15 RECOMMENDATIONS, RESEARCH SUGGESTIONS & NEXT STEPS

In this section, several recommendations are made to various agencies/organisations in order to address data gaps and to help reduce potential risks to insect pollinators.

These recommendations are followed by several general suggestions for further research which might lead to a better understanding of the situation with respect to the use of neonicotinoids in Australia.

Finally, in Section 15.3 the APVMA outlines some of the further steps it is taking to help reduce the risks to insect pollinators arising from the use of insecticides in agriculture and horticulture.

15.1 Recommendations

15.1.1 Managing the release of neonicotinoid seed-treatment dusts at planting

As noted in this overview report, one of the potential routes of exposure of insect pollinators is to fine dust containing neonicotinoid arising from the process of planting seeds coated with these insecticides. The American Seed Trade Association (ASTA) and CropLife America have developed a best practice guide, *The Guide to Seed Treatment Stewardship* (www.seed-treatment-guide.com), which outlines good stewardship practices related to the use of seed treatments and treated seed (ASTA & CLA, 2013). Similarly, CropLife Canada has worked with their national regulator, the Pest Management Regulatory Agency (PMRA) to help manage the issue of neonicotinoid dusts, especially during corn planting, a major crop in Canada (see www.croplife.ca/issues/pollinators).

The APVMA is aware that in 2010 the EU amended the provisions of the approval for clothianidin, imidacloprid and thiamethoxam, permitting their use as seed treatments (1) only where the seed coating was performed in professional seed treatment facilities which apply the best available technology to minimise the release of dust during seed treatment, storage and transport; and (2) where seeding equipment used is such that it ensure a high degree of soil incorporation of the seed, and minimises spillage and dust generation.

Recommendation: *CropLife Australia could consider working together with relevant member companies to develop a best-management practice guide relevant to Australia and focussing on those industries where there is the potential for neonicotinoid dusts to be generated during the process of coating, transporting and planting of treated seeds. This may require liaison with relevant agricultural machinery manufacturers as well seed-treatment facilities and with agricultural commodity groups.*

While the APVMA does not have any information or evidence to hand to indicate that the generation of neonicotinoid dusts during planting of treated seeds has been an issue in Australia, the development of a best-management practice guide to help minimise any dust generation during the process of seed coating, transport of treated seed, and planting is considered to be a sensible and precautionary step. The APVMA is (1) liaising with CropLife Australia about the development of best management practice guidance; and (2) seeking any information, *via* its adverse experience reporting program (AERP), about any problems that might be occurring in agricultural areas with neonicotinoid seed treatment dusts.

15.1.2 Surveillance - bee poisoning incidents

The APVMA has received very few submitted reports of adverse effects of pesticides on bees and other pollinators in Australia; this issue is discussed in more detail in this overview report (see Section 12). During the preparation of this overview report discussions were held with a number of people associated with the honeybee industry and with some farmers about factors impacting bee health. However, the opportunity to consult with a larger number of apiarists, farmers and horticulturalists was limited.

Therefore, the following recommendation is directed to the Australian Honey Bee Industry Council (AHBIC; www.honeybee.org.au) and its member associations (including the various State apiarists' associations).

Recommendation: *AHBIC and its member associations could consider the feasibility of trialling an annual survey of apiarists in the different states/territories and agricultural/horticultural regions on the health of their hives. This information would then be collated into a national report, with assistance from the Department of Agriculture, RIRDC and/or state/territory agriculture departments, as appropriate. (The possibility of extending the survey to farmers and horticulturalists growing crops dependent on insect pollinators for production could be considered, depending on the outcomes of a 2-3-year trial of the survey of apiarists.)*

The APVMA's adverse experience reporting program (AERP) collects information on adverse effects arising from approved on-label uses of the pesticide products it regulates, but this does not extend to collecting information about other factors which may be impacting bees (eg. the ongoing drought in some regions and the lack of adequate nutrition for hive bees). Nevertheless, the APVMA would be in a position to provide advice to AHBIC if it did decide to trial a survey of Australian apiarists.

15.1.3 Residue monitoring for pesticide residues in bee media

Because of the physicochemical properties of the neonicotinoids, there is the potential for these systemic insecticides and/or their metabolites to be found as residues in plant components, including nectar and pollen.

The following recommendation is directed more broadly to relevant agencies/organisations and relates to the monitoring of pesticide residues in various bee media. In North America, over 800 samples of bees, pollen, and wax have been analysed for the presence of 171 different pesticides. Sixty percent of the 350 pollen samples contained at least one systemic insecticide and nearly half had two miticides (applied by apiarists to control mite affecting bees), as well as the agricultural fungicide chlorothalonil. In bee-collected pollen several insecticides, fungicides and an herbicide were detected. The pollen samples contained an average of 6 different pesticides. Almost all comb and foundation wax samples contained three pesticides used by beekeepers to control bee pests and diseases (Mullin et al, 2010; Frazier et al, 2011). Frazier et al. noted (www.extension.org/pages/60318/pesticides-and-their-involvement-in-colony-collapse-disorder) that:-

> "Although our work represents the largest data set of pesticides in honey bee colonies to date, and was drawn from samples collected across 23 states and a Canadian province, it was not the product of a well-designed systematic survey of honey bee colonies in the US. It thus does not give us a clear picture of the current state of pesticide residues in honey bee colonies. Such a study is critically needed yet we know of no current plans to accomplish this expensive task."

The APVMA is unaware that any such pesticide residue monitoring of various plant and bee media has been conducted in Australia.

Recommendation: *It is suggested that a research project be established and funded to analyse pesticide residues in various plant (nectar, pollen, guttation fluid) and bee (collected pollen, comb and foundation wax, bee bread, honey) media. It should be conducted in such a way to allow comparison with the quite extensive results collected in North America, in order to clarify whether conditions (climate, landscape), the absence of certain bee diseases, and different agricultural/ horticultural practices in Australia mean that there is a similar, or less of an issue with respect to pesticides. Such a project could involve RIRDC, State departments of agriculture, and agricultural/ horticultural research institutions.*

While the APVMA is not funded or resourced to conduct such monitoring, it could provide some advice on the conduct of such research, as well as information on the availability of published data from overseas monitoring studies.

A separate recommendation of this overview report was to be that the Australian Government's National Residue Survey (NRS; www.daff.gov.au/agriculture-food/nrs) extend the range of residues it tested in honey (www.daff.gov.au/agriculture-food/nrs/animal-product-testing/animal-results-2011-12) to include the neonicotinoids and relevant metabolites. However, in discussing the proposed recommendation with staff of the NRS, they advised the APVMA that such monitoring had already commenced and that the 2012-13 honey sampling program had tested 23 random samples of Australian honey for the following neonicotinoid insecticides and their metabolites: acetamiprid; N-demethyl acetamiprid; imidacloprid; 5-hydroxy imidacloprid; imidacloprid olefin, thiacloprid; and clothianidin. (Thiamethoxam was not assayed as its primary active metabolite is clothianidin.) Results of the first set of monitoring data for neonicotinoids in honey are likely to be published on the NRS website later in 2013.

15.1.4 Holding a national information symposium

An APVMA workshop for regulatory stakeholders was held on 24 July 2013 - attendance was primarily limited to regulatory staff from relevant federal and state government agencies (as partners in the National Registration Scheme for Agricultural and Veterinary Chemicals, or NRS). It was convened to address issues relating to bee protection statements on labels and the possible expansion of testing requirements for new insecticides being brought on to the Australian market.

Nevertheless, the APVMA sees value in holding a national bee/pesticide forum which could involve a wider range of stakeholders and at which issues related to bee health and pesticide impacts on pollinators could be more broadly discussed. Such a forum would recognise that protection of insect pollinators goes beyond farmers and horticulturalists but needs to include others, including local and regional authorities, private industry, the general public, and bee keepers themselves.

Recommendation: *Relevant agencies (eg. RIRDC, Plant Health Australia, the Department of Agriculture, the Department of the Environment) should consider holding a one-day symposium for a wide range of stakeholders to hear about issues relating to bee health from Australian and international experts. This would also provide an opportunity for the APVMA to provide a report of its overview of neonicotinoid insecticides* *and pollinator health, as well as a summary of the outcomes of the July 2013 workshop for regulatory stakeholders.*

The APVMA has been holding discussions with RIRDC, Plant Health Australia, GRDC, the Department of Agriculture, and the Department of the Environment about the organisation of, and program for a one-day information symposium on issues relating to the protection of insect pollinators. [**Note**: *A symposium date has now been set down for Wednesday 9th April 2014 and will take place in Canberra; it is being organised by Plant Health Australia and jointly funded by RIRDC, GRDC and the APVMA.*]

15.2 Research suggestions

It became apparent while investigating the issues for this overview that there are a number of areas where targeted scientific research might help answer some questions relating to pollinator health and the use of neonicotinoids in Australia. While specific recommendations have not been formulated, the following list points to issues which could be gainfully investigated:-

Canola: The APVMA has seen and received several reports suggesting that there is a problem in Australia from bees feeding on canola grown from neonicotinoid-treated seed eg. "[in] the last couple of years we have stayed away from canola and we have had the best bees we've had for years" (see www.theabk.com.au/article/neonicotinoids-australia). Yet most other reports received suggest that canola was, and remains an excellent crop for apiarists. For example, the WA Department of Agriculture & Food advised the APVMA that, partly due to the abundant canola crops in that State, feral honey bees are multiplying and taking over tree hollows needed for nesting by native parrots (R Manning, *pers. com*).

It is possible that these different reports are a reflection of effects Somerville (2002) described viz:-

> "A weak colony should benefit from being placed on canola blossom. The fresh nectar and pollen supply will encourage the colony to breed and to expand the brood area. If the colony experienced a particularly severe winter or is suffering from nosema disease, access to canola blossom could help the colony to overcome the disease by enabling the bees to rapidly expand the population, displacing the old bees and quickly populating the hive with young, healthy bees. However, the reverse can happen just as often, when the adult workers are placed under so much stress, foraging for pollen and nectar, ripening nectar and keeping the brood area warm, that the longevity of the bees is reduced and the hive population declines. This, particularly when combined with poor weather, will see the levels of *Nosema increase*."

Nevertheless, there are indications that there may be a regional difference in these conflicting reports. Considering the different varieties/cultivars of canola grown in different parts of Australia (OGTR, 2002) and the fact that that they have changed over time since there has been a rapid and extensive genetic development of 'oilseed' rape' by the oilseed industry, it would be useful to know whether there are differences in the output and quality of the nectar and pollen from the current range of commercially-grown varieties/ cultivars which might help explain these different reports. [There has been some work to look at the issue of nectar quality in particular canola hybrids (eg. Pernal & Currie, 1998). By way of comparison, the APVMA has been advised that different soya bean and lucerne varieties can significantly vary in their attractiveness to bees.]

Neonicotinoid persistence: Because of the reasonably long soil half-lives of the N-nitroguanidine neonicotinoids (depending upon local conditions), more information on their potential to accumulate in the soil and in plants grown in fields used to grow crops treated with neonicotinoids (either as a seed or a soil treatment) in previous seasons would be useful. Australian field studies on whether accumulation is occurring, its extent, and whether it varies according to the neonicotinoid, soil type and application method, would help regulators to assess whether any additional controls on neonicotinoid use, especially in rotational crops, might be warranted. Such studies could be extended to investigate soil penetration and run-off in areas where neonicotinoids are most heavily used. [Preliminary results (Sánchez-Bayo & Hyne, 2013) indicate the detection of several neonicotinoids, albeit at low levels, in river water samples taken around Sydney after a run-off event.]

Honey bee research: As one of the few remaining countries in the world without *Varroa*, Australia would be an ideal location to study the health of honey bee colonies without the confounding factors of *Varroa* mite and the chemicals deliberately used within hives to treat it. This fact suggests that Australia would be well placed as a location to contribute to studies on the complex interactions between the large number of factors which can adversely impact bee health.

15.3 Next Steps - APVMA

15.3.1 Bee protection goals, new tests for measuring hazard and exposure, labels

As noted above (see Section 10 – 'Testing Requirements' and Section 11 – 'Product Labels'), in 2012 the APVMA, as part of its investigations into the use of neonicotinoids in Australia, contracted the Australian Environment Agency Pty Ltd (AEA PL) to investigate the issue of pollinator toxicity testing requirements, taking into account the work being done internationally on this subject.

In particular, AEA was requested to:

- advise whether the current APVMA data requirements for testing of insecticides are adequate to address scientific concerns about subtle effects of neonicotinoids (and other pesticides) on honey bees and other insect pollinators, which have been suggested as impacting their ability to pollinate plants and collect honey.

- propose additional data requirements in the event that the current ones are inadequate.

- consider the labels of those Australian products which carry bee protection statements and review the consistency or inconsistency of the wording in those statements and advise the APVMA if changes need to be made to standard statements and to existing labels.

The full AEA report, *Consideration of Testing Requirements and Label Statements in Relation to the Impact of Pesticides on the Health of Honey Bees and other Insect Pollinators* (dated 13 November 2012), is available on the APVMA's website. It made five (5) recommendations to the APVMA; these are listed below, followed by a summary of APVMA's responses to date.

Recommendation 1: *The APVMA and its advisory agency, the Department of the Environment, should consider the suite of tests currently available, and those being developed, to examine (1) the potential extent* *of exposure of bees and other insect pollinators to pesticides; and (2) the effects of pesticides on bees and other insect pollinators. These are not reflected in current Australian data requirements*[21]*.*

Recommendation 2: *The APVMA should request its environmental advisory agency, the Department of the Environment, to establish appropriate Australian protection goals for insect pollinators and link data requirements and risk assessment methodology to these protection goals.*

Recommendation 3: *Considering the large inconsistencies found in wording of bee protection statements on current Australian product labels, the APVMA needs to review them with a view to reducing the number of different statements currently available. The Department of the Environment has developed standard bee protection statements, but they are as yet only found on a limited number of products. In developing a more consistent label approach, related issues for consideration include:-*

- *identification of use patterns that will require labelling because of the potential for exposure of pollinators*
- *identification of uses that can be addressed through label statements (for example, products applied by foliar application) and those products (eg. seed treatments and soil-applied products) that might be better addressed through appropriate product stewardship*
- *detail of label statements compared to assessed risk. For example, active constituents shown to be acutely toxic to adult bees and where residues have been shown to remain toxic to larvae for extended periods of time will contain more detailed protection statements than actives that do not display residue toxicity.*
- *development of guidance for label statements for home garden products.*

Recommendation 4: *The APVMA and the Department of the Environment should consider convening a workshop to address the issues outlined in recommendations 1 to 3 above. The workshop should be attended by relevant stakeholders and include relevant staff from the APVMA, the Department of the Environment, the Department of Agriculture, Plant Health Australia and State/Territory departments of agriculture, as well as industry (apiarists and registrants).*

APVMA Response: Recommendation 4 was acted upon and a workshop was held at the APVMA on 24 July 2013 to discuss Recommendations 1-3. Considering the regulatory focus of the workshop, invitees included those with a level of familiarity with the regulatory environment in Australia, and in particular, State partners in the National Registration Scheme for Agricultural and Veterinary Chemicals (the NRS) and Commonwealth government agencies which provide specialist technical advice to the APVMA. A report on the outcomes of that workshop has been prepared.

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[21] Current Australian data requirements for insect pollinator toxicity testing are those identified in the *Environmental Risk Assessment Guidance Manual for Agricultural and Veterinary Chemicals* (EPHC, 2009). The acute adult contact and oral toxicity tests are part of the standard data requirements. The need for the other two types of tests listed (viz. pollinator exposure to residues on foliage and a semi-field test) is considered on a case-by-case basis and depends on the toxicity and proposed use pattern of the chemical under consideration.

Recommendation 5: *In preparing to develop expanded risk assessment methodology to consider the impact of pesticides on insect pollinators, the APVMA should request the Department of the Environment to evaluate the increasing amount of data being submitted with pesticide applications (especially applications being submitted to multiple agencies as Global Joint Reviews, or GJRs) so that they can gain a better understanding of the additional studies being conducted to address the issue of pesticide effects on pollinators. This will assist in developing revised risk assessment approaches in Australia.*

APVMA Response: This recommendation has been actioned and the evaluation of expanded data packages is now taking place. As these data are evaluated, the relevant area of the Department of the Environment will be in a position to provide advice to the APVMA on the usefulness of new test methods being developed and introduced to better assess (1) the acute and sub-chronic impacts of pesticides on bees and bee brood; and (2) the extent of exposure of insect pollinators to neonicotinoids and other pesticides.

The Department of the Environment has been asked to consider the recommendations of the 24 July 2013 APVMA workshop (relating to bee toxicity test methodology, product labelling, and pollinator protection goals), together with the more recently-published (5 August 2013) European Food Safety Authority's *Guidance on the risk assessment of plant protection products on bees (Apis mellifera, Bombus spp. and solitary bees)* (EFSA, 2013e); this latter document suggests a tiered risk assessment scheme for possible impacts of plant protection chemicals on bees, with a simple and cost-effective first tier to more complex higher-tier studies under field conditions. It is also expected that the US EPA's guidance document on their risk assessment for bees, based on their *White Paper in Support of the Proposed Risk Assessment Process for Bees* (USEPA, 2012) will be available early in 2014 for consideration.

Once the APVMA and the Department of the Environment have reached a final conclusion on additional bee toxicity testing methods and revised/updated product labelling to better protect insect pollinators, the APVMA will post regulatory advice on its website and also decide whether a formal review of the labels of current insecticide products is warranted.

15.3.2 Recommendations to external agencies/organisations - APVMA input

In Section 15.1 (above) the APVMA made four (4) recommendations which are directed to external agencies/organisations. The APVMA will continue to liaise with these agencies/organisations about the possible implementation of these recommendations.

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[**Note**: The five case studies listed below were prepared as part of *Pollination Aware – The Real Value of Pollination in Australia*, by RC Keogh, A Robinson and I Mullins, which consolidates the available information on pollination in Australia at a number of different levels: commodity/industry; regional/state; and national. The document and the accompanying case studies provide a base for more detailed decision making on the management of pollination across a broad range of commodities. The full report and individual case studies (35 in all) are available at www.rirdc.gov.au]

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17 ATTACHMENT 1: NEONICOTINOIDS (AND RELATED COMPOUNDS) APPROVED IN AUSTRALIA AND THEIR REGISTERED USES

ACTIVE INGREDIENT	REGISTERED USE IN AUSTRALIA
Neonicotinoids	
Acetamiprid	*Spray*: cotton *Foliar spray*: potatoes, flowers, ornamental plants (indoor and outdoor), including roses, shrubs palms, bedding plants and trees *Soil drench*: ornamental plants in potting mixes
Clothianidin	*Soil drench & foliar spray*: pome fruit, stone fruit, grapes *Water dispersible granules*: turf *Spray*: cotton *Stem spray & injection*: bananas *Soil band spray*: sugar cane *Soil injection*: eucalyptus seedlings and young trees
Imidacloprid	*Spray*: cotton, fruit, stone fruit (including peach, plum, nectarine, apricot), apples, vegetables (capsicum, melon & other curcurbits, eggplant, sweet potato, potato, cucumber, tomatoes, brassicas), turf, ornamentals, shrubs, roses, Duboisia, Pandanus trees *Seed treatment*: maize, sweet corn, lentils & lupins, faba beans, field peas, canola, sorghum, cereals, pulses, sunflower, cotton, forage & seed pasture (eg. red clover, subterranean clover, strawberry clover, white clover, ryegrass, phalaris, lucerne, medics), forage brassicas (Kale, turnip, rape and swedes) *Soil treatment*: sugarcane, apples, citrus, vegetables (capsicum, curcurbits, eggplant, sweet potato, tomatoes), potatoes, Elm trees, eucalyptus seedlings, roses, azaleas and other ornamentals in pots *Trunk injection*: bananas *In-ground tablets*: roses, azaleas, Lillypillies, potted palms, magnolias, Eucalypt trees *Soil spraying, trenching and rodding*: protecting buildings, fences and poles against termites *Reticulation systems*: termite protection of buildings *Wall, pole or tree injection*: termite nests *Spray*: flowers, shrubs, trees, fruit trees, vegetables, lawn (home garden) *Timber treatment*: manufacture of veneers, boards and plywood *Topical paste*: flea control in cats and dogs *Fly bait*: Houseflies in commercial, industrial and domestic areas *Foam*: PCO use for termites, European wasps, ants, bed bugs, cockroaches *Gel*: cockroaches *Pour-on*: Lousicide for sheep

ACTIVE INGREDIENT	REGISTERED USE IN AUSTRALIA
Nitenpyram	Tablets: fleas on cats and dogs. [No crop uses]
Thiacloprid	*Foliar spray*: pome fruit (including apples), stone fruit, maybush, roses, camellia (commercial nurseries only) *Dip:* Lousicide for sheep *[A product for use as an insecticide spray on cotton is approved but it is not marketed, nor is there any intention of the registrant to do so.]*
Thiamethoxam	*Spray*: cotton, citrus, tomatoes, turf & lawns, roses and ornamentals, home garden (indoor and outdoor) *Soil-incorporated granules*: indoor and outdoor ornamental plants, shrubs and small trees (home garden) *Seed treatment*: cotton, cereals, canola, maize, sweet corn, sorghum, sunflower *Soil drench*: seedlings of fruiting vegetables, brassicas and leafy vegetables *Fly spray, paint-on and bait*: House flies in commercial, industrial and domestic areas *Bait gel*: ants (around buildings)
Related insecticides acting at nicotinic AChRs (see footnote to Table 1)	
Sulfoxaflor	*Foliar spray:* Canola, cereals, cotton, soybeans, curcurbits, fruiting vegetables, leafy vegetables, root and tuber vegetables, vegetable brassicas

18 ATTACHMENT 2: SUMMARY OF SOME FIELD STUDIES AND MONITORING DATA

COUNTRY	MONITORING PROJECT	TIME	FOCUS	CONCLUSION FINDINGS
Europe				
Austria	MELISSA Project (Girsch & Moosbeckhofer, 2010).	2009-10	Investigation of bee –poisoning incidents in several regions	A number of incidents related to seed treatment dusts (maize) were recorded from certain regions - dust deposition from planting of small maize fields onto neighbouring flowering vegetation. No increased bee mortality was observed in areas growing neonicotinoid seed-treated canola (oilseed rape). Overwintering losses caused mainly by *Varroa*. Engineering controls etc. reduced the risks cf. planting 2009 season.
Belgium	Study on the influence of imidacloprid seed treatment in maize on bee health (Nguyen et al, 2009)	2004-05	Sixteen apiaries located in the vicinity of treated or untreated fields were surveyed over one year.	No adverse effects of imidacloprid seed treatment on exposed bee colonies were found. [Results suggested a correlation between the number of colonies per apiary and mortality rates in the respective apiary.]
Finland	Neomehi project – impact of neonicotinoid use in spring oilseed rape and turnip rape on honey bees (MTT & EVIRA, 2014)	2013-15	Beehives positioned in five different locations. Possible links between the proximity of the hives to rapeseed fields, death of beehives, and occurrence of bee diseases examined. Residues analysed in oilseed nectar, pollen, honey and in bees.	Initial results suggest that the insecticides do not cause immediate harm to honey bees and there was no connection between seed treatment and colony loss. Residues of neonicotinoids (in oilseed plants, nectar, pollen, honey and honeybees) were "fairly small and beneath the risk limit".
France	Three-year field survey of bee colony mortalities (Chauzat et al, 2009; 2010a)	2002-05	Multi-factorial monitoring project involving 125 bee hives from 25 apiaries in five different regions of France.	No correlation between in-hive residues of pesticides (41 different chemicals assayed, including imidacloprid and its 6-chloronicotinic acid metabolite), abundance of brood and adults, or bee colony mortality was found. (Possible synergistic effects between different pesticides were not discounted.) Fouldbrood and *Varroa destructor* infestation were the most severe conditions positively related to mortality.
	Case-control study of bee colony mortality (Chauzat et al, 2010b)	2005-06	Comparison of apiaries with high winter losses with neighbouring apiaries with no abnormal losses – apiaries homogenous with respect to climate, vegetation and pesticide exposure.	The cause of the high losses appeared to be absence of preventative treatment for *Varroa*.

COUNTRY	MONITORING PROJECT	TIME	FOCUS	CONCLUSION FINDINGS
	Survey of apiary mortality (Chauzat et al, 2010b)	2005-06	Overwintering mortality in 18 apiaries at 13 locations in France.	*Varroa* infection had a dominant role in over-wintering losses. Imidacloprid residues found in beebread samples from 3 apiaries (2 at levels <LOD).
	Monitoring for impacts of thiamethoxam seed treatment of maize in several regions (DGAL, 2012)	2008-12	Comparison of corn grown from treated and untreated seeds (across 3, 5 & 6 regions over the period). Monitoring of dust generation during seeding; residues of thiamethoxam and clothianidin metabolite in pollen; and health of bee colonies.	Normal bee behaviour was maintained and bee health and mortality was not affected. Use of dust collectors during seeding and paying attention to wind controlled the problem of airborne dusts. Bee exposure to the neonicotinoids during flowering (via pollen) was negligible and there was an absence of quantifiable residues in hives. There was no increase in bee pathogens (either viral or parasitic).
	Monitoring for impacts of thiamethoxam seed treatment of maize and oiseed rape (Pilling et al, 2013)	2005-2008	Effects of repeated exposure of bees to maize and oilseed rape crops grown from seed treated with thiamethoxam.	Mortality, foraging behaviour, colony strength and weight, brood development and food storage levels were similar between treatment and control colonies. Colonies exposed to treated crops successfully overwintered, with similar health status to controls in the following spring. The study concluded there is a low risk to honey bees from systemic residues in nectar and pollen following the use of thiamethoxam as a seed treatment on oilseed rape and maize.
Germany	German Bee Monitoring (Genersch et al, 2010b)	2004/5 - 2007/8	Four-year monitoring project looking at overwintering losses in honeybee colonies	1200 hives monitored across *ca.* 120 apiaries. Winter losses related to (1) high *Varroa* infestations; (2) deformed wing virus and acute bee paralysis virus in autumn; (3) queen age; and (4) weakness of colonies in autumn. No correlation with *Nosema* or pesticides
	Monitoring of bee incidents by the Julius Kühn-Institut, Federal Research Centre for Cultivated Plants) (Seefeld, 2005, 2006, 2008).	1960-2006	Ongoing monitoring of pesticide incidents involving bees	In several years, incidents were caused by off-label uses of neonicotinoid sprays, otherwise no significant incidents with neonicotinoids were observed before 2008. Imidacloprid was not found in any honey bee or plant sample. The numbers of incidents steadily declined since the mid-1970s and, since 1992, has been constant. "In summary, ... the damage to honey bees as a consequence of pesticide application has clearly decreased during the course of the past 20 years [1985-2006]"
	Monitoring of hives on corn grown from clothianidin-treated seed in south-western Germany (Liebig et al, 2008)	2008-09	Bee hives set up in different locations in a region with maize crops grown from clothianidin-treated seed - monitored during a season until the following spring. Extensive residue sampling conducted.	New colonies developed well ie. there were no adverse effects of feeding on crops grown from treated seed were reported. [The development of twelve productive colonies from two apiaries severely affected by high mortality following dust drift during planting in spring (April) was also monitored between May and October – they had recovered by early summer.]

COUNTRY	MONITORING PROJECT	TIME	FOCUS	CONCLUSION FINDINGS
Hungary	Pesticide incident monitoring (Fazekas et al, 2012)	2007-11	Investigated 151 incidences of bee poisoning by pesticides (over 5 years).	222 bee samples and 129 plant samples assayed – 151 bee samples contained pesticide residues; in 64 cases, plant samples from the same poisoning incident contained the same pesticide(s) as in the bee sample. Poisonings were most frequently caused by chlorpyrifos, then dimethoate, fipronil and six different synthetic pyrethroids. Thiamethoxam was detected in one plant and one bee sample.
Italy	APENET - network for monitoring honeybee losses (see EFSA, 2012c).	2009-11	Network of beehives situated in different areas periodically analysed for pathogens and chemicals in dead bees, live bees, brood, honey, wax and pollen	EFSA concluded that it was not possible to draw any definitive conclusions from this monitoring. Tests on free flying bees in the vicinity of unmodified pneumatic planters (no deflector to direct the air from the fan down to the ground) suggested that forager bees could be at risk if they fly through dusts emitted by seeders sowing maize seeds coated with either fipronil, or the neonicotinoids thiamethoxam, clothianidin or imidacloprid.
	BEENET Monitoring (successor project of APENET)	2011-13	Survey on incidences of intoxication by pesticides, pesticide residues in bee hives and bee disease incidence in Italy	EFSA (2013b) reported that "no further data were available since their 2012 evaluation of APENET data (see row above).
Poland	Hives placed near oilseed rape crops seed treated or sprayed (Pohorecka et al, 2012)	2010 and 2012	Winter oilseed rape seed treated with thiamethoxam and imidacloprid and sprayed with acatamiprid and thiacloprid. Spring oilseed rape seed treated with clothianidin, thiamethoxam and imidacloprid, and sprayed with thiacloprid.	Study did not see any short-term or long-term effects of neonicotinoids in either winter or oilseed rape. However, because of various detections of neonicotinoid residues in nectar and/or pollen, the authors noted that there was a potential for adverse effects, especially from combined effects of exposure to insecticides and bee pathogens eg. *Nosema*.
Slovenia	Monitoring of pesticide residues in bee hives and bee colony health (Kozmus et al, 2011)	2009-10	Monitoring project including 90 colonies at 30 locations in different agricultural and horticultural areas. 50 pollen samples were analysed in 2009, 52 in 2010.	The highest number of residue detections was found in intensive viticultural and horticultural areas, with fungicides the most common. Insecticides (chlorpyriphos-ethyl, methoxifenozide, thiacloprid) were found in pollen samples from six of the 30 locations. The authors concluded that the pollen residues did not affect the honeybee colonies or infestation rate of *Varroa*, *Nosema* or bee viruses.

COUNTRY	MONITORING PROJECT	TIME	FOCUS	CONCLUSION FINDINGS
Spain	Large-scale survey on pesticide residues in bee hives and bee colony mortality (Bernal et al, 2010)	2006-07	Evaluation of the exposure of bees to pesticide residues in stored pollen and effects of pesticide exposure to colony mortality. 1,021 apiaries were surveyed.	Pesticide residues were detected in 42% of spring and 31% of autumn samples. Fluvalinate and chlorfenvinphos were the most frequently detected pesticides (as a consequence of the use of these acaricides in homemade formulations to control *Varroa*). Fipronil was detected in 3.7% of spring but not in autumn samples. Neonicotinoid residues were not detected. A direct relation between pesticide residues found in stored pollen samples and colony losses was not evident. Further studies would be necessary to investigate possible chemical synergism.
Switzerland	A series of field studies by the Swiss authorities to investigate insecticide seed treatments (BLW, 2009).	2009	Effects of neonicotinoid in dust during maize seeding, and in guttation liquid, on exposed honey bee colonies	No increased mortalities or other adverse effects of the treatment were seen, either during sowing of the crop - conducted in compliance with prescribed safety measures - or during the guttation phase of the crop.
UK	UK Wildlife Incident Investigation Scheme (WIIS) (Fletcher & Barnett 2003 and Barnett et al, 2007)	1988-2003	Incidents of possible acute poisoning of bees by pesticides investigated and recorded by the authorities	No cases of acute bee intoxication in which neonicotinoids were involved are reported from these years.
	Wildlife Incident Investigation Scheme (WIIS) (www.pesticides.gov.uk/guidance/industries/pesticides/topics/reducing-environmental-impact/wildlife	2009-13	See above	Very few acute bee poisoning incidents in which neonicotinoids (imidacloprid, thiamethoxam, thiacloprid) were detected - between 1 to 6 per year from 2009-12. The following other pesticides were measured in the bee incidents investigated: fungicides (azoxystrobin, boscalid, carbendazim, prochloraz, propiconazole, prothioconazole, tebuconazole), insecticides/acaricides (bendiocarb, chlorpyrifos, cypermethrin, dieldrin, dimethoate, fipronil, fluvalinate, gamma-HCH, permethrin, lambda-cyhalothrin) and an herbicide (glyphosate) [These not necessarily implicated in the bee deaths investigated.]
	Investigation of the effects of neonicotinoid seed treatments on bumble bees by the UK Food and Environment Research Agency (Thompson et al, 2013)	2012	Field study conducted to investigate laboratory study of Whitehead et al (2012) suggesting that field-realistic levels of imidacloprid reduce bumble bee (*Bombus terrestris*) colony growth and queen production. The study monitored 60 buff-tailed bumblebee colonies over 3 UK sites.	Only 35-37% of the pollen collected by the bees was from oilseed rape ie. bumblebees were not feeding exclusively on oilseed rape. No consistent relationships were observed between colony mass, the number of new queens produced, and the observed variations in neonicotinoid residues across colonies (within and between sites). The absence of effects is “reassuring but not definitive”. The study underlines the need to take care in extrapolating laboratory studies to the field, and the need for further field studies.

COUNTRY	MONITORING PROJECT	TIME	FOCUS	CONCLUSION FINDINGS
America				
Canada	Monitoring of honeybee health in canola grown from clothianidin-treated seed (Cutler & Scott-Dupree, 2007)	2005-06	Bee mortality, worker longevity and brood development after 3 weeks on canola (grown from untreated and clothianidin-treated seed). Clothianidin levels in beeswax, honey, pollen and nectar.	Honey bees unaffected by exposure to clothianidin seed-treated canola. Clothianidin detected in honey, nectar and pollen but max. Concentrations were 8-22-times lower than no-observable-effect concentrations. No detects in beeswax. [Because of Canadian regulatory concerns about the size and separation of the plots and the detection of low levels of clothianidin in nectar from colonies in control fields, a larger study was conducted in 2012. A final report is due in late 2013 – see below.]
	Large-scale project to monitor honeybee health in canola grown from clothianidin-treated seed (Cutler et al, 2013).	2012-123	Colony weight gain, honey production, bee pest incidence, bee mortality, number of adults, amount of sealed brood.	No adverse effects on honeybee colonies over summer and autumn 2012. Overwintering success measured in April 2013 – colony survival virtually equivalent.
Argentina	Monitoring health of honey bees [*Apis mellifera ligustica* (Spin.] exposed to imidacloprid-treated sunflower during blooming	Field trial reported in 2003	Beehive weight, brood and honey production, foraging activity, pollen entrance, and mortality, residue analysis in soil, sunflower heads, pollen, wax and hives.	Parameters assessed after 10, 28 and 216 days. No residues of imidacloprid or its metabolites olefin-imidacloprid and hydroxy-imidacloprid were detected (lower detection limit = 1.5 μg/kg) in sunflower heads or bee media 10 days after exposure to treated sunflower. No adverse effects were observed after short-term or long-term monitoring. Hives were more productive (average weight, honey production, foraging activity, worker brood and comb foundation), considered to be due to the better condition of the treated crop.

19 ATTACHMENT 3: GLOSSARY

ac	active constituent
AChE	Acetylcholinesterase enzyme
AChR	acetylcholine receptors
AEA	Australian Environment Agency Pty Ltd
AER	adverse experience report
AERP	Adverse Experience Reporting Program
AFB	American Foulbrood
AHBIC	Australian Honey Bee Industry Council
APVMA	Australian Pesticides and Veterinary Medicines Authority
Bt corn	Genetically-modified corn containing a gene which codes for *Bt* delta endotoxin protein from a naturally-occurring soil bacterium, *Bacillus thuringiensis*. This protein is highly effective at controlling lepidopteran pests.
CCA	Crop Consultants Australia Inc
CCD	Colony Collapse Disorder
CNS	central nervous system
Cotton CRC	Cotton Catchment Communities
CSD	Cotton Seed Distributors
DWV	Deformed Wing Virus
EBI	Ergosterol biosynthesis inhibitor (a class of fungicides)
EC	European Commission
EC	Emulsifiable Concentrate
EC	European Commission
EFSA	European Food Safety Authority
EU	European Union
FCAAA	Federal Council of Australian Apiarists' Associations
GABA	gamma-amino-butyric acid
GJR	Global Joint Reviews
GM	genetically modified

HAL	Horticulture Australia Limited
HFCS	high-fructose corn syrup
IAPV	Israel Acute Paralysis Virus
IIV-6	Invertebrate Iridescent Virus type 6
IRAC	Insecticide Resistance Action Committee
LD50	Lethal Dose 50% - the estimated dose of a chemical which kills 50% of a test group of organisms dosed with the chemical
nAChR	nicotinic acetylcholine receptor
NRS	National Registration Scheme for Agricultural and Veterinary Chemicals
NRS	National Residue Survey
NSW	New South Wales, Australia
OPs	Organophosphorus insecticides, commonly called 'organophosphates'
PCP	'Pesticide & Chemical Policy', a weekly newsletter from Informa Ltd
PHA	Plant Health Australia
PMRA	Canadian Pest Management Regulatory Authority
PNS	peripheral nervous system
Qld	Queensland, Australia
RFID	radiofrequency identification
RIRDC	Rural Industries Research and Development Corporation
SPs	synthetic pyrethroids
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
WIIS	United Kingdom Wildlife Incident Investigation Scheme