Carrots: around 12,000 ha grown, and 1/3 treated with thiacloprid for aphids (willow-carrot). Pirimicarb is available as an alternative.

Lettuce: 5877 ha grown, around 1200 treated with thiamethoxam, thiacloprid or acetamiprid for aphid control, including the currant-lettuce aphid. Alternatives to which there is no resistance are spirotetremat and pymetrozine.

Apple, plum: thiacloprid and flonicamid are used for aphid control.
Blackcurrant: sawfly - thiacloprid or chlorpyrifos
Raspberry – raspberry beetle, capsids, sawfly – thiacloprid and a range of other actives
Strawberry – capsids are controlled by thiacloprid or bifenthrin, biological control agents are an important component of IPM.

Hardy nursery stock – thiacloprid can be used for aphid control, but where IPM practised other actives are used with a shorter persistence to avoid impacts on predators e.g. pirimicarb, pymetrozine, permethrins. It is more widely used for thrips control (larvae), particularly because of resistance in alternatives such as pyrethroids, abamectin and spinosad.
Protected ornamentals – thiacloprid is used for control of aphids, with pymetrozine and pyrethroids as alternatives. It is also used for thrip control, along with spinosad and abamectin.

21 November 2012

Written evidence submitted by Paul Matthews

«The atmosphere was very cordial, with pleasant people proposing totally unacceptable things. To give an example, one of the risk calculations defined 'low risk' as a product which didn't expose bees to a chronic lethal dose value of 50 [which kills 50% of a population over a long period]. So the product was low risk if it only killed 49% of bees. It was simply unbelievable». Beekeeper Janine Kievits testifying of her experience at the 10th International Symposium of the Internation Commission for Plant-Bee Relationships - Bee Protection Group - Bucharest (Romania) in 2008.

(1) On 25 September 2012, the Environmental Audit Committee members launched what their press release calls a new inquiry into the impact of insecticides on bees and other insects. It invited organisations and members of the public to submit written evidence, setting out their views on these issues, adding that more wide ranging responses would also be welcome.

(2) The Clerks of the Environmental Audit Committee requested that I expurgate, as it were, my initial, very detailed testimony and evidence to avoid what they think might prove 'potentially libellous allegations against many people and organisations' and to restrict myself to issues covered by the inquiry's terms of reference.

(3) The Environmental Audit committee inquiry terms of reference are stated as : (a) the impact of insecticides on bees and other insects, (b) the basis on which DEFRA has decided not to take action following a review of research done earlier in the year on the effects of neonicotinoid pesticides and (c) the use (or abuse) of evidence in this particular case, for setting policy and regulations on pesticides (d) evidence of any potential impacts of systemic neonicotinoid insecticides on human health and (e) what alternative pest-control measures should be used.

(4) To examine the impact – negative, potential or otherwise – of insecticides on bees and other insects – pollinating or otherwise - and to understand the basis of action taken or not taken to limit that impact, negative, potential or otherwise, one needs to scrutinise the behaviour of human individuals and enterprises empowered by wealth made by manufacturing, approving, marketing, regulating and supposedly policing, both pesticides and themselves, able apparently to persuade UK civil servants of the need to accept what the evidence suggests is an ecocide.

(5) Neither professional beekeeper nor academic naturalist, I am a member of the public with a declared interest : the protection of fundamental human rights relevant to the sustenance and pleasure obtained from a wholesome environment. This is something which, to the best of my knowledge, is identified, determined or measured by an abundance of natural assets – called loosely biodiversity – both in towns and the countryside – and high levels of drinking water and food chain quality. The operative words here are 'identified', 'determined' and 'measured'.

(6) The public is alienated from decision-making processes by specialist knowledge often used to discredit what may be deemed *lay* opinion. Conversely *expert* opinion is *de facto* judged to be '*science*-based'. Yet o*pinion*-based science also exists. So while experts may be appointed or hired by government to monitor and testify to key parameters considered commensurate with human health and a wholesome environment, expertise is no guarantee against some forms of bias or conflicts of interest – declared or otherwise – prejudicial to the wider public interest,

(7) Having followed where the evidence leads and in the light of what I personally have learned about events in Europe and elsewhere since the introduction of the type of insecticides called neonicotinoids, I would like to think the Environmental Audit Committee members have a duty to consider several legal and ethical issues central to contemporary UK government practice.

(8) Corroboration of what I believe to be true can be found in a more detailed form, with references, in my proof of evidence [*Not reported as evidence*]. I would ask EAC inquiry members to consider the testimony presented to them fully in the light of the following phenomenon. I understand that financial and commercial pressures are seriously compromising the canons of objectivity and impartiality within which strategic committees and sub-committees of departments, non-departmental public bodies and executive agencies are expected to operate. I would ask the MPs to probe effectively the degree to which - even before the current climate of austerity kicked in - DEFRA and key statutory consultees, notably FERA, EA, CRD,

Natural England, may have been 'obliged by the government to pay their way' through contractual arrangements with the private sector.

(9) In addition to the fact of a 'privatisation culture' delegating hitherto government tasks to outside organisations, budgetary constraints cause reductions in independence and loss of sovereignty, so that capacity in terms of monitoring, enforcement, research and the advisory rôles may be jeopardised by a lack of scientific rigour. So that regulation and other missions may become adjuncts of the business community's extremely focused needs. To the detriment of the wider public interest. Despite and because of the EAC inquiry's terms of reference, I suggest any such lack of scientific rigour is relevant to recommendations the MPs may choose to make.

(10) No livestock breeders of mammals or poultry are expected by DEFRA to accept as normal a loss rate among their animals regularly in excess of 30%. The use (or abuse) of neonicotinoids raises fundamental moral issues. The legal protected status of bumble bees and other invaluable invertebrates seems in doubt. Some feature as priority species in the Red Data Book system of Biodiversity Action Plans. The enforcement and prevention culture prevailing at DEFRA makes legislation unworkable and irrelevant. Eradicating irreversibly key life forms endangers entire ecosystems and is illegitimate and unethical. The question is : how can DEFRA, FERA and the CRD be allowed to continue to approve molecules whose chemical properties make them unlawful ?

(11) For example in soil under aerobic conditions, imidacloprid is persistent with half-lives of the order of 1–3 years ie significantly higher than the 120 days ceiling stipulated in REGULATION (EC) No. 1107/2009. The parent molecule produces several metabolites, two of which : the 5-hydroxy-imidacloprid and olefin imidacloprid : are toxic to bees (Cf. Araki et al. 1994). As a very water soluble systemic pesticide, imidacloprid translocates easily in the xylem of plants from the soil into the leaves, fruit, pollen, and nectar of a plant. Imidacloprid's excellent capacity for translaminar movement in plant tissues indicates that this agrochemical development - dating from 1992 – represents a paradigm shift technologically, agronomically and toxicologically. Such traits should have prevented their approval by EU regulators. Why didn't this happen ?

(12) Relative to Annex VI of the Council Directive 91/414/EEC, the Commission Guidance Document on Persistence in Soil dated 12.07.2000 (Pages 4 and 5) is categorical and limpid:

2.5.1.1 Fate and behaviour in the environment (Annex VI, part C, decision-making) : No authorization shall be granted if the active substance and, where they are of significance from the toxicological, ecotoxicological or environmental point of view, metabolites and breakdown or reaction products, after use of the plant protection product under the proposed conditions of use :

- during tests in the field, persist in soil for more than one year (i.e. DT90 > 1 year and DT50 > 3 months), or

- during laboratory tests, form non-extractable residues in amounts exceeding 70 % of the initial dose after 100 days with a mineralization rate of less than 5 % in 100 days, unless it is scientifically demonstrated that under field conditions there is no accumulation in soil at such levels that unacceptable residues in succeeding crops occur and/or that unacceptable phytotoxic effects on succeeding crops occur and/or that there is an unacceptable impact on the environment, according to the relevant requirements provided for in points 2.5.1.2, 2.5.1.3, 2.5.1.4 and 2.5.2. (Cf. http://ec.europa.eu/food/plant/protection/evaluation/guidance/wrkdoc11_en.pdf) :

(13) Clothianidin is the metabolite of thiamethoxam and has a half-life that can range from 148 days to values in excess of 1,155 days depending on soil type. It would seem that these systemic pesticide have been approved and registered in full knowledge of the fact that their persistence made them unsuitable as plant protection products. The evidence suggests their continued use and approval indicate an unscrupulous and possibly delinquent mind set, expert at subverting the risk assessment process. These substances are now massively deployed in monoculture despite :

- their scientifically observed sub-lethal effects on insect pollinator populations ;
- their obvious knock-on effects on biodiversity in removing a healthy and plentiful food source for innumerable species, notably birds, reptiles, amphibians and many other mammals ;
- their obvious tendency to pollute significantly surface and groundwater ;
- their obvious tendency to impoverish soil quality - depleted of invertebrates :
- their impact on neonatal mammalian brains and other suspected adverse health effects.

(14) Further corroboration of illegality can be found in my proof of evidence (Cf. also the URL references infra). The only reasonable response to this disavowal of the wider public interest is to consider as imperative the need to apply without further delay the Precautionary Principle.

(15) Unreported by Britain's press and media, an AFP press release dated 9 November 2012 announces how, invoking their attachment to the precautionary principle, a total of five former French government ministers for the environment, hailing from France's five major political parties, have called for a revision of GMO approvals and for what amounts effectively to a call for a root and branch reform also of the European pesticide safety assessments régime.

(16) This event in France is followed by the five demands for a change at EFSA presented at Parma on 12 and 13 November 2012 by key social networks and environmental organisations, indicating the need for a radical overhaul of Europe's food and environmental safety system.

(17) A powerful statement signed by 139 French scientists, including many agricultural sector researchers and supported by others fearful of losing jobs and advised not to sign, challenges the recent virulent attacks on Gilles-Eric Séralini and his CRIIGEN team. Entitled 'Science et Conscience' and published by Le Monde on 14 November 2012, the document criticises double standards condemning a two-year scientific study on the GMHT maize NK 603 and the Roundup herbicide which reveals massive data gaps and serious shortcomings in EFSA's methodology.

(18) On 15 November 2012 an Open Letter, sent to the European Commission and signed by cross party MEPs, requires greater transparency and independence on GMOs and food safety.

(19) The CRIIGEN researchers suggest the immediate need to review market approvals for pesticide tolerant crops with the 90 day test duration extended to two years for agricultural GMOs. Crucially, they add that all pesticides be tested in their formulations (not the active principle alone) for two years, including at very low levels. They indicate that the regulatory testing process for biotech and pesticide products necessitates transparent, open-to-public scrutiny, subject to independent review and performed independently of firms manufacturing them in the future. CRIIGEN has received support from the leading scientists of 33 countries, including more than 160 letters of support from professors, doctors and researchers, while more than a hundred others have supported the CRIIGEN research study by signing an open letter.

(20) In July and September 2012, Le Monde publishes two articles concerning neonicotinoid insecticides and bees. In the first Stephane Foucart shows how, through incompetence or the accumulation of conflicts of interest, the management of Europe's key advisory group for pesticides and bee health has fallen totally under the control of the agrochemists. In the second, the same investigative journalist indicates the fact that Exeter university – named the Sunday Times' University of the Year 2012-2013 – published, on 21 September 2012, a press release, accusing a French team's research of probably being "instrumental in the French government's recent decision to ban the use of thiamethoxam, a neonicotinoid that is the active ingredient of Cruiser OSR, a pesticide produced by the Swiss company Syngenta". It also claims, falsely, the French study is biased and ignores, declines or fails to mention the French team's solid rebuttal of criticism arising not from original research but from 'technical comments' by two Britons. These are Helen M Thompson of the Food and Environmental Research Agency (FERA) and James E Cresswell of Exeter University's Biosciences. Exeter University' press release declines or fails to acknowledge the fact that James E Cresswell's laboratory is funded by Syngenta.

(21) Apparently part of a conspiracy of silence exercised in Britain over international concern about relations between governments, regulators and agrochemical companies - and similarly unreported by the UK mainstream media - a very important development has occurred which, if made known to and fully understood by the public would fundamentally alter the current ultra-liberal approach to the use of neonicotinoids – because of their effect on honey bees and other pollinating insects. What would also **impact on the way all systemic xenobiotics** are assessed in respect to human health is an admission on pages 12 of a 45 page document, published by SETAC, edited jointly by Bayer CropScience USA and the USA's Environmental Protection Agency.

«**Risk assessment for systemic compounds** : Many who are familiar with pesticide risk assessment recognize that the methodology and testing scheme employed for foliar application products (where exposure may be primarily through surface contact) is not adapted to assess potential hazard and risk from systemic pesticides». Summary of the SETAC Pellston Workshop on Pesticide Risk Assessment for Pollinators 15–21 January 2011 Pensacola, Florida, USA**.** (NB SETAC have suppressed the original URL to this document).

(22) This official acknowledgement of a serious shortfall in methodology relates to the true ENVIRONMENTAL FATE of neonicotinoids and not the one industry and government would have us believe. We have Dr Rosemary Mason, MB, ChB, FRCA (retired) to thank for this discovery. I cannot improve on the way the naturalist and writer from South Wales presents the evidence and, in the interests of brevity, quote relevant passages from her September 2011 testimony :

«So, as we suspected, the whole purpose of the SETAC meeting was to try to develop methodology and protocols for tests that are specific to systemic pesticides whilst still allowing them to remain on the market (…) The SETAC conference was heavily sponsored by the pesticides industry, so they were well represented; three from Bayer, two from Syngenta, two from BASF (one of whom had boasted on the net about BASF's financial contribution), one from Monsanto and one from DuPont (…) The UK was represented by Mark Clook (Chemical Regulation Directorate) and Helen Thompson (Food & Environment Research Agency, FERA). Helen Thompson had worked closely with three scientists from Bayer, Syngenta and Dow on the International Commission on Plant-Bee Relationships (ICPBR) Bee Protection Group (she was the Group's secretary). The same three had also helped with the UK Defra Research SID5A (2007-2009) Systemic Pesticide Risk Assessment, which, incidentally, only got as far as protocols for Tier 1 tests. The conclusions of the ICPBR working group in 2008 were that protocols for the second and higher tier (Tunnel Tests and Field Tests) **were still to be developed.** So, members of the ICPBR must have known for **at least 3 years** that the science underpinning protocols for risk assessment for systemic pesticides was inadequate. The ICPBR have 17 members on their three bee working groups. Six are from the pesticides industry, some of whom service two groups. This may explain why the CRD, FERA, Defra and the AFSSA (French equivalent of FERA) have repeatedly advised UK and European Ministers and informed us, the public, that there was no evidence that the neonicotinoid pesticides are harmful to honey bees». Rosemary Mason September 2011.

(23) As can be verified by scrutiny of the lists of attendees, staff members of FERA (formerly CSL) and the CRD (formerly PSD) such as Mark Brown, Mark Clook, Julie Howarth **or** HM Thompson are no stranger to what are regular, secretive, mostly apparently private, get-togethers uniting senior or junior government scientists, advisors from industrial academia or professional consultancies involved in the lucrative business of elaborating Draft Assessment Reports and pesticide company employees. Until 2008, what actually transpired at the triannual ICB-PR bee protection group symposia was anybody's guess. The literature says the participants have been concerned with a 'harmonization of methods for testing the toxicity of pesticides to bees' ever since the 1st symposium in Wageningen in the Netherlands in 1980.

(24) Events at annual meetings and workshops of SETAC are an enigma. Mark Clook features alongside Martin Streloke, BBA, Germany and Anne Alix, ex-Novartis France and former French government official now Dow UK, on a 2011 Steering Committee of a SETAC Environmental Monitoring Advisory Group on Pesticides (EMAG-Pest). Processing the European Probabilistic Risk Assessments for the Environmental Impacts of Plant Protection Products, (EUPRA) to *harmonise* Risk Assessment brought together Martin Stroleke and Mark Clook - as ambassadors of their respective governments - in a 2001 Netherlands workshop chaired by Andy Hart of the CSL in York, alongside delegates from other EU member states, the US Environmental Protection Agency, the OECD and Syngenta representing the European Crop Protection Association.

(25) In good faith three beekeepers from Belgium and France – with professional qualifications in agronomy and/or specialist knowledge of and experience in bee husbandry - attended the 10th International Symposium of the ICP-BR Bee Protection Group Bucharest (Romania) in 2008. They found themselves face to face with seven of the nine members of the dedicated working group - Anne Alix, Marie P Chauzat, Sophie Duchard (AFSSA), Gavin Lewis (JSC International Ltd), Mark J Miles (Dow) Christian Maus (Bayer), Ed Pilling (Syngenta), Helen M Thompson (CSL) , Klaus Wallner (Hohenheim University) - tasked with preparing the UK Defra Research SID5A (2007-2009) Systemic Pesticide Risk Assessment, which, apparently, only got as far as protocols for Tier 1 tests. This despite the fact they had been working on the problem since the 9th Symposium of the

Bee Protection Group of the International Commission for Plant-Bee Relationships) located at the CSL Sand Hutton complex, York in October 2005. As can be discerned by an examination of the transcript of the plenary discussion the three beekeeper's concerns are given short shrift.
(26) Moreover as is revealed by Stéphane Foucart's Le Monde article (q.v.) the trio of outsiders wrote to the ICB-PR sécretariat - with copies to the EPPO members state's *ad hc*c agencies - to express their concerns at the way the 'standardised tests' used in the preparation of the Draft Assessment Reports were divorced from the biological reality. Their letters were ignored.

(27) Worth noting are the unambiguous conclusions of a paper from a ten-strong team of Italian ecotoxicologists, whose data collected in 2008 indicates that higher number of bee loss events occurred in intensively cultivated flat areas, located in the North of Italy, mainly during or after corn sowing. They establish a spatial and temporal correlation between hive damages and corn sowing and suggest that a presence of residues of agricultural insecticides, namely imidacloprid, thiamethoxam and clothianidin, used for seed dressing, in almost half the samples confirms the relationship between spring mortality and the sowing of corn seed dressed with neonicotinoids. They go on to say that the fact that half of the analysed samples did not contain residues is not enough to exclude the responsibility of neonicotinoids in hive damages, given that many factors can influence the presence of residues and their level : the exposure path of the agrochemicals to bees can be direct due to corn sowing dust or indirect via pollen and nectar from surrounding flora ; dead bee samples could have been collected with some delay after intoxication or could have not been properly stored with a consequent degradation of the active ingredients.

(28) The EAC inquiry members will have been briefed on systemic insecticide exposure pathways via phenomena like guttation. In hot, dry conditions, pollinating insects will quench their thirst from other more classical sources of moisture. Examining the impact of neonicotinoids on water quality should therefore come within the EAC inquiry remit. In April 2012, I contacted SW Water and the Environment Agency for information on surface and ground water quality concerning residues from three water soluble neonicotinoids. The response from the utility subsidiary of the Pennon Group was almost totally void of interest. But Maggie Summerfield of the Environment Agency's Customer and Media Communications Team emailed me on 16 April 2012. Her message is reproduced in my Proof of Evidence [*Not reported as evidence*].The following day Environment Agency's National Team's Technical Adviser Rob Barron phoned to confine himself to amending this sparse information, saying that the GS/MS scan for the groundwater quality monitoring was extended to surface water – with a possible monthly frequency - and that 'procedures are under review'.

(29) The alacrity with which the authorities highlight how they control the microbial quality of drinking water, notably by the addition of chlorine - a highly reactive halogen - contrasts with the opacity governing the way the chemical hygiene of drinking water is ensured. Public unease on this topic is amplified by the prevalence of disinfection by-products (DBP), particularly the trihalomethane (THM) compounds and bromates in relation to a cocktail of xenobiotic residues.

(30) Neonicotinoids are highly miscible in water. Studies prove that they move readily from the fields of farmers fields into ditches, streams, ponds, lakes and rivers, where they poison insects, arthropods and aquatic invertebrates. Water in the USA contaminated with imidacloprid is found in pools, streams, private wells, wells on golf courses etc. Arguably as a result of lobbying, not one neonicotinoid features among the 33 compounds classed in the Water Framework Directive (WFD) as priority hazardous substances or among the eight other pollutants. Lacking data for UK water I refer to two other European regions where the results of scrutiny are rendered public. Documents from 2006-2011 show aquifers beneath an intensively cultivated alluvial plain known as Berre-l'Etang, north of Marseille, contains residues of éthidimuron, metalaxyl, oxadixyl and imidacloprid in concentrations that exceed the 0,1 µg/l WFD thresholds for drinking water quality. Two separate pieces of research in 2010 by Dutch toxicologist, Dr Henk Tennekes, and a magister student, Teresa C. van Dijk, indicate significant levels of water-borne pollution in the Netherlands. According to the former in several instances related to flower-bulb monoculture, neonicotinoid levels have been recorded in untreated water at 600 times the statutory norm. He also says the Dutch Water Board have found concentrations of imidacloprid in streams and ponds

near the bulb growing areas which are 4-5,000 times above the legal limit for this molecule. The MSc student uses, for practical purposes, the Maximaal Toelaatbaar Risiconiveau (Dutch : Maximum Admissible Risk) as a benchmark and has discovered that neonicotinoid pesticides are applied in the largest amounts where potatoes, horticultural products and chicory are grown.

(31) Teresa C. van Dijk goes on to explain that, in these areas, which are mainly found in the Dutch provinces of Zuid-Holland, Noord-Holland, Zeeland and Groningen, imidacloprid can be traced in surface waters in concentrations often far exceeding the MTR norm which, formerly at 13 ng/l has been raised today to 67 ng/l ; a substantial hike which, one could argue, amounts to regulatory sleight of hand, without scientific or medical justification, but introduced to mask and effectively license the currently excessive and alarming pollution rates in the Netherlands.

(32) It is well worth taking the effort to read Teresa C. van Dijk's thesis (Cf. more details in my Proof of Evidence) [*Not reported as evidence*]. In attempting to correlate neonicotinoid water pollution and recorded losses in insect numbesr, the MSc student herself complains of a lack of appropriate data, saying that her task is complicated by the fact many studies are funded at least in part by large chemical concerns such as Bayer, which produce the pesticides in question. She nonetheless seems to establish insect loss-neonicotinoid pollution correlations that are statistically credible for flies (Diptera), beetles (Coleoptera) aquatic crusatceans (Amphipoda) and caddisflies (Trichoptera).

(33) How does one get MPs to, as it were, 'think outside the box' ? There is clearly no made-to-measure answer. But the chapter on 'Outstanding Questions'[*Not reported as evidence*] may provide a means of response.

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23 November 2012

Further written evidence submitted by John Hoar

'The Independent' (22nd November) reported that FERA is speeding up its field studies and that the Environment Secretary Paterson will ask the Advisory Committee on Pesticides (ACP) for an up-to-date view on neonicotinoids in the light of this work.

If you examine Annex 3 of the ACP Annual Reports for the last five years (2007-2011) you will see that 4 or 5 of the ACP independent members declare interests with the pesticides industry. This conflicts with the claim that the ACP is an independent scientific advisory committee.

The role of the pesticide industry is fundamentally different from that of the ACP, which is tasked solely with the protection of the health of human beings, creatures and plants, and to safeguard the environment. Declaring members' industry interests does not absolve this conflict of interest.

Pesticides are now referred to as 'plant protection products'. In an article in 'Chemistry World' July 2012, the representative from Bayer CropScience refers to neonicotinoid insecticides as being more or less 'bee-friendly' and intrinsically 'bee-safe'. The first is an oxymoron and the second is not proven, yet this is the message the industry sells to the public, farmers and horticulturalists. This sort of nonsense undermines the responsibilities and caution of the users of pesticide products.

Why is the pesticide risk-assessment for bees inadequate, 20 years after the neonicotinoid Imidacloprid was approved as a seed treatment by the Pesticides Safety Directorate in 1993? This aspect alone should be investigated.

It is the responsibility of government to ensure that not only is ACP is independent, but that it is seen to be independent and arrives at the right decisions and recommendations to Ministers. In this respect, any association by ACP with industry undermines this.

I urge you to insist that ACP members with links to the pesticides industry have nothing to do with the forthcoming ACP evaluation of FERA field studies.

26 November 2012

Written evidence submitted by Professor Simon Potts

1. Executive Summary

1.1. Wild pollinators (bumblebees, solitary bees, hoverflies and other insects), not managed honeybees, are the main pollinators of crops and wild flowers in the UK.
1.2. Both wild pollinators and managed honeybees are in decline in the UK and the drivers of pollinator loss are likely to be multi-factorial.
1.3. About 20% of cropped area in the UK needs insect pollination and demand for pollination services is increasing.
1.4. The total value of pollination services to UK agriculture was £603 million in 2010.
1.5. The cost of replacing insect pollination with artificial means would be ~£1.9 billion and therefore does not present a viable alternative.
1.6. The public would be willing to pay between £1.3-1.8 billion per year to conserve pollinators.
1.7. Pollination of wild plants underpins a suite of other ecosystem services (e.g. carbon sequestration, soil and water quality, and biodiversity) which is likely to have a very high, but currently unknown, value.
1.8. Multiple mitigation options are available to minimise the impacts of pesticides on pollinators. These include reducing overall application, improving application technologies, replacing pesticides with biocontrol and other IPM strategies, and landscape management to provide additional pollinator habitats.
1.9. It is recommend that Defra undertakes or funds research to conduct cost benefitsanalyses and multi-stakeholder risk assessments of the various mitigation scenarios to understand the impactson farmer livelihoods, food security, pollinator conservationandpublic opinion.

2. Introduction

2.1. I am Professor of Biodiversity and Ecosystem Services at the School of Agriculture, Policy and Development, reading University, with more than 20 years' experience working on pollinators and pollinationservices. I was the lead author for the Chapter on Pollination in the UK National Ecosystem Assessment (Smith et al. 2011).
2.2. I have a number of professional roles advising or providing evidenceto national and international organisations including: UK Parliamentary Office of Science and Technology; Defra; Natural England; UK Science and Innovation network (FCO); UK Office of Government Commerce - Starting Gate review "Healthy Bees Implementation"; European Environment Agency; European Commission DG Agriculture and DG Environment; Food and Agricultural Organisation of the United Nations; International Commission of Plant-Pollinator Relationships; and IUCN Task force on declining pollinator services.

3. Background

3.1. Pollination is a critical ecosystem service for agricultural crop production and the maintenance of wild flower diversity. Pollination levels depend both on the <u>supply</u> of pollinators (i.e. the availability of sufficient numbers of the right sort of pollinators in the right place at the right time) and the <u>demand</u> from plants (i.e. the area and type of crops needing pollination).
3.2. The main pollinators of crops and wild flowers in the UK are bees (honeybees, bumblebees, solitary bees) and hoverflies, and to a lesser extent other flies, wasps, beetles and butterflies.

4. Supply of Pollinators

4.1. Wild pollinators, not managed honeybees, are the main pollinators in the UK. In 2007, UK populations of honeybees were only capable of supplying a maximum of 34% of pollination service demands of crops even under favourable assumptions; dropping from 79% in 1984 (Breeze et al. 2011). The actual current contribution is expected to be closer to 15%.

4.2. Wild pollinators, including bumble bees, solitary bees and hoverflies and other insects are therefore estimated to be responsible for ~85% of crop pollination services (Breeze et al. 2011).

4.3. While yet to be fully assessed, wild pollinators, rather than managed honeybees, are likely to be the main pollinators of wild flowers.

4.4. Wild pollinators are in severe decline in the UK. More than half of British landscapes, where sufficient data was available, have shown significant declines in wild bee diversity since 1980 (Biesmeijer et al. 2006). Some areas have also seen significant declines in hoverfly diversity, while other have shown no change or increases.

4.5. Honeybees are in severe decline in the UK. Almost all honeybees are managed, and feral colonies are extremely rare in the UK. The number of honeybee colonies has dropped significantly between 1985 and 2005: England 54% loss, Wales 23% loss, and Scotland 14% loss (Potts et al. 2010a). There has been a modest increase in the number of colonies in some areas very recently.

4.6. Drivers of pollinator loss in the UK are likely to be multi-factorial and include: loss and fragmentation of habitat, environmental chemicals including pesticides and herbicides, pests and pathogens, climate change and invasive species (Potts et al. 2010b). However, the relative contribution of each driver and their synergistic effects are largely unknown.

5. Demand for Pollination Services

5.1. Most crops and wild flowers need insect pollination. Approximately 84% of European crops depend at least in part on insect pollination services (Williams 1994). About 78% of temperate wild flowers need insect pollination (Ollerton et al. 2011).

5.2. About 20% of the area of UK crops are comprised those which are pollinator dependent; this is a 38% increase since 1989 (Breeze et al. 2011). This trend of increasing area is expected to continue with growing demands for: biofuel crops (e.g. oilseed rape which is insect dependent), locally grown fruits and vegetables, and the uptake of new crops (e.g. blueberries).

5.3. The UK produces only a small proportion of pollinator dependent products and imports the rest from overseas (e.g. 30% apples and 57% of strawberries are UK grown) (Smith et al. 2011).

6. Value of Pollinators to UK Agriculture

6.1. Total pollinator loss for UK agriculture would translate into an annual loss of £603million in 2010 (updated for 2010, from Smith et al. 2011); equivalent to about 13% of total farmgate crop value. However, this estimate fails to take into account the contribution of pollinators to: forage crops, such as clover, which support livestock; small-scale agriculture, such as allotments and gardens; ornamental flower production; and seed production for agricultural crop planting.

6.2. The value of pollinators to UK agriculture is increasing year on year as the area of pollinator dependent crops increases in response to increasing demands biofuels (e.g. oilseed rape), locally grown fruits and vegetables and novel crops (e.g. blueberries) (Breeze et al. 2011).

6.3. The cost of replacing the service provided by insect pollinators with hand pollination is £1.9 billion, and therefore does not present an economically viable option in the UK (Breeze et al. 2012).

7. Other Values of Pollinators

7.1. In addition to crop pollination, the public values pollinators for aesthetic, cultural, and recreational reasons in terms of their inherent conservation worth and that of wild and garden flowers they pollinate, and florally rich landscapes. The public would be willing to pay between £1.3 billion (Breeze 2012) and £1.8 billion (Mwebaze et al. 2010) per year to conserve pollinators.

7.2. Healthy and diverse plant communities rely on insect pollination, and these communities provide a wide range of other ecosystem services. These include the support of wider biodiversity through the provision of food (e.g. seeds and fruit) and shelter for other species including birds, mammals, reptiles and insects. Plants also contribute, to varying degrees, to carbon sequestration, the maintenance soil fertility and structure, flood protection, clean drinking water, and noise regulation (Smith et al. 2011). The contribution of pollinators to these services is indirect, but as the services themselves are likely to be valued at many billions of pounds, the value of pollinators is non-trivial.

8. Mitigation of Insecticide Impacts on Pollinators

8.1. There are a number of options available to mitigate against the impacts of pesticides on pollinators. These fall in to three broad categories: (i) reduction of use of pesticides; (ii) reduction in risk of exposure at point of application; and (iii) landscape management approaches. It is likely that a combination of these would be the most effective approach to safeguarding UK pollinators and pollination services.

8.2. <u>Reduce pesticide applications</u>. Pesticide application rates rose by 6.5% between 2005 and 2010 due to increasing treatment intensity per ha on a number of crops (FERA, 2012). A phased reduction in the application of all pesticides, including neonicotinoids, would be likely to benefit pollinators. In parallel, the adoption of other pest control methods such as supplementing with biocontrol agents or the management of uncultivated areas of farmland to enhance natural enemy populations, would help maintain overall pest control.

8.3. <u>Improved application technologies</u>. Adopting more stringent requirements for famers to use the best available application technologies, such as those reducing the loss of seed coating dust and the latest spray nozzle designs, would help minimise exposure risks.

8.4. <u>Landscape management approaches</u>, using instruments such as Agri-Environment Schemes, could be used to provide four sorts of benefits to pollinators. First, adding non-sprayed elements to the landscape would result in an overall dilution of the total amount of pesticide per unit area; secondly, if these areas were floristically rich then they could provide additional forage resources for both wild and managed pollinators; thirdly, these areas could provide ‘safe heavens’ to effectively reduce exposure of pollinators to sprayed crops; and finally, modifying cropping patterns and rotations so that flowering times were synchronised across a landscape could reduce overall exposure.

8.5. Based on expert opinion, it is estimated that the cost of using current agri-environment scheme options for conserving wild pollinators would be in the region of £40-79M for 5 years (Breeze 2012). This was based on mitigating against multiple pressures on pollinators not just pesticides.

9. Recommendations

9.1. Defra to fund research (directly or through Research Councils) to address key knowledge gaps focussed on the costs and benefits of implementing different mitigation actions; this would need to take into account multi-stakeholder risks assessments for farmer livelihoods, food security (including farm productivity, food prices for consumers and reliance on imports), environmental quality (pollution and harm to wildlife), pollinator conservation and public opinion. These should include cost:benefit analysis and risk assessment of the following scenarios:

9.2. Business as usual with no change in current policy or practice.

9.3. The potential loss in food production following a phased reduction in overall pesticide use: (i) without any substitute pest control methods; (ii) with replacement of neonicotinoids with other available pesticides; (iii) with the use of current biocontrol technologies.

9.4. Adoption of state of the art application technologies.

9.5. Adoption of landscape management practices to protect pollinators using current Agri-Environment Scheme instruments and/or using novel instruments, such as those that may arise under the CAP reform or payment for ecosystem service tools.

9.6. Developing a 'polluter pays model' where the estimated negative impacts of pesticide applications carry a cost which is then used to pay for biodiversity offset to provide habitat elsewhere to protect pollinators.

9.7. Combinations of 9.3 to 9.6.

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