Commonwealth of Australia
*Patents Act 1990 (Cth)*
*Regulation 22.13 of the Patents Regulations 1991*

IN THE MATTER of Australian Patent Application 2016203677
in the name of DOW AGROSCIENCES LLC

- and -

Opposition thereto by NUFARM AUSTRALIA LIMITED

**DECLARATION**

I, Phillip Maxwell Hay, of 42 Cooloongup Crescent, Harkness, in the State of Victoria, Australia, declare as follows:

1. I made a previous Declaration in this proceeding on 23 April 2018 together with annexures "PMH-1" to "PMH-27" thereto ("**my First Declaration**"). I make this further Declaration on behalf of Nufarm in support of its opposition against the grant of a patent on Australian Patent Application 2016203677 ("**the opposed Patent Application**"). The numbering for the annexures referred to in this Declaration follows on consecutively from the numbering used for the annexures of my First Declaration. In addition, I use the defined terms from my First Declaration in this Declaration.

**MY EXPERIENCE**

2. My experience remains unchanged from my First Declaration and I remain an employee of Nufarm.

**MY INSTRUCTIONS**

3. I have been provided with a copy of evidence filed by Dow Agrosciences LLC being a Declaration of Terry R. Wright dated 22 July 2018 together with Exhibits "TRW-1" to "TRW-12" thereto ("**the Wright Declaration**") and a Declaration of David G. Ouse dated 20 July 2018 together with Exhibits

"DGO-1" to "DGO-4" thereto ("**the Ouse Declaration**"). I have been asked to read these Declarations and provide my views.

4. In making this Declaration I will seek to address the Wright Declaration and the Ouse Declaration to the extent that I consider it relevant to the main issues in dispute in this proceeding. My decision not to comment on all the statements made in the Declarations either in part or in full should not be taken as an indication of my agreement with that evidence generally or the comments made therein.

5. The publications and other documents to which I refer in this Declaration and which are identified by the designation "**D-[numbered]**" are annexed to the Statement of Grounds & Particulars dated 20 January 2018.

6. Arcadia Intellectual Property has reminded me of my obligations in respect of my engagement as an expert witness to give evidence in this proceeding. In so doing I have reread Annexure A to the Expert Evidence Practice Note as issued by Chief Justice Allsop of the Federal Court of Australia on 25 October 2016 titled "Harmonised Expert Witness Code of Conduct" which is marked Annexure PMH-2 to my First Declaration.

**PRELIMINARY COMMENTS ON THE WRIGHT AND THE OUSE DECLARATIONS**

7. At the outset I believe that it is again worth noting that the claims of the opposed Patent Application are directed to a method for preventing a herbicidal composition that has been administered to a locus of unwanted vegetation from injuring a crop that neighbors the locus and to which the herbicidal composition has not been administered, the method comprising administering to the locus of unwanted vegetation but not to the crop, a herbicidal composition comprising the reaction product of a herbicidal carboxylic acid and a (tetraalkyl) ammonium hydroxide; thereby preventing the herbicidal composition from injuring the crop. That is, the claims are directed to a method of utilizing the herbicidal composition being a quaternary ammonium derivative of a herbicidal carboxylic acid to "<u>prevent</u> injury to a neighboring crop". The claims are <u>not</u> directed to or limited to any particular method of preparing the quaternary ammonium derivative of a herbicidal

carboxylic acid. I note that both Dr Wright and Mr. Ouse accept my view (see paragraphs 142 and 143 of the Wright Declaration and paragraphs 39 and 68 of the Ouse Declaration).

8. I further note that the quaternary ammonium derivative of a herbicidal carboxylic acid utilized in the claimed method can be prepared in various ways and that the Applicant has provided three alternative preparative methods on page 9 of the opposed Patent Application as well as a "general method" on page 4, lines 6 to 12. One such preparative method outlined at lines 13 to 20 on page 9 provides the herbicidal composition being prepared by combining equimolar amounts of the carboxylic acid herbicide, an *N*-(($C_1$-$C_{16}$) alkyl or arylalkyl) tri(($C_1$-$C_{16}$) alkyl)ammonium halide (such as chloride or bromide) and a metal hydroxide (such as sodium or potassium hydroxide) in a solvent such as methanol. The product is then isolated by evaporative removal of the methanol (and any water present) at room temperature to 50$^{o}$C and removing the metal halide salt by selective dissolution in water, to provide the compounds of the present invention as liquids or solids. Whilst this is not the combination of a herbicidal carboxylic acid and a (tetraalkyl) ammonium hydroxide it nevertheless produces the same reaction product as the combination of a herbicidal carboxylic acid and a (tetraalkyl) ammonium hydroxide. I note that both Dr Wright and Mr. Ouse agree with my view (see paragraph 143 of the Wright Declaration and paragraphs 41 and 68 of the Ouse Declaration).

9. I also note that the quaternary ammonium derivative of a herbicidal carboxylic acid utilized in the claimed method and that is administered "to the locus of unwanted vegetation" may be applied in conjunction with one or more other herbicides to control a wider spectrum of weeds. This is consistent with the description on page 5, lines 8 to 20 of the opposed Patent Application. I note that Dr Wright agrees with my view (see paragraph 28 of the Wright Declaration).

10. Finally I note that Mr. Ouse, a named inventor of the opposed Patent Application, makes it clear in paragraph 68 that any of the preparative three methods on page 9 may be used to prepare the herbicidal composition being

a quaternary ammonium derivative of a herbicidal carboxylic acid. Mr. Ouse has also made it clear that he does not need to explicitly identify which of the preparative methods on page 9 is the "best mode".

**OVERVIEW OF THE OUSE DECLARATION**

11. In my opinion Mr. Ouse's evidence

    i. introduces new matters to be considered in the form of new experimental data;

    ii. consists primarily of opinions which are unsubstantiated; and

    iii. offers objections to the evidence in my First Declaration which are, in many instances, simply incorrect, not factual and/or not scientifically based.

12. In my opinion, when read as a whole, Mr. Ouse's opinions on the opposed Patent Application particularly the experimental results are based on a misunderstanding of the claim language and the erroneous application of a 10% margin of error for the results reported in the opposed Patent Application. Detailed reasons for this will be provided below.

13. Turning now to relevant paragraphs of Mr. Ouse's evidence I make the following comments.

*Alleged aim of the Invention*

14. In paragraphs 24 to 27 Mr. Ouse states that it is not "critical" for the herbicidal composition of the opposed Patent Application to be "at least as active" as commercially used carboxylic acids and to have a reduced volatility. Whilst Mr. Ouse appears to rely on the language such as "desirable" at page 2, line 1 it is my view that he has completely ignored the background discussion provided on page 1 and the opening words to the particular paragraph on page 2, lines 1 to 4 being

> *"Thus it would be desirable to have an herbicidal carboxylic acid derivative that is at least as active as the commercially used carboxylic*

> *acid herbicide salts, but which is less volatile so that its use would not damage nearby sensitive crops."* (my emphasis added)

15. Mr. Ouse has also ignored the following paragraph on page 2 where at lines 5 to 9 it states:

> ***"****It has now been found that compounds formed by combining a carboxylic acid herbicide with either a tetraalkylammonium or an (arylalkyl)trialkylammonium hydroxide have herbicidal activity on an acid equivalent basis at least comparable to the commercially used carboxylic acid herbicide salts, but with reduced volatility"* (my emphasis added)

as well the language in the Abstract which makes it clear that the

> ***"****Compounds formed by combining a carboxylic acid herbicide with N-((C1- C16) alkyl or arylalkyl) tri((C1-C16) alkyl)ammonium hydroxide have herbicidal activity on an acid equivalent basis at least as active as the commercially used carboxylic acid herbicide salts, but are less volatile"* (my emphasis added).

16. It is my understanding that the claims must be read in light of the specification as a whole and not in isolation as Mr. Ouse appears to have done. Also, without the aim of the invention as being what I have set out, it is unclear what the aim of the invention is. I note that Mr. Ouse does not provide an alternative aim based on what is written in the specification merely that the composition must act as a "herbicide". The aim of the invention must be something more than merely acting as a herbicide. I note that the claims require that the herbicidal composition must prevent injury to a neighboring crop. It seems to me that the aim must encompass what is contemplated by the claims otherwise there is a clear and unresolvable disconformity between what the claims state is the invention and what is described in the specification.

17. I see in paragraph 49 of the Wright Declaration that Dr Wright has formed a view contrary to that reached by Mr. Ouse in paragraphs 24 to 27. Dr Wright makes it clear that he agrees with me that a "primary consideration" when preparing a herbicidal formulation to minimize vapor drift is to ensure that the herbicidal efficacy is retained.

18. I disagree with Mr. Ouse's statements in paragraphs 28 and 29. It is my view the fact that the herbicidal compositions of the opposed Patent Application may exhibit herbicidal activity is not the test that has been set by the Applicant as being its clear aim. It remains that the clear aim of the claimed herbicidal compositions is that the herbicidal compositions must be "at least as active" as commercially used carboxylic acids. For many of the so-called inventive compositions listed in Table II on page 11 the results simply do not show this.

19. I note that the views expressed by Mr. Ouse in paragraphs 28 and 29 have been contradicted by Dr Wright in paragraph 49 of the Wright Declaration.

20. Mr. Ouse's statements in paragraphs 30 and 31 are scientifically flawed. A 10% variation between individual plants is often observed and for this reason it is universal practice to apply the same herbicide treatment to a number of plants and to calculate the mean (average) response to the treatment. I disagree that a person skilled in the art would consider a 10% difference in the means of different treatments to be "comparable". It also remains that the aim of the claimed herbicidal compositions is that the herbicidal compositions must be "at least as active" not "comparable" to commercially used carboxylic acids,

21. In the experiment described on pages 10 and 11 of the opposed Patent Application, several seeds (actual number not specified) of each of the weed species (*Rumex obtusifolia* and *Kochia scoparia*) were planted in 10 cm square pots. At line 8, page 11 the treatments are said to be "replicated 3 times". Thus, the person conducting the experiment has compared the visual appearance of "several plants" in three separate pots with the control. Well known statistical procedures are available to determine if two or more treatments are statistically the same or different. However, these statistical procedures rely on knowing the value of each of the three replicate treatments which have not been reported in either the opposed Patent Application or in the evidence presented by either Mr. Ouse or Dr Wright. Absent the data to conduct a statistical analysis, all that can be said with any degree of certainty is that a treatment is the same, more efficacious or less efficacious on average.

22. To examine Mr. Ouse's proposition that all results are "comparable", I have reproduced Table II of the opposed Patent Application with prior art treatment normalised to 100% as shown in the following Table.

| Compound | Treatment number | Rate g a.e / ha | Broadleaf Dock *Rumex obstusifolia* | Kochia *Kochia scoparia* |
|---|---|---|---|---|
| **2,4-D dimethylamine salt** | | **560** | **100** | **100** |
| 2,4-D tetramethylammonium salt | 1a | 560 | 100 | 96.5 |
| 2,4-D tetraethylammonium salt | 1b | 560 | 102.6 | 103.5 |
| 2,4-D tetrapropylammonium salt | 1c | 560 | 94.8 | 96.5 |
| 2,4-D choline salt | 1e | 560 | 88.3 | 100 |
| **Triclopyr triethylamine salt** | | **560** | **100** | **100** |
| triclopyr tetramethylammonium salt | 2a | 560 | 104.9 | 86.8 |
| Triclopyr tetraethylammonium salt | 2b | 560 | 97.5 | 96.7 |
| triclopyr tetrapropylammonium salt | 2c | 560 | 97.5 | 104.4 |

23. The above Table shows that two of the reported treatments differ from their respective control by more than 10% and are not "comparable" based on the criterion used by Mr. Ouse. Specifically:

(a) the average % weed control for 2,4-D choline salt was 11.7% less than the average % weed control for the reference product 2,4-D dimethylamine salt, and

(b) the average % weed control for triclopyr tetramethylammonium salt was 13.27% less than the average % weed control for the reference product triclopyr triethylamine salt.

24. Accordingly, Mr. Ouse is not correct in his assertion that the herbicidal activity of so-called inventive compositions is "comparable" to commercially used

herbicidal salts. In any event, as I have already outlined, the test is that the herbicidal activity of the so-called inventive compositions is **at least as active** as the commercially used herbicidal salts. This is not shown by the results reported in Table II.

*Prevention of injury – Paragraphs 32 to 37 of the Ouse Declaration*

25. Mr. Ouse is not correct is his assertion that the term "preventing" is not an absolute term and that it does not require 0% injury. It is my view that for the following reasons it cannot mean anything else:

(a) the specification as filed;

(b) the way in which the claims were amended by the Applicant during examination; and

(c) the dictionary meaning of the term "preventing".

I will address each of these reasons in turn.

26. Claim 1 of the specification as filed clearly referred to "A method <u>for reducing or preventing</u> injury to non-target plants". By use of both terms "reducing" and "preventing" and the conjunction "or", which is used to link alternatives, the Applicant clearly intended for the word "preventing" to mean something different to the word "reducing". Table III of the opposed Patent Application as filed shows both an alleged reduction (6% injury – composition 2b; 12% injury –composition 4a) and an alleged prevention (0% injury – composition 1b). I note that the specification does not provide any definition as to what is meant by "reducing" and by "preventing". The only guidance is Table III.

27. I have been informed by Arcadia Intellectual Property that the claims of the opposed Patent Application were amended during prosecution to address the Examination Report dated 29 November 2016 in which the Examiner maintained his objection in respect of JP51106728 (identified as D2 in my First Declaration). Specifically, I note that it was the Examiner's view that D2 disclosed

> *"the use of a combination of 2,4-D (DCP) and choline in a manner that would inevitably infringe the claims of the present application. D1 employs choline to increase the selectivity of phenoxy herbicides including 2,4-D. The result of an increased selectivity would be a reduction in injury to any non-selected (non-target) plants nearby. Indeed, paragraphs 2 and 3 of page 5 discuss the reduction in damage to non-target plants. This falls within the scope of the said claims"*.

In response to this Examination Report the Applicant amended claim 1 to remove the words "*reducing … injury to non-target plants or crops nearby a locus of unwanted vegetation that requires herbicidal treatment"* which had the effect of limiting the claim to "a method of preventing injury to nearby crops". The Applicant also added a second reference to the word "preventing" at the end of claim 1. Now produced and shown to me and marked **PMH-28** is a copy of the Second Examination Report dated 29 November 2016 and the Applicant's Response dated 28 June 2017. It is my view that had the Applicant wished to cover compositions which show "significantly less injury to sensitive crops compared to herbicidal standards", as asserted by Mr. Ouse in paragraph 37, then the amendment to remove the word "reducing" would not have been made.

28. The dictionary meaning of "preventing" is the "act or practice of keeping or stopping something from happening". On its dictionary meaning it is an absolute term meaning 0% injury, nothing less. It is my view that the description in the opposed Patent Application supports this as well as Mr. Ouse's additional data provided in the Table in paragraph 44 which is said to be "supportive of the data in the opposed Patent Application". I note relevantly that the "Compositions of the invention" all show a "**0%** grape injury" which, in my view, is an alleged "prevention" <u>not</u> "reduction" in injury to the neighboring crop.

29. Mr. Ouse's attempt in paragraph 33 to undermine my interpretation of the term "preventing" by suggesting that if my view was correct there would be "no need for a range which accounts for degrees of injury prevention, and the assessments would be simply 'yes' or 'no'" is, with respect, simply absurd and

fails to take account of the amendments that have been made to claim 1 during prosecution of the opposed Patent Application. I put to Mr. Ouse that perhaps a range may have been relevant to the claims prior to amendment where there was a reference to "reducing" injury to the non-target plants or crops. With the Applicant's decision to remove the word "reducing" from the claims and its reliance on the word "preventing" in order to presumably distinguish the invention as claimed from the disclosure in JP51106728 (identified as D2 is my First Declaration), the range which accounts for degrees of injury prevention is no longer relevant to the method of the claimed invention. This is not to say that the range has no function given that the prior art compositions clearly show a wide range of degrees of injury prevention as borne out by the results shown in Table III on page 13 and the additional data presented by Mr. Ouse in paragraph 44. I therefore remain of the view that "preventing" is an absolute term meaning 0% injury and there is nothing that Mr. Ouse has put forward in paragraph 33 to change my view.

30. In response to Mr. Ouse's comments in paragraph 34 I have been informed by Arcadia Intellectual Property that what happens in the regulatory approval environment is irrelevant to the way in which a claim is to be interpreted. As noted above the Applicant chose to remove the word "reducing" from claim 1 and to keep the word "preventing". Importantly the Applicant also added a second reference to the word "preventing" at the end of claim 1 in the form of the words "thereby preventing the herbicidal composition from injuring the crop." Had the Applicant not wished to limit the claimed method to require 0% injury, then it should have chosen different language or even retained the word "reducing". It is clear to me based on my review of the prosecution history (PMH-28) that claim 1 was amended to remove the word "reducing" to overcome the disclosure in JP51106728. The word "preventing" was retained in the claims and therefore it was the intention of the Applicant for the term to be read as an absolute.

31. In response to paragraph 36 if I were to accept Mr. Ouse's theory about the so-called 10% margin of error to accommodate the data for inventive compositions 2b and 4a of 6% and 12% respectively which Mr. Ouse asserts

are “representative of preventing injury”, a point that I do not concede, then applying this theory to the results reported in paragraph 44 reveals that at least two of the prior art compositions namely 2,4-D triethylamine (TEA) and 2,4-D diethylethanolamine (DEEA) having a % grape injury of 11% and 10% respectively are also “representative of preventing injury”.

32. For the reasons provided in the preceding paragraph Mr. Ouse is not correct in his assertion that the inventive compositions show significantly less injury to sensitive crops compared to commercially used carboxylic acid herbicidal salts. Based on Mr. Ouse’s so-called 10% margin of error theory the data shows that prior art compositions 2,4-D triethylamine (TEA) and 2,4-D diethylethanolamine (DEEA) also show significantly less injury to sensitive crops that is in line with the data for the so-called inventive compositions 2b and 4a.

33. In any event I do not accept Mr. Ouse’s contention that prevention of injury in the context of the opposed Patent Application does not mean 0% injury or that it should not be read as an absolute. A non-zero performance standard as asserted by Mr. Ouse equates to “reducing” not “preventing” as required by the claims. It is an undisputed fact that the word “preventing” was intentionally chosen by the Applicant in its amendment to the claims to address the matters raised by the Examiner during prosecution. Mr. Ouse has not provided any evidence to show that my position in respect of the word “preventing” is not based on fact.

34. Concerning paragraph 37, herbicidal standards have no relevance here. There is no discussion anywhere in the specification of herbicidal standards. Table III of the specification clearly shows both an alleged reduction (6 and 12% injury) and an alleged prevention (0% injury).

*Substituted (tetraalkyl) ammonium hydroxide salts – Paragraphs 38 to 42 of the Ouse Declaration*

35. In response to Mr. Ouse’s comments in paragraphs 38 to 42 (and paragraph 68) I note with interest the following points:

(a) Mr. Ouse clearly states that the reaction product formed by combining herbicidal carboxylic acids and unsubstituted or substituted N-alkyl/arylalkyl ammonium hydroxide can be prepared using the “general method” described on page 4, lines 6 to 12 or any of the “three more descriptive preparative methods” provided on page 9. Mr. Ouse’s comments concerning the methods provided on page 9 are repeated in paragraph 68. In this respect I note specifically that Mr. Ouse makes it clear in paragraph 68 that the three alternative methods on page 9 instruct him on “how to prepare the compositions utilized in the claimed method” and that he does not see a discussion of which of the three methods is the “best mode” and therefore does not identify one. I agree with Mr. Ouse that the methods provided on page 9 are all methods that could be used to prepare the reaction product that is used in the method of claim 1 and that one is not preferred over another. It also follows from Mr. Ouse’s comments that the claims are not limited to the herbicidal composition being prepared by any particular method and are not limited to the method of combining herbicidal carboxylic acids and unsubstituted or substituted N-alkyl/arylalkyl ammonium hydroxide. The reference to the combination in the claim is therefore merely provided to define the reaction product. Page 9 provides other ways including combining herbicidal carboxylic acids and unsubstituted or substituted N-alkyl/arylalkyl ammonium halides to produce the same reaction product such as the preparative method on page 9, lines 13 to 20 of the opposed Patent Application.

(b) .Mr. Ouse seeks to rely on the data presented in the Table in paragraph 44 to support his view that the reaction product of a herbicidal carboxylic acid and a (tetraalkyl) ammonium hydroxide exhibits reduced volatility. Whilst the claims of the opposed Application are clearly and unequivocally directed to “a method of <u>preventing</u> injury” not “reducing injury”, I note that the results in the Table in paragraph 44. Most importantly I see that the unsubstituted (tetraalkyl) ammonium salt of 2,4-D (compositions 1a (2,4-D/tetramethylammonium hydroxide) and 1b (2,4-D/tetraethylammonium hydroxide)) and the substituted (tetraalkyl)ammonium salt of 2,4-D

(composition 1e (2,4-D/choline hydroxide)) all appear to show 0% grape injury.

36. In response to Mr. Ouse's opening statement in paragraph 39 I restate my earlier comments concerning the claims of the opposed Patent Application. Claim 1 is NOT, as Mr. Ouse contends, directed to a method of "utilising a herbicide composition comprising a reaction product of a herbicidal carboxylic acid and a (tetraalkyl)ammonium hydroxide". Rather, and most importantly, claim 1 is directed to a method for "preventing a herbicidal composition that has been administered to a locus of unwanted vegetation from injuring a crop that neighbors the locus and to which the herbicidal composition has not been administered, the method comprising administering to the locus of unwanted vegetation but not to the crop, a herbicidal composition ….". Whilst the reaction product may be described on pages 2 and 3 of the opposed Patent Application, the method of claim 1 specifically the "method for preventing injury to a neighboring crop" is certainly not described. I further note that the specification does not provide any actual definition as to what is meant by the word "preventing". The only guidance appears to be Table III which shows composition 1b as having 0% injury in contrast to compositions 2b and 4a which appear to show an alleged "reduction" in injury of 6% and 12% respectively.

*Additional data to support in the Patent Application – Paragraphs 43 to 48 of the Ouse Declaration*

37. In response to Mr. Ouse's comments in paragraph 43, I repeat my comments above in respect of prior art compositions 2,4-D triethylamine (TEA) and 2,4-D diethylethanolamine (DEEA) having a % grape injury of 11% and 10% respectively. Applying Mr. Ouse's 10% margin of error which he used to accommodate the data for so-called inventive compositions 2b and 4a in Table III of the opposed Patent Application, the data for 2,4-D triethylamine (TEA) and 2,4-D diethylethanolamine (DEEA) shows that these prior art compositions exhibit volatility which equates to the volatility of inventive compositions 2b and 4a.

38. In response to Mr. Ouse's comments in paragraph 46, whilst the results may allegedly show that the herbicidal compositions of the opposed Patent Application have reduced volatility, a point I do not concede, I note again that the claims of the opposed Patent Application are directed to "a method of preventing a herbicidal composition comprising a herbicidal carboxylic acids and a (tetraalkyl) ammonium hydroxide that has been administered to a locus of unwanted vegetation from injuring a crop that neighbors the locus". "Reduced volatility" does not equate to "no injury".

39. With respect to the experiments on the exposure of vapour from triclopyr ester and triclopyr salts to tomato plant in a humidome experiment reported in paragraphs 47 and 48, I note that these experiments are not part of the opposed Patent Application nor is this evidence from Mr. Ouse in response to anything I have said in my First Declaration. It is my view that these experiments constitute new evidence. I am informed by Arcadia Intellectual Property that the Applicant has not filed an application for leave to introduce this new evidence.

40. I also note that the new experiment in paragraph 47 reported by Mr. Ouse showed the observed injury levels for the triclopyr/choline salt (composition 2e of the opposed Patent Application) on tomatoes for Days 1 and 7 was 3% and 2% respectively and that the observed injury level for the same salt on grapes for Day 1 was 1%. It is my view that "prevention of injury" as required by claim 1 of the opposed Patent Application has not been demonstrated by this new experiment. As already stated "prevention" means 0% injury; nothing less. For the above reasons I also disagree with Mr. Ouse's assertions in paragraph 48 that this new data in any way supports the data presented in the opposed Patent Application. The results of this new experiment showed that when triclopyr/choline salt was used the observed injury levels to the sensitive tomato crop after day 1 and day 7 and to the sensitive grape crop after day 1 were both visible and measurable. Whilst the data may show that composition 2e has a lower volatility compared to triclopyr triethylamine and triclopyr butoxyethylester, a point that I do not concede, an injury level which is anything other than 0% (where according to page 11, line 12 of the

opposed Patent Application *"0 is equal to no injury"*) does not equate to "prevention" as required by the claims.

*Selective administration to unwanted vegetation and not to the crop – Paragraphs 49 to 53 of the Ouse Declaration*

41. In paragraphs 129 and 130 of my First Declaration I made it abundantly clear that opposed Patent Application does not provide any information as to how the "invention" being "a method for preventing a herbicidal composition that has been administered to a locus of unwanted vegetation from injuring a neighboring crop in which the method comprises the selective administration of a herbicidal composition comprising the reaction product of an herbicidal carboxylic acid and a (tetraalkyl) ammonium hydroxide to the locus of unwanted vegetation but not to the crop" can be put into effect. There is simply nothing that Mr. Ouse has said in response which has changed my view.

42. The aim of the invention is to provide a herbicidal composition having a herbicidal activity on an acid equivalent basis which is at least as active as the commercially used carboxylic acid herbicides salts, but with less volatility. The claims have the further limitation that the compositions prevent injury to a neighboring crop. It is my view that "reduced volatility" or even "reduced vapour drift", which is the primary focus of Mr. Ouse, does not equate to "no injury" to neighboring crops as required by the claims. My opinion is supported by the results reported in Table III which show that when herbicidal compositions 2b and 4a were used there was visible and measurable injury to the sensitive grape crops 7 days after the exposure to the vapours of those compositions. The injury was in fact measured at 6% and 12% respectively. I further note that the additional data provided by Mr. Ouse in paragraph 44 shows prior art compositions 2,4-D triethylamine (TEA) and 2,4-D diethylethanolamine (DEEA) having a % grape injury of 11% and 10% respectively. I also note the results reported by Mr. Ouse in paragraph 47. Whilst the data suggests that triclopyr/choline hydroxide has a low volatility compared to triclopyr triethyamine and triclopyr butoxyethylester, a point that I do not concede, low volatility does not equate to no injury as required by the

claims. As already stated the data reported by Mr. Ouse appears to show that triclopyr/choline hydroxide (composition 2e of the opposed Patent Application) causes visible and measurable injury to the sensitive tomato crop after day 1 and day 7 and visible and measurable injury to the sensitive grape crop after day 1.

43. I agree with Mr. Ouse when he says that it is well understood in the art that that the testing methods utilised in the laboratory do not need to be identical to the commercial processes applied to vegetation. I also agree there are many methods available to simulate what happens in the field. The post-emergence application method for herbicide evaluations provided on pages 10 and 11 of the opposed Patent Application is an example of a laboratory method that can simulate field conditions. However, when I consider the method on page 12 and compare it with the method on pages 10 and 11 there is, in my view, a number of problems. An obvious and unexplained component of the procedure on page 12 is that exposure to the vapour was over a 24 hour period at 40$^{o}$C. Consideration of the method on page 10 and 11 suggests an exposure temperature of 26–28$^{o}$C would more closely simulate what happens in the field. Another important difference between the experiment on page 12 and the method on page 10 and 11 is that vapours are confined within a humidome of undefined dimensions and the dispersion effects of wind and atmospheric stability are absent. Accordingly, Mr. Ouse is not correct in his assertion that the method on page 12 “simulates a sensitive crop being grown downwind from treated unwanted vegetation”.

44. It is my view that the problems I have identified in respect of the method on page 12 equally apply to the additional experiments conducted by Mr. Ouse and reported at paragraph 45. Specifically, the solvent used to prepare the solutions of 2,4-D acid, 2,4-D DMA, 2,4-DMEA and 2,4-D choline salt was not reported. Whereas 2,4-D DMA, 2,4-DMEA and 2,4-D choline salt are freely soluble in water, 2,4-D acid is only sparingly soluble in water. It follows that a solvent other than water was used to prepare the 2,4-D acid sample. The sprayed petri dishes were allowed to dry for 10 minutes; however, it is not stated if this was sufficient time for all solvent to be removed from the sprayed

deposit. It is well understood that any solvent remaining after drying for 10 minutes will affect the observed volatility.

45. Further, the quantity of spray of each sample is not shown. It is known from the work of Que Hee and Sutherland in 1974 (PMH-16 to my First Declaration) that the rate of volatility is an inverse function of the ratio of initial surface area to applied mass. If this ratio was not the same for each sample tested, no conclusions regarding difference in volatility can be inferred from the experiment.

46. Finally, samples were collected at times varying from 144 to 240 hours. It is not possible to compare the volatility of samples collected after various time periods. A test sample measured at 144 hours may show greater volatility if measured after 240 hours.

47. In any case, the additional experiments reported by Mr. Ouse at paragraph 45 do not address prevention of damage or injury to sensitive plants that may result from vapour exposure as required by claim 1 of the opposed Patent Application. Instead the additional experiments purport to measure the rate of evaporation of different salts in a laboratory apparatus. It is my view that no conclusions can be drawn from the results of these additional experiments.

*Operating conditions – Paragraph 54 of the Ouse Declaration*

48. Mr. Ouse has misstated my comments in paragraphs 133 and 136 of my First Declaration. In paragraph133 I made it clear that I considered the specification to be insufficient because “the operating conditions such as the application rate and concentration which are required to perform the method of claims 1 to 12 …have not be provided” and in paragraph 136 I stated that the claims lack definition because they do not define the operating conditions required to “perform the method of any one of claims 1 to 12”. I did not say anything in respect of the operating conditions required to “achieve the herbicidal compositions of claims 1 to 12” as Mr. Ouse has suggested. Contrary to Mr. Ouse’s assertions the claims of the opposed Patent Application are directed to “a method of preventing a herbicidal composition that has been administered to the locus of controlling unwanted vegetation

from damaging or injuring a neighboring sensitive crop"; NOT the herbicidal composition *per se* or a process of achieving the herbicidal composition. I stand by my earlier comments that I have not been provided with enough information in specification to allow me to perform the method and to achieve the requirement of "preventing" the herbicidal composition from damaging or injuring a neighboring sensitive crop i.e. 0% injury. I further add that there is nothing that Mr. Ouse has put forward in paragraph 54 to change the clear views that I expressed in paragraphs 133 and 136 of my First Declaration.

49. In any event Mr. Ouse's comments in paragraph 54 are nonsensical. Simply because the operating conditions such as the application rate and the concentration required to perform the claimed method and to achieve the selective herbicidal properties are not listed in the claims Mr. Ouse is of the opinion that the Applicant should not be obliged to provide them. Mr. Ouse has acknowledged that exaggerated rates are used to "more readily detect differences at low levels of exposure in trials". In so doing Mr. Ouse has conceded that there is a level of exposure. Given that the claimed method specifically defines "preventing injury to neighboring crops" i.e. no or 0% injury not a "reduction in injury", the Applicant should be required to provide the precise operating conditions so that the skilled reader is able to determine whether the claimed method is actually achievable.

50. The experiment in the opposed Patent Application and the new experiment reported by Mr. Ouse in paragraphs 47 and 48 were conducted at exaggerated rates to demonstrate small differences at low exposure levels. However, these experiments say nothing about the effect of vapour at typical, as opposed to exaggerated application rates. As it stands I cannot tell from these exaggerated rate experiments what happens at all application rates. Mr. Ouse states that the claims do not give any application rates. It must therefore follow that at any application rate injury to neighboring crops due to vapour will be "prevented" i.e. 0% injury when the quaternary ammonium derivative of a herbicidal carboxylic acid is administered to the locus of unwanted vegetation but not to the crop. Equally, commercially used compositions available before February 2007 must show some injury

neighboring crops due to vapour at any application rate. If this is the case, then this is not borne out by the experiments. Even at an exaggerated application rates the experiments of the opposed Patent Application and the new experiment reported by Mr. Ouse in paragraph 47 shows that the herbicidal compositions of the claimed invention caused a visible and measurable injury to sensitive plants (see paragraph 40 above). These experiments say nothing about the effect of herbicidal compositions of the invention compared to commercially used compositions available before February 2007 at low or typical application rates.

*Herbicidal carboxylic acid – Paragraphs 55 to 61 of the Ouse Declaration*

51. In response to paragraph 60 I note that Mr. Ouse contends that the opposed Patent Application informs the skilled person how to assess "prevention of injury" by what is described on "page 12". As already stated the results reported in Table III showed that at least two out of the three so-called inventive compositions were evaluated as showing a measurable visible injury/damage to the sensitive grape crops of 6% and 12% respectively and not prevention i.e. 0% injury as required by claim 1. I therefore do not accept that the opposed Patent Application provides a skilled person with enough information to assess all the compositions which fall within the scope of claim 1 and to have any confidence that the requirement for preventing the herbicidal composition, that has already been administered to a locus of unwanted vegetation, from injuring a neighboring sensitive crop i.e. 0% injury can be achieved. I stand by my comments in paragraphs 142 and 143 of my First Declaration and there is simply nothing that Mr. Ouse has put forward in paragraph 60 to change my view. In fact as noted above in paragraph 40 even the new experiment said by Mr. Ouse to be "supportive of the data in Table III" (see paragraphs 47 and 48 of the Ouse Declaration) showed that yet another herbicidal composition of the claimed invention being composition 2e caused visible and measurable injury to sensitive plants.

52. In response to Mr. Ouse's comments in paragraph 61, I disagree with his assertion that the data provided in Tables II and III provide representative data for all herbicidal compositions within the scope of the claimed method.

The only herbicidal composition which appears to show no injury was 2,4-D tetraethylammonium hydroxide. The other compositions of the invention being 2b and 4a showed visible and measurable injury to the sensitive grape crop. Likewise, the results reported by Mr. Ouse at paragraph 47 also show that triclopyr/choline hydroxide (composition 2e) caused visible and measurable injury to the sensitive tomato crop after day 1 and day 7 and visible and measurable injury to the sensitive grape crop after day 1.

53. I reiterate my earlier comments that "reduced volatility" does not equate to "no injury/prevention" as required by the claims.

*Priority Document – Paragraphs 62 to 66 of the Ouse Declaration*

54. I disagree with Mr. Ouse's comments in paragraphs 62 to 66 that the priority document (PMH-8 of my First Declaration) would provide support for a method of "preventing" a herbicidal composition from injuring a nearby sensitive crop that neighbors the locus of the unwanted vegetation. Whilst PMH-8 may describe the compositions as being less volatile, this does not equate to "no injury" as required by the claims. As noted Tables II and III, which are said by Mr. Ouse in paragraph 61 as providing "representative data for the herbicidal compositions utilized in the claimed method", are absent from PMH-8. The experiments underlying Tables II and III are also absent.

*Clarity and Succinctness – Paragraphs 67 and 68 of the Ouse Declaration*

55. With respect to the chemical structure incorporated in Claim 1, Mr. Ouse states in paragraph 67 that "$(CH_2)_n$-" would be understood as referring to a repeat unit, and that the claim describes there may be between 3 to 5 repeat units. Mr. Ouse also understands that there would be a terminating $CH_3$ group because "that is what an alkyl is". However, claim 1 needs to be understood by what is written, not by what Mr. Ouse may understand it to mean. Claim 1 does not explicitly state the $R^1$, $R^2$ or $R^3$ are alkyl. The description of the formula in claim 1 is *"…wherein $R^1$, $R^2$ and $R^3$ independently represent ($C_1$-$C_{16}$)alkyl or any two of $R^1$,$R^2$ and $R^3$ represent – $(CH_2)_n$ where n is an integer from 3-5 and $R^4$ represents (($C_1$-$C_{16}$)alkyl or*

*alkylaryl"* (my emphasis added). Thus, the second definition of $R^1$, $R^2$ and $R^3$ are not explicitly stated to be alkyl groups.

56. It is therefore not clear to me whether within the second definition of $R^1$, $R^2$ and $R^3$ which of the following alternative meanings apply:

    a) The "$–(CH_2)_n$" repeating units are terminated by group other than -$CH_3$;

    b) The intended meaning is, as suggested by Mr. Ouse, "$-(CH_2)_nCH_3$" where n is an integer from 3 – 5, which describes a ($C_4$-$C_6$) alkyl group, or

    c) The intended meaning is "$-(CH_2)_{n-1}CH_3$" where n is an integer from 3 – 5, which describes a ($C_3$ – $C_5$) alkyl group.

57. Further if, as Mr. Ouse suggests, "any two of $R^1$, $R^2$, and $R^3$ represent -$(CH_2)_n$- where n is an integer from 3 – 5" refers to alkyl groups, then these alkyl groups are encompassed in the first part of the definition, being within the scope of "($C_1$-$C_{16}$) alkyl".

58. I also note that the definition of "alkyl" provided on page 2, lines 21 to 27 of the opposed Patent Application encompasses more than just carbon and hydrogen atoms:

    *"Unless specifically limited otherwise, the term "alkyl", as well as derivative terms such as "arylalkyl", as used herein, include within their scope straight chain, branched chain and cyclic moieties. Unless specifically stated otherwise, each may be unsubstituted or substituted with one or more substituents selected from but not limited to halogen, hydroxy, alkoxy or alkylthio, provided that the substituents are sterically compatible and the rules of chemical bonding and strain energy are satisfied."*

59. Accordingly, Mr. Ouse's assertion in paragraph 67 that claim 1 is clear is simply not correct.

60. In response to paragraph 68 I note that Mr. Ouse accepts that page 9 identifies three alternative preparative methods of preparing the reaction product which is used in the method of claim 1. I also note that Mr. Ouse has chosen not to identify which of the methods provided on page 9 is the "best mode". From this I conclude that the reaction product that is used in the method of claim 1 can be prepared in a number of ways including according to the preparative method provided at lines 13 to 20 on page 9.

**OVERVIEW OF THE WRIGHT DECLARATION**

61. At the outset I believe that it is worth noting again as I have already stated in my First Declaration that the claims of the opposed Patent Application are directed to a "method of preventing a herbicidal composition that has been administered to a locus of unwanted vegetation from injuring a crop that neighbors the locus and to which the herbicidal composition has not been administered …". The claims of the opposed Patent Application are not directed to a method of "reducing" injury to a neighboring crop nor are the claims directed to a herbicidal composition having "reduced volatility" or being "less volatile". The claims of the opposed Patent Application are of a significantly narrower focus. Based on the dictionary meaning of the term "preventing" the claims are directed to a method of stopping the herbicidal composition from injuring a neighboring crop. Based on the scale provided on page 11, lines 11 to 13 "preventing" means 0% injury; nothing less.

62. With the above in mind I turn to Dr Wright's evidence I make the following comments. My decision not to comment on all the statements made in the Wright Declaration either in part or in full should not be taken as an indication of my agreement with that evidence generally or the comments made therein.

*Herbicides; 2,4-D; Modifying the chemical structure of 2,4-D into a useful product - Paragraphs 27 to 30 of the Wright Declaration*

63. In response to Dr Wright's comments in paragraphs 28 and 29 I simply note that there are many different ways in which herbicides may be classified. For example, by the mode of application, pre-emergent (generally meaning application to soil before seeds germinate) or post-emergent (generally meaning application to the foliage of plants which have emerged from soil). Further, herbicides may be classified as either total herbicides, which have an adverse biological effect on essentially all plants or selective herbicides which have an adverse effect on a specific subset of plants.

64. I also note and agree with Dr Wright's comments in paragraph 28 that 2,4-D is often used in mixtures with other herbicides. I add that it was known and in fact common practice in the field well before February 2007 to combine two or more herbicides in order to control a wider spectrum of weeds/unwanted vegetation. I further note that this is consistent with the description on page 5, lines 8 to 20 of the opposed Patent Application.

*Spray Drift - Paragraphs 32 to 35 of the Wright Declaration*

65. In response to paragraph 35 I agree in part with Dr Wright's comments that the susceptible plants may be "at some distance from the locus of application" however claim 1 of the opposed Patent Application provides no dimension for the locus of unwanted vegetation or the spatial relationship between the locus of unwanted vegetation and the neighboring crop. As it stands therefore the neighboring crop or susceptible plants may be "nearby" (as stated at page 2 lines 3 and 4 of the opposed Patent Application) or even "adjacent" (page 1 line 14 of the opposed Patent Application) to the unwanted vegetation.

*Alternative forms of 2,4-D - Paragraphs 36 to 49 of the Wright Declaration*

66. In response to Dr Wright's statements in paragraphs 36 to 45 where he seeks to question the characterizations in the technical literature that amine salts of 2,4-D are "non-volatile", I simply refer to PMH-16 of my First Declaration which is the paper published by S.S. Que Hee and R. G. Sutherland

published in *Weed Science*, Vol. 22, No. 4, (Jul., 1974) and titled "Volatilization of Various Esters and Salts of 2,4-D". The final paragraph on page 318 states as follows:

> *"The results in this paper show that if vapour drift is important for 2,4-D type of compounds, that this can be essentially eliminated by the use of amine salts instead of esters, as the volatilities of salts measured here even with no formulation materials present, and using an unrealistically high Q value, are less than 10% after 48 hr, by which time most of the salt impacted on plant leaves will be absorbed".*

PMH-16 shows that although the presence of 2,4-D amine vapours can indeed be detected using highly sensitive laboratory techniques, the quantity of vapour was insufficient to cause damage to sensitive plants.

Accordingly, Dr Wright's criticisms of my evidence and his assertion in paragraph 46 that amine salt forms of 2,4-D are not "non-volatile" is certainly not supported by the established literature dating to the early 1970s. I reiterate that from a practical agriculture perspective, amine salt forms of 2,4-D are non-volatile. Also, Dr Wright's statement in paragraph 47 that the potential problem of vapour drift still existed at the Relevant Date, even with the use of amine salts, is also not supported by the findings in the *Weed Science* paper (PMH-16).

67. In paragraph 34 Dr Wright states that vapor drift is a problem associated only with volatile herbicides. At paragraph 46 he further states, "a substance that has a non-zero vapor pressure therefore exhibits some degree of volatility" and in paragraph 47 Dr Wright continues: "I disagree that the amine salts of 2,4-D are totally non-volatile; there is no absolute zero of volatility." It appears that it is Dr Wright's view that all amine salts of 2,4-D are volatile and are associated with vapor drift. Not only is this view contradicted by the established literature (see the *Weed Science* paper PMH-16), but the results reported in Table III of the opposed Patent Application and the "supportive data" reported in paragraph 44 of the Ouse Declaration do not suggest that this is in fact correct. I note that some of the compositions of the invention

have a volatility which is no better than the amine salts of 2,4-D. Table III shows that herbicidal compositions 2b and 4a having a % grape injury of 6% and 12% respectively are comparable with the results reported by Mr. Ouse in paragraph 44 of the Ouse Declaration in respect of compositions 2,4-D triethylamine (TEA) and 2,4-D diethylethanolamine (DEEA), being % grape injury of 11% and 10% respectively. Accordingly, these results show that the reaction products of the opposed Patent Application do not achieve an outcome that is any better than or, most importantly, any different to the results obtained for the tertiary amine salts of 2,4-D.

68. Finally, Dr Wright asserts in paragraph 47 that there is “no absolute zero of volatility” and that, as a consequence, the problem of vapour drift still existed at the Relevant Date, even if amine salts were utilized. In making this assertion Dr Wright is saying the presence of vapour in the air, in any amount, may cause the problem with vapour drift which is the damage to sensitive plants after movement of the vapour. I reiterate my earlier comments that a sufficient quantity of vapour is required to damage sensitive plants. The notion that the presence of any amount of vapour, however minute, will cause damage is not supported by the established literature (see PMH-16). In any event it is not clear to me how the corresponding “absolute zero” of damage to neighboring crops equating to “prevention of injury”, is achieved with a quaternary ammonium salt of 2,4-D of the alleged invention particularly when such herbicidal compositions have non-zero volatility. Examples of such herbicidal compositions are compositions 2b and 4a (see Table III on page 13 of the opposed Patent Application) and 2e (see paragraph 47 of the Ouse Declaration).

69. My comments in the preceding paragraph are reinforced when I consider claim 1 of the opposed Patent Application which provides no dimension for the locus of unwanted vegetation or the spatial relationship between the locus of unwanted vegetation and the neighboring crop. As noted above this means that the neighboring crop could be nearby or even adjacent to the unwanted vegetation. On this basis therefore if Dr Wright is correct in his assertion in paragraph 47 that there is “no absolute zero of volatility”, then it is not clear to

me to what extent the volatility needs to be reduced compared to commercially used carboxylic acid herbicide salts to achieve the claimed method of preventing injury (0% injury) to neighboring crops.

70. In response to Dr Wright's assertions in paragraph 45 and his subsequent assertions in paragraph 47 concerning the existence of a "potential problem of vapour drift at the Relevant Date" I comment as follows. The problem purported to be solved by the opposed Patent Application is described on page 1, lines 9 -15 as being.

> *"Acid herbicides such as 2,4-dichlorophenoxyacetic acid (2,4-D) have long been used to control unwanted vegetation. 2,4-D is normally converted into liquid formulations by conversion to water soluble salts or emulsified esters. The ester formulations have been found to be more effective than the salts on an acid equivalent basis in the control of noxious vegetation but have the unwanted characteristic of migrating to adjacent desirable vegetation because of the volatility thereof, resulting in unacceptable damage to sensitive plants."*

This passage makes it very clear that the opposed Patent Application is about the use of herbicidal carboxylic acids, such as 2,4-D, in agriculture. D5 is a document prepared by Agriculture Western Australia to explain the problem of volatility to farmers. D6 is a document prepared by a task group of the World Health Organization (D6 at page 3) which discusses the environmental aspects of 2,4-D. Section 2.3 on page 7 of D6 describes the volatility of 2,4-D derivatives as follows:

> *"2,4-D esters with short-chain alcohols are highly volatile. This influences the effectiveness of their application to target crops, their effects on neighbouring crops, and the degree of contamination of the atmosphere. 2,4-D alkali salts or amine salts are much less volatile than esters, and these products are to be preferred when the use of 2,4-D esters might lead to evaporative 2,4-D losses and to crop damage or damage to the surrounding environment."*.

D7 is a document prepared by NSW Agriculture to explain the problem of spray drift, as droplets, particles or vapours, to farmers.

PMH-11 is a review of the environmental effects of 2,4-D esters by the Australian Pesticides and Veterinary Medicines Authority (APVMA), the

Australian government entity responsible for regulating the use of pesticides, including herbicides, in Australia. The scope of the document is explained at page 9:

> *"Products containing 2,4-D (a phenoxy herbicide) are used for control of broadleaf and grass weeds in an extensive range of crops and non-cropping situations. Aerial, handheld and ground methods of application are used. Major agricultural uses of 2,4-D include pasture, stubble and fallow maintenance, cereal crops (including wheat, oats, barley, rye, triticale), grain crops (including sorghum, millet, maize) and oilseed crops (safflower, canola, rape). Other agricultural uses include cotton, citrus crops (particularly to inhibit post harvest abscission of buttons), sugar cane, sweetcorn, peanuts and control of banana suckers. 2,4-D is also used extensively for weed control in non-cropping situations, including commercial and industrial areas, turf and aquatic areas.*
>
> *The active constituent 2,4-D, all products containing 2,4-D and their associated labels were placed under review because of concerns over toxicological, occupational health and safety and environmental issues (including impacts on waterways, non-target animals and plants).*

From the above it is clear that D5, D6, D7 and PMH-11 discuss the comparative volatility of salts and esters of 2,4-D from the perspective of practical agriculture which is concerned with damage to sensitive non-target plants caused by vapour, not from the perspective of academic physical chemistry. Collectively these references, which were published well before February 2007, show that problem of damage to off-target plants as a result of vapour drift caused by 2,4-D esters could be eliminated by the use of various amine salts of 2,4-D.

71. Nevertheless, if Dr Wright wishes to consider the issue of whether damage to off-target plants as a result of vapour drift caused by 2,4-D esters can be eliminated by the use of various amine salts of 2,4-D. from a pure academic perspective, then I simply say that I have already addressed the relevant physical chemistry in my First Declaration. Table 4 on page 317 of the paper by Que Hee and Sutherland (1974) (PMH-16 of my First Declaration) reports the vapour pressure of methylamine, dimethylamine (a secondary amine), n-butylamine, n-dodecylamine and n-tetradecylamine salts of 2,4-D and the

volatilsation of these salts after 48 hours at 38$^{o}$C, 0% relative humidity, based on measurements of $^{14}$C ring labelled 2,4-D. I note that the volatilisation of the 2,4-D amine salts was measured using a similar bell jar experiment to that reported by Mr. Ouse at paragraph 45 of the Ouse Declaration. Most importantly, the concluding paragraph of the paper states:

> "*The results in this paper show if vapor drift is important for 2,4-D type compounds, that this can essentially eliminated by the use of amine salts instead of esters, as the volatilities of salts measured here even with no formulation materials present, and using unrealistically high Q values, are less than 10% after 48 hr, by which time most of the salt impacted on plant leaves will have been absorbed".*

Thus, the Que Hee and Sutherland paper showed in 1974 the vapor pressures of 2,4-D amines salts were known and that the volatile loss of these salts could be measured, albeit under laboratory conditions. In the decades that followed the Que Hee and Sutherland paper, Australian Agricultural departments regarded the class of 2,4-D amines salts to be "non-volatile" because the problem of damage to non-target sensitive plants was simply not observed following application of herbicides comprising 2,4-D amines. These same government sources differentiated the class of 2,4-D amines from the class of 2,4-D esters.

72. As already noted Dr Wright is not correct in his assertion in paragraph 47 that the potential problem of vapour drift still existed in February 2007. The findings in the Que Hee and Sutherland published in 1974 (PMH-16) concluded that this problem had already been "essentially eliminated by use of amine salts". That is PMH-16 showed that amine salts of 2,4-D including the dimethylamine salt form were not sufficiently volatile for damage to occur. Accordingly the problem of vapour drift identified on page 1, lines 21 to 25 of the opposed Patent Application had already been addressed well before February 2007.

73. In response to Dr Wright's comments in paragraph 48 it appears that he has not read or comprehended my earlier evidence. D7 is referenced in my paragraph 45. In D7 spray drift is sub-divided, or categorized, as having three

types, droplet drift, vapour drift or particle drift. The need to maintain effectiveness is apparent for all three modes of drift described in D7.

74. In paragraph 49 Dr Wright appears to recognize the importance of the herbicidal composition of the opposed Patent Application having sufficient herbicidal efficacy and in so doing seeks to rely on the disclosure in JP51106728 (identified as D2 in my First Declaration) in support of this. Dr Wright also states that he and others in the field would deem a level of herbicidal activity that still produces the outcome of controlling unwanted vegetation to be a "retention of sufficient herbicidal activity". I agree that this is indeed the case although I note with interest that Mr. Ouse does not agree (see paragraphs 24 and 25 of the Ouse Declaration). Mr. Ouse considers that merely acting as a herbicide is enough.

75. Further, whilst the compositions of the invention are said to have a herbicidal activity that is "*comparable to the commercially used carboxylic acids"* as I have already noted the results in Table II on page 11 do not show that all compositions of the alleged invention have a comparable herbicidal activity compared to commercial controls. I again note that Table II shows that 2,4-D choline salt (composition 1e) showed only 68% control on Broadleaf Dock (*Rumex obtusifolia*) compared to commercially used 2,4-D dimethylamine salt (2,4-D DMA) which showed a control of 77%. On my calculations the % control of Broadleaf Dock (*Rumex obtusifolia*) by 2,4-D choline salt is 88.3% of the commercial control. Table II also shows the herbicidal activity of triclopyr tetramethylammonium salt was 79% for Kochia (*Kochia scoparia*) compared to 91% for commercially used triclopyr triethylamine salt. Again, on my calculations the % control of Kochia (*Kochia scoparia*) by triclopyr trimethylammonium salt was 86.8% of the commercial control.

76. I note that in paragraph 40 Dr Wright agrees with me that D5 describes dissociation of 2,4-D dimethylamine salt in aqueous solution to the 2,4-D anion and dimethylammonium anion at Table 1, however he does not agree that the dissociation is "rapid". Dr Wright is clearly wrong on this point. In this regard I refer to Section 4.3.3.1 of PMH-11 on page 28 which states:

*"Direct evidence of the stability of 2,4-D amine salts in soil and aquatic environments is difficult due to the lack of analytical methods. The US EPA point out in their report that based on maximum application rates for 2,4-D amine salts (@ 4.5 kg ai/ha), 2,4-D amine salts are expected to fully dissociate in soil environments because their theoretical concentrations in soil solution does not exceed water solubilities. Additionally, dissociation studies indicate the time for complete dissociation is rapid (< 3 minutes). Reim (1989) considered the dissociation of 2,4-D and 2,4-D DMA in water. Analytical grade 2,4-D and 2,4-DMA, in HPLC grade water had dissociation times of ≥120 minutes and <1 minute, respectively. Complete dissociation was determined through a comparison of theoretical and estimated electrical conductance measurements at infinite dilution. For 2,4-D DMA, plots of equivalent conductance vs. concentration$^{½}$ (Onsager equation) are linear indicating it is a strong electrolyte while that for 2,4-D is non-linear indicating it is a weak electrolyte. Conductivity data are consistent with the premise that 2,4-D DMA completely dissociates in aqueous solution to form dimethylammonium ion and the conjugate base of 2,4-D."*

77. In response to Dr Wright's assertions in paragraphs 44 and 59 it is not clear to me what point he is attempting to make. It cannot be disputed that herbicidal formulations containing diethanolamine and triethanolamine had been produced and sold since the early 1980s. It cannot be disputed that a person skilled in the art at that time would know, by reference to standard chemical reference works readily available at the time, that the boiling points of diethanolamine (271$^{o}$C at atmospheric pressure) and triethanolamine (277$^{o}$C at 150 mm Hg) were significantly higher than the boiling point of dimethylamine (7$^{o}$C at atmospheric pressure). It should not come as any surprise to Dr Wright that the person skilled in the art would refer to standard chemical reference works rather than Agriculture Department notes published 20 years in the future. It seems to me that Dr Wright has confused the broad classification of 2,4-D amine salts as being "non-volatile" in the sense used in practical agriculture, such as in D5, D6, D7 and PMH-11, and the concepts used in physical chemistry.

*Quaternary ammonium salts – Paragraphs 50 to 57 of the Wright Declaration*

78. In response to paragraph 53 I note that Dr Wright agrees with me that the reactivity of quaternary ammonium hydroxides is comparable to sodium hydroxide and are therefore expected to react with carboxylic acids in a similar way. It follows that as a strong base the quaternary ammonium cation will readily dissociate in aqueous solution.

79. In response to paragraphs 55 to 57 of the Wright Declaration whilst it is agreed that n-tetradecylamine is not a quaternary ammonium, I stand by my comments including that the synthesis and properties of quaternary ammonium cations were clearly well known before February 2007. As stated in paragraph 48 of my First Declaration the extract from the elementary organic chemistry text from M.F. Grundon and H.B. Henbest 5$^{th}$ Edition (1971) (PMH-14 of my First Declaration) shows the synthesis of the tetraalkylammonium halides and the conversion into the corresponding base. The example shown is butyltrimethylammonium hydroxide, which is a quaternary ammonium. I note that my comments in respect of this extract have not been questioned by Dr Wright. I further note that Dr Wright agrees with me that quaternary ammonium hydroxides are strong bases and that they have a base strength which is comparable to sodium hydroxide (paragraph 53 of the Wright Declaration). In any event PMH-15 does disclose 2,4-D quaternary ammonium salts as outlined below.

80. Dr Wright is therefore not correct in his assertion in paragraph 55 that the text "Phenoxyalkanoic Herbicides" (PMH-15 to my First Declaration) does not disclose a 2,4-D quaternary ammonium salt. The first paragraph of the section entitled "B. Amine Salts" on page 117 of PMH-15 in particular footnotes **"188-220"**. Now produced and shown to me and marked **PMH-29** is a copy of pages 143 to 144 of the text "Phenoxyalkanoic Herbicides"; Chemistry, Analysis, and Environmental Pollution Volume 1 of (Pesticide Chemistry Series) S.S. Que Hee & R.G. Sutherland, CRC Press, 1981 which provides a list of relevant references to various footnotes including references relating to footnotes 188 to 220. Reference 189 on page 143 is *"Harwood, J., US 2,900,411"*. Now produced and shown to me and marked **PMH-30** is a

copy of this patent. US 2,900,411 describes the development of compositions being the reaction of an aliphatic amine having at least 6 carbon atoms in an aliphatic radical with a plant hormone carboxylic acid such as 2,4-D to form the salt. The compositions are described as being selectively applied to weed infested areas to eradicate the noxious vegetation, while at the same time leaving the desirable plants unharmed. Column 2, lines 26 to 33 of US 2,900,411 describes the amines which may be used as including *"quaternary compounds, such as trimethyloctylammonium hydroxide and trimethyldodecylammonium hydroxide".* In addition, reference 214 on page 144 of **PMH-29** is *"May & Baker Ltd., Netherlands Patent* 6,506,449*, 1965"*. Now produced and shown to me and marked **PMH-31** is a copy of GB equivalent of Netherlands Patent 6,506,449. Page 5, lines 72 to 86 of GB 1,056,235 describes a method of preparing the tetramethylammonium salt of 2,4-D. I note that the melting point of the tetramethylammonium salt of 2,4-D reported in GB 1,056,235 of 212-214$^0$C is the same as the melting point of composition 1a 2,4-D tetramethylammonium salt reported in Table 1 on page 10 of the opposed Patent Application. It follows that PMH-15 includes a reference to 2,4-D quaternary ammonium salts.

*Discussion as to a non-volatile 2,4-D formulation - Paragraphs 58 to 61 of the Wright Declaration*

81. The reasons provided above Dr Wright is not correct in his assertion in paragraph 58 as to the volatility of the amine salts of 2,4-D. His position is not supported by the established literature dating to the early 1970s (PMH-16).

82. In response to Dr Wright's criticisms (in paragraph 60) of my statements in paragraph 55 of my First Declaration, I reiterate my earlier comments that I would not have ruled out the use of other amine salts such as quaternary ammonium salts. There is simply no basis to do so particularly given that the processes used to prepare a quaternary ammonium salt form of 2,4-D by neutralization of 2,4-D with a quaternary ammonium hydroxide in aqueous solution would not involve complicated laboratory techniques. In my opinion **all** salts of 2,4-D, including quaternary amine salts, would have been considered in any research program. In fact, it would be highly unusual to

reject a class of salts simply because they may not have been in wide use or even in commercial use or more expensive or more difficult to make. Quaternary ammonium salts of 2,4-D were widely known before February 2007 as I have already established in my First Declaration. In this regard I rely on the disclosure in the extract from the elementary organic chemistry text from M.F. Grundon and H.B. Henbest 5th Edition (1971) (PMH-14 of my First Declaration); the extract from the text "Phenoxyalkanoic Herbicides" (PMH-15 to my First Declaration); JP51106728 with a publication date of 21 September 1976 (D2), GB 1339315 with a publication date of 5 December 1973 (D3); DD203677 with a publication date of 2 November 1983. I also rely on US 2,900,411 **(PMH-30)** and GB 1,056,235 **(PMH-31).**

83. Dr Wright is not correct in his contention that quaternary ammonium salts of 2,4-D are more difficult to produce than primary, secondary or tertiary amine salts. Production starting from the quaternary ammonium hydroxide is no more difficult than production from any other amine. It would merely involve mixing the quaternary ammonium hydroxide with 2,4-D in water. As noted by Mr. Ouse in paragraphs 41 and 68 of the Ouse Declaration quaternary ammonium salts of 2,4-D can be produced using the second preparative method on page 9, lines 8 and 9 of the opposed Patent Application. The alternative preparative methods provided on page 4, lines 6 to 12, page 9, lines 2 to 8 and lines 13 to 20 are, with respect to Dr Wright, not particularly complex. Even if I were to accept Dr Wright's contention as to difficulties of preparing the quaternary ammonium salts of 2,4-D, a point that I do not concede, this is certainly not a reason to rule them out.

84. Dr Wright's assertion that simply because I may not have made quaternary ammonium salts of 2,4-D that this somehow undermines my statement in my First Declaration, is with respect, a nonsensical argument. Nufarm was already selling a non-volatile 2,4-D amine salt product that met the market need and there was no perceived need to change.

85. In response to Dr Wright's assertions in paragraph 61 my comments in paragraph 56 of my First Declaration as to water solubility I simply state that it relates to practical utility of the resultant amine. It is a common feature of the

commercial amine salts of 2,4-D and triclopyr that they are readily soluble in water. This has advantages in the application of the resultant product. Readily soluble products may be stored and transported as a concentrated aqueous solution and be easily diluted in water for application as a spray.

## *E. AUSTRALIAN PATENT APPLICATION NO. 2016203677*

86. Concerning Dr. Wright's comments in paragraphs 62 and 63, I refer to my comments in paragraphs 79 and 80 above. The use of amine salts including quaternary ammonium salts to eliminate vapor drift caused by 2,4-D esters was well known before February 2007 (see PMH-16).

87. I disagree with Dr Wright that PMH-16 merely describes the use of primary amine salts to "minimize vapor drift". As noted above the results in PMH-16 showed that if vapour drift is important for 2,4-D formulations that *"this can be essentially eliminated by the use of amine salts instead of esters".* Accordingly, the problem of vapour drift associated with 2,4-D esters had been addressed by the *Weed Science* paper (PMH-16) in 1974.

88. Dr Wright's comments in paragraph 63 that PMH-16 provides no information regarding the herbicidal activity of 2,4-D n-tetradecylamine are nonsensical. It should go without saying that 2,4-D by its very nature is a herbicide and therefore the n-tetradecylamine salt form of 2,4-D would have herbicidal activity.

89. Further Dr Wright's assertion in paragraph 63 that PMH-16 only describes the "use of *primary* amine salts to minimize vapor drift" is incorrect. Not only do the results reported in PMH-16 show that the problem of vapour drift is "essentially eliminated" (not "minimized" as suggested by Dr Wright) but PMH-16 uses both a secondary amine (dimethylamine) salt of 2,4-D and the primary amine salt form. If a secondary amine 2,4-D salt such as dimethylamine, which I note is the amine formulation specifically referred to on page 1 line 17 of the opposed Patent Application, is shown by PMH-16 to be not sufficiently volatile for damage to occur, then the problem sought to be solved by the opposed Patent Application in respect of the quaternary amine salt did not exist at the Relevant Date.

## *F. OBVIOUSNESS IN LIGHT OF THE COMMON GENERAL KNOWLEDGE ALONE*

90. In response to Dr Wright's assertions in paragraph 64 it is accepted that n-tetradecylamine is a primary amine. However, my comments in paragraphs 76 and 77 of my First Declaration still stand. The use of quaternary ammonium salts to minimize vapour drift of herbicides was known before February 2007. I refer to my comments in paragraphs 79 and 80 above. I also note that in PMH-16 showed that the problem of vapour drift could be "essentially eliminated" by the use of amine salts of 2,4-D not "minimized" as Dr Wright has suggested.

91. In response to Dr Wright's assertions in paragraph 65 I stand by my comments in my First Declaration. To address the adverse effects of volatility arising from the ester form of 2,4-D I would have certainly looked at an amine salt form as it was certainly known well before February 2007 that the problem of vapour drift could be essentially eliminated by the use of such salts (PMH-16). With a base strength that is comparable to sodium hydroxide (NaOH) (which has been accepted by Dr Wright – see paragraphs 53, 78, 84, 91 and 149 of the Wright Declaration) I would have considered quaternary ammonium hydroxides knowing that they react with carboxylic acids including herbicidal carboxylic acids to form salts in the same way sodium hydroxide reacts with a carboxylic acid. I would not have ruled out other bases such as sodium hydroxide (caustic soda) to form a sodium salt. As stated in my First Declaration my choice of a base would have been simply a function of using water soluble compounds that would be easy for us to formulate and easy for the user to mix.

92. In paragraph 66 Dr Wright seeks to draw on the data in Tables II and III of the opposed Patent Application to "demonstrate a significant reduction in volatility of herbicidal carboxylic acids formulated with N-(($C_1$-$C_{16}$)alkyl or alkylaryl) tri(($C_1$-$C_{16}$) alkyl)ammonium hydroxides, including choline hydroxide, compared with known 2,4-D formulations while maintaining comparable herbicidal activity". I make the following comments in response:

(a) "Significant reduction in volatility" does not equate zero volatility or no injury as required by the claims. In this regard I reiterate my comments above in paragraph 61. Claim 1 of the opposed Patent Application is directed to a method for "prevention of injury to a neighboring crop" not "reduction in volatility" or for that matter, "reduction in injury".

(b) Table III shows that herbicidal compositions 2b and 4a having a % grape injury of 6% and 12% respectively are comparable with the results reported by Mr. Ouse in paragraph 44 of the Ouse Declaration in respect of compositions 2,4-D triethylamine (TEA) and 2,4-D diethylethanolamine (DEEA), being % grape injury of 11% and 10% respectively. Accordingly, these results show that the reaction products of the opposed Patent Application do not achieve an outcome that is any better than or, most importantly, any different to the results obtained for the tertiary amine salts of 2,4-D.

(c) I refer to my comments above in paragraphs 22 to 24 with respect to the results reported in Table II of the opposed Patent Application. The herbicidal activity of the so-called inventive compositions being at least as active as the commercially used herbicidal salts is simply not shown.

## *G. COMPARISON OF THE PATENT APPLICATION AND THE PRIOR ART*

### D2: JP 51-1 06728 – paragraphs 68 to 109 of the Wright Declaration

93. In response to Dr Wright's comments in paragraph 76 I note that the claims of the opposed Patent Application are directed to a method of "preventing injury to neighboring crops" not the problem of volatility of 2,4-D or how that volatility could be reduced. As noted above "prevention" is not "reduction" and therefore Dr Wright has not been asked the correct question. Furthermore, the claim 1 of the opposed Patent Application is not limited to the method being conducted at a particular temperature nor are there any subsidiary claims which specify a temperature range. It is my view that Dr Wright is reading into the claims particular requirements that are simply not present. I would also point out that PMH-20 (D2) describes "greatly reducing the risk of chemical damage to the crop" i.e., prevention of injury.

94. Dr Wright's comments in paragraph 77 are contrary to what is actually demonstrated in PMH-20 (D2). As stated in paragraph 93 of my First Declaration the results of the use of the herbicide of practical embodiment (1) being a mixture of 2,4-D, choline hydroxide, a surfactant and water reported in Table 2 on page 8 of PMH-20 (D2) showed that at concentrations ranging from 30 ppm to 1000ppm there was maximum herbicidal effect against the Daikon and beans and **no** i.e. 0% chemical damage to the maize and wheat crops after 17 days. The claims of the opposed Patent Application are directed to a method of "preventing injury to neighboring crops". As noted above the specification does not provide any actual definition as to what is meant by "preventing". The only guidance is Table III on page 13 of the opposed Patent Application where 0% injury is equal to no injury (see page 11, line 12). On my reading of PMH-20 (D2) the results of Table 2 clearly show that the herbicide of practical embodiment (1) demonstrated no injury to neighboring sensitive crops. Whether Dr Wright would have expected the composition of PMH-20 (D2) to have reduced volatility is, with respect, not the correct question to have been asked.

95. I disagree with Dr Wright's assertions in paragraphs 78 and 79 that PMH-20 (D2) does not disclose choline hydroxide. According to PMH-20 (D2) the characteristics of "choline" are:

    i. It is not a "salt of choline" (page 3, line 18). In fact, according to D2 "choline salts" are said to be for example salts of choline with organic acids such as such as oxalic acid and ascorbic acid or salts of choline with inorganic acids such as phosphoric acid and carbonic acid (page 3 lines 18 to 21);

    ii. It reacts with phenoxy substituted lower aliphatic acids to form choline salts of phenoxy substituted lower aliphatic acids (page 3, lines 22 to 24) which is that is water soluble (page 3, lines 33 to 39).

    iii. That if the molar ratio of cholines to phenoxy compound is greater than 1.2 then the herbicide becomes highly alkaline and risk of harm increases (see page 3, lines 31 and 32).

It is my view that the term "choline" in D2 is "choline hydroxide" and there is nothing that Dr Wright has said to change my view.

96. To confirm my view that the term "choline" in D2 is "choline hydroxide" I instructed Dr Jason McKerrow to conduct a series of experiments where each of choline hydroxide, choline chloride and choline bitartrate were reacted with 2,4-D acid to compare the results with those reported in D2. The experiments were as follows:

(a) Experiment 1, a slurry of 2,4-D (90 mmol) acid in water was reacted with a 10% aqueous solution of choline hydroxide (90 mmol).

(b) Experiment 2, a slurry of 2,4-D (90 mmol) acid in water was reacted with a 10% aqueous solution of choline chloride (90 mmol), a choline salt with an inorganic acid.

(c) Experiment 3, a slurry of 2,4-D (90 mmol) acid in water was reacted with a 10% aqueous solution of choline bitartrate (90 mmol), a choline salt with an organic acid.

(d) Experiment 4, a slurry of 2,4-D (90 mmol) acid in water was reacted with a 10% aqueous solution of choline hydroxide (117 mmol, molar ratio 1:1.3)

(e) Experiment 5, a slurry of 2,4-D (90 mmol) acid in water was reacted with a 10% aqueous solution of choline chloride (117 mmol, molar ratio 1:1.3).

(f) Experiment 6, a slurry of 2,4-D (90 mmol) acid in water was reacted with a 10% aqueous solution of choline bitartrate (117 mmol, molar ratio 1:1.3).

97. Dr McKerrow's results are summarized in the following table.

| Expt # | T ($^{o}$C) Initial | T ($^{o}$C) after addition | T($^{o}$C) 20min after addition | pH | Comments |
|---|---|---|---|---|---|
| 1 | 19.0 | 20.6 | 20.3 | 6.9 | Mixture changed from slurry to almost clear immediately after addition to clear 20min after addition. Obvious temperature increases due to addition. |
| 2 | 19.2 | 19.1 | 19.3 | 2.8 | No increase or decrease in total solid content of mixture |
| 3 | 19.2 | 19.2 | 19.3 | 3.4 | No increase or decrease in total solid content of mixture |
| 4 | 20.0 | 21.4 | 21.2 | 12.7 | Mixture changed from slurry to almost clear after addition to clear 20min after addition. Obvious temperature increase due to addition. |
| 5 | 20.0 | 20.3 | 20.3 | 2.7 | No increase or decrease in total solid content of mixture |
| 6 | 20.2 | 20.3 | 20.4 | 3.4 | No increase or decrease in total solid content of mixture |

98. Dr McKerrow's experiments showed that 2,4-D acid reacts with choline hydroxide in equimolar proportions to form a clear aqueous solution, with the evolution of heat, to form a solution of pH 6.9. This is consistent with the behavior reported in D2 for the choline at page 3, line 22 and lines 36 to 39.

99. Dr McKerrow's experiments show that 2,4-D acid reacts with choline hydroxide in a molar ratio of 1:1.3 to form a clear aqueous solution, with the evolution of heat, to form a solution of pH 12.7. This is consistent with the behavior reported in D2 for the choline (see page 3, line 22, lines 31 to 32 and lines 36 to 39).

100. Dr McKerrow's experiments show that a 2,4-D acid does not react with a choline salt of an inorganic acid (choline chloride) or a choline salt of an organic acid (choline bitartrate) in either equimolar proportion or in molar ratio 1:1.3. Specifically, 2,4-D acid does not dissolve and there was no evolution of heat.

101. As the herbicides envisaged by D2 are water soluble chemicals comprising phenoxy substituted lower aliphatic acids and choline (PMH-20 in the

sentence bridging pages 3 and 4), Dr McKerrow's experiments clearly demonstrate the "choline" of D2 is choline hydroxide.

102. I reject Dr Wright assertions in paragraphs 84 and 85 that the terms "choline" and choline hydroxide" in documents D8 to D14 have been "carelessly and incorrectly used interchangeably." I have revisited these documents and it is my view that the term "choline" has been defined in very clear and precise terms as denoting the chemical entity $[(CH_3)_3NCH_2CH_2OH]^+OH^-$ - being the hydroxide salt of choline and that there is simply no basis for Dr Wright's assertions.

**D3: GB 1339315 – Paragraphs 110 to 118 of the Wright Declaration**

103. I remain of the view that D3 describes the use of a herbicidal composition resulting from mixing a herbicidally active compound such as the 2,4-D acid and a quaternary ammonium salt where the radicals R, $R_1$, $R_2$ and $R_3$ may be a "hydroxy-substituted alkyl" which encompasses choline hydroxide, to treat the locus of unwanted vegetation and to prevent injury to neighboring cereal crops. There is nothing that Dr Wright has put forward in paragraphs 116 to 118 to change my view.

104. In response to paragraph 116 I note that Dr Wright <u>accepts</u> that the options for the quaternary ammonium radicals, R, $R_1$, $R_2$ and $R_3$, would encompass of the quaternary ammonium anion "choline", however, I disagree with Dr Wright that D3 does not describe the nature of the counter ion. Page 2, lines 60 to 65 of D3 clearly describes the method of preparing a herbicidal salt composition as involving

> *"reacting the <u>bases</u> with the [at least one herbicidally active] acid to form a mixture of salts …"* (my emphasis added).

I further note that page 2, lines 109 to 113 describes the salts which may be employed as including the

*"alkali metal salts and the salts formed by the reaction of <u>other bases such as ammonium hydroxide</u>, with the appropriate acids"* (again my emphasis added).

It is my view that this description in D3 could not be any clearer that the counter ion is "hydroxide" and that this prior disclosure does encompass "choline hydroxide".

105. Finally in response to Dr Wright's comments in paragraphs 110 to 113 I note that he has curiously omitted reference to the statement at line 59 to 64 on page 1 that compared to an ester derivatives noting that *"a salt of a herbicidally active acid (the amine salts being the most widely used group of salts) is substantially always <u>non-volatile</u> due to ionization of the salt in an aqueous carrier"*. As stated in my First Declaration D3 has a publication date of 1973.

**D1: DD203677 – Paragraphs 119 to 133 of the Wright Declaration**

106. Whilst I agree with Dr Wright's comments in paragraph 125 as to the difference between the use of 2,4-D to promote plant growth and the use of 2,4-D to kill plants centres around the amount of 2,4-D used and the sensitivity of the plant towards 2,4-D, I stand by my comments in my First Declaration concerning the relevance of the teachings in D1.

107. I disagree with Dr Wright's comments in paragraph 128 that amount of 2,4-D used in D1 is not sufficient to result in plant death "*as a herbicide would*". I note that the term "herbicide" is defined in the opposed Patent Application on "*an active ingredient that kills, controls or adversely modifies the growth of plants*" (page 4, lines 13 and 14). I also note that the opposed Patent Application differentiates term "herbicide" from "*an herbicidally effective or vegetation controlling amount*" (page 4, line 15). That is, the property of being a "herbicide" is different to being in a herbicidally effective or vegetation controlling amount. Finally, I note that in addition to "killing", the herbicidal effect may be "non-lethal" such as "causing deviation from natural development, regulation, desiccation retardation and the like" (see page 4, lines 16 and 17).

108. Accordingly whilst I agree that the growth regulation effect shown in D1 results from the amount of 2,4-D applied, it does not follow that application of the composition of D1 to any other plant species, over the range of application rates of "1 – 2,000 g/Ha" described in the opposed Patent Application at page 5, line 3 would not result in herbicidal effect as described at page 4 line 14 namely as causing a deviation from natural development, regulation, retardation, desiccation and the like.

109. In response to Dr Wright's comments in paragraph 133 I reiterate my comments in my First Declaration that the meaning of choline in the D1 must be understood in context of the document being considered. The term "cholin" was used in the original German text of D1. Page 720 of *Beilstein Handbuch der Organische Chemie* (PMH-25) identified *"cholin"* as *"Trimethyl-[β-oxy-äthyl]-ammonium hydroxid"* with the chemical structure "$C_5H_{15}O_2N$ = $(CH_3)_3N(OH)CH_2CH_2OH$". At the time D1 was published *Beilstein Handbuch der Organische Chemie,* was the definitive reference for chemistry in the German language. I further note that page 719 of RÖMPP CHEMIE LEXIKON (PMH-26) also confirms that the reference to "cholin" in D1 is choline hydroxide.

## H. COMPARISON OF THE PATENT APPLICATION AND THE PRIOR ART – SUMMARY – Paragraphs 134 to 138 of the Wright Declaration

110. I reject Dr Wright's assertions in paragraph 135 that I have not provided any examples of prior art documents which disclose a herbicidal composition comprising the reaction product of a herbicidal carboxylic acid and a tetraalkylammonium hydroxide. D3 is one such example. This prior art document clearly describes the use of a herbicidal composition resulting from mixing a herbicidally active compound such as the 2,4-D acid and a quaternary ammonium hydroxide where the radicals R, $R_1$, $R_2$ and $R_3$ may be a "hydroxy-substituted alkyl" which encompasses the hydroxide form of choline (see page 2, lines 109 to 113 of D3), to treat the locus of unwanted vegetation and to prevent injury to neighboring cereal crops. As stated in paragraph 96 of my First Declaration D3 provides field examples showing no injury to the cereal crops. Example XIV on pages 10 and 11 demonstrates

the biological effectiveness of the herbicidal compositions of D3 on several hard to control weed species with no injury or damage to the adjacent wheat crop. The disclosure in D3 could not be any clearer.

111. Likewise, the disclosure in PMH-20 (D2) and its relevance to the claims of the opposed Patent Application is also clear. This prior art document describes the reaction product of 2,4-D, choline hydroxide, a surfactant and water to form a "herbicide" and its use eradicate broad-leaved weeds. As stated in paragraph 93 of my First Declaration this herbicide is applied to a mixture of Daikon, beans, maize and wheat with the Daikon and beans being used as the undesirable broad-leaved plants in the intended cereal (maize/wheat) crop. The data set out in Table 2 of PMH-20 (D2) shows that, at a concentration of 1000ppm the herbicide was completely effective in eradicating the Daikon and beans as there was 0% green growth (Indicator 5 = 0% mass of green growth) and there was most importantly no chemical damage to the neighboring maize or wheat crops.

112. Also as noted above in paragraph 80 reference 214 on page 144 of **PMH-29** is *"May & Baker Ltd., Netherlands Patent* 6,506,449*, 1965"*. Page 5, lines 72 to 86 of GB 1,056,235 (**PMH-31),** which is the GB equivalent of Netherlands Patent 6,506,449), describes a method of preparing the tetramethylammonium salt of 2,4-D.

113. In response to Dr Wright's assertions in paragraph 136 I stand by my comments in my First Declaration at paragraphs 54 to 56. To address the adverse effects of volatility arising from the ester form of 2,4-D, not an alternative to 2,4-D amine salts as Dr Wright has suggested, I stated that I would have certainly looked at an amine salt form as it was certainly known well before February 2007 that volatility could be essentially eliminated by the use of such salts (PMH-16). With a base strength that is comparable to sodium hydroxide (NaOH) (which has been accepted by Dr Wright – see paragraphs 53, 78, 84, 91 and 149 of the Wright Declaration) I would have considered quaternary ammonium hydroxides knowing that they react with carboxylic acids including herbicidal carboxylic acids to form salts in the same way sodium hydroxide reacts with a carboxylic acid. I would not have ruled

out other bases such as sodium hydroxide (caustic soda) to form a sodium salt. As stated in my First Declaration my choice of a base would have been simply a function of using water soluble compounds that would be easy for us to formulate and easy for the user to mix.

114. In response to Dr Wright's assertions in paragraph 137 I have, as already noted, provided examples of prior art documents which disclose the use of a herbicidal composition comprising the reaction product of a herbicidal carboxylic acid and a tetraalkylammonium hydroxide to "prevent injury to neighboring crops". Again, it appears that Dr Wright has not properly considered the language of the claims of the opposed Patent Application and what they define. Contrary to Dr Wright's comments in paragraph 137, claim 1 of the opposed Patent Application is not directed to the use of quaternary ammonium hydroxide salts for combining with 2,4-D for the purpose of making a "less volatile herbicide". Rather claim 1 is directed a method for <u>preventing</u> a herbicidal composition that has been administered to a locus of unwanted vegetation from injuring a neighboring crop in which the method comprises the administration of a herbicidal composition comprising the reaction product of an herbicidal carboxylic acid and a tetraalkylammonium hydroxide. The volatility of the herbicide is not mentioned in the claim.

115. In response to paragraph 138 I make the observation that Dr Wright has "acknowledged" that the subject matter of the following claims was "generally known" before February 2007:

(i) Claim 12 whereby the herbicidal carboxylic acids, particularly 2,4-D, are selective for broadleaf weeds;

(ii) Claim 11 in which the non-target plants or crops are susceptible to herbicidal carboxylic acids, particularly 2,4-D, and again

(iii) Claim 11 in which genetic manipulation and selective breeding may be used to reduce the damage from accidental spray drift;

116. Whilst Dr Wright has not specifically commented on claims 8, 9 and 10 I remain of the view that the subject matter of these claims was also well known before February 2007.

117. In response to Dr Wright's comments that "it was not known how to prepare or use a composition of Claims 1 to 7", I strongly disagree with both these assertions. The preparatory methods used to prepare a reaction product of an herbicidal carboxylic acid and a tetraalkylammonium hydroxide including the three alternative methods provided on page 9 of the opposed Patent Application were certainly well known before February 2007. I have already shown that the disclosures in D1 and D2 each describe a herbicidal composition comprising the reaction product of the quaternary ammonium compound choline hydroxide with 2,4-D, prepared by the second of the three methods described on page 9, line 8 of the opposed Patent Application. I am therefore very surprised by Dr Wright's comments to the contrary.

118. Dr Wright's comments in paragraph 138 also appear to be contradicted by his subsequent comments in paragraph 143 where Dr Wright makes it clear that three alternative methods on page 9 are "preparative examples" and by statements made by Mr. Ouse in paragraphs 41, 58 and 68 of the Ouse Declaration. I also note, most importantly, that claims 1 to 7 do not stipulate a particular method by which the herbicidal composition must be prepared, and it was certainly my (and Mr. Ouse's) understanding that any preparative method to produce the reaction product could be used. Accordingly, I must question the basis of Dr Wright's assertions in this regard.

119. Dr Wright's position that "it was not known how to use a composition of Claims 1 to 7" before February 2007 is also contradicted by the clear teachings in prior art documents D1, D2 and D3. For instance as was made clear in my First Declaration D3, which was published in December 1973, describes the use of a herbicidal composition resulting from mixing a herbicidally active compound such as the 2,4-D acid and a quaternary ammonium salt where the radicals R, $R_1$, $R_2$ and $R_3$ may be a "hydroxy-substituted alkyl" to treat the locus of unwanted vegetation and to prevent injury to neighboring cereal crops. As stated above, in response to Dr

Wright's comments in paragraph 116, D3 describe the nature of the counter ion of the quaternary ammonium anion as including *"the salts formed by the reaction of other bases such as ammonium hydroxide, with the appropriate acids"* (page 2, lines 109 to 113 of D3). D3 clearly encompasses a choline salt of 2,4-D. D3 describes the herbicidal compositions as being *"non-volatile and thus, do not possess a most undesirable characteristic of esters which as previously mentioned has been eliminated their use in certain areas due to the fact that upon volatilization, esters will kill or severely injure adjacent susceptible crops. Tests have shown that the present compositions do not possess this negative feature"*. (page 5, lines 80 to 88) Again I question the basis of Dr Wright's assertions.

120. Dr Wright's comments that "it was not known how to prepare or use a composition of Claims 1 to 7" are also contradicted by other documents that were published well before February 2007. I note that the claims 1 to 7 of the opposed Patent Application encompass a number of herbicidal compositions including the tetramethylammonium salt of 2,4-D (compound 1a in Table 1 on page 10 of the opposed Patent Application). When I consider the teachings in GB 1,056,235 (**PMH-31**) which was published on 25 January 1967 again the basis of Dr Wright's assertions in paragraph 138 are unclear. GB 1,056,235 describes quaternary ammonium salts 4-hydroxybenzonitrile derivatives and their mixtures. Example II on page 4, commencing at line 60 describes mixtures of quaternary ammonium salts of 4-hydroxybenzonitrile derivatives with "a second component" comprising quaternary ammonium salts of "other herbicidally active compounds" including (i) MCPB; (ii) 2,4-D, (iii) MCPA; (iv) CMPP [α-(4-chloro-2-methylphenoxy)propionic acid]; also known as mecroprop; (v) 2,4-DP [α-(2,4-dichlorophenoxy)propionic acid]; also known as dichlorprop; (vi) 2,4,5-T and (vii) 2,4,5-TP. I note that each of these herbicides is recited in the opposed Patent Application at page 3, lines 5 to 15 and that page 5, lines 8 to 20 makes it clear that the compounds of the alleged invention are applied in conjunction with one or more other herbicides "to control a wide variety of undesirable vegetation". This is also consistent with Dr Wright's comments in paragraph 28.

121. The paragraph bridging pages 4 and 5 of GB 1,056,235 describes "the second component" as being used to control "perennial broad-leafed weeds such as Coltsfoot (*Tussilargo farfara*), Creeping Thistle (*Cirsium arvense*), Perennial Sowthistle (*Sonchus arvensis*), field bindweed (*Convolvulus arvensis*) and Docks (*Rumex* spp.). I note that the Dock species *Rumex obtusifolia* was a species used in the efficacy tests of Table II shown in the opposed Patent Application.

122. Example III of GB 1,056,235 identifies the first component, a quaternary ammonium salts of a 4-hydroxybenzonitrile derivative, as the tetramethylammonium salt of 3,5-diiodo-4-hydroxybenzonitile. (also known as ioxynil) and the second component as the tetramethylammonium salt of 2,4-D. Page 5, lines 72 to 86 of GB 1,056,235 describes the tetramethylammonium salt of 2,4-D being prepared by adding a solution of tetramethylammonium chloride (2.8 g.; 0.026 mole) in 20 ml ethanol to a refluxing solution of sodium 2,4-dichlorophenoxyacetic acid (6.2 g.; 0.026 mole) in 200 ml ethanol. After refluxing for 2 hours the reaction mixture was cooled and filtered to remove sodium chloride. Evaporation of ethanol gave the solid tetramethylammonium salt of 2,4-dichlorophenoxyacetic acid (6.7 g) with melting point 212-214$^{o}$C.

123. I note that the third alternative preparative method provided on page 9, lines 13 to 20 describes the samples being prepared by *"combining equimolar amounts of the carboxylic acid herbicide, an N-($(C_1$-$C_{16})$ alkyl or alkylaryl) tri($(C_1$-$C_{16})$ alkyl)ammonium halide and a metal hydroxide in a solvent such as methanol. The product is then isolated by evaporative removal of methanol (and any water present) at room temperature to 50$^{O}$C and removing metal halide salt by selective dissolution in water to provide the compounds of the present invention as liquids or solids"*. The melting point of the tetramethylammonium salt of 2,4-D is reported in Table I as 213-216$^{o}$C "dec".

124. Example II (page 4, line 12 onwards shows how the second component, being a quaternary ammonium salt of phenoxyalkanoic acid will complement the first component, being quaternary ammonium salts of 4-hydroxybenzonitrile derivatives and that the combined use to control the growth of undesirable weeds but without substantial permanent damage adjacent crops (see also

claim 32 of GB1,056,235). Having regard to the above Dr Wright is clearly wrong when he states, "it was not known how to prepare or use a composition of Claims 1 to 7".

## I. OTHER MATTERS - Paragraphs 139 to 150 of the Wright Declaration

125. In response to paragraph 141 I note that Dr Wright has not been asked the correct question. The claim has nothing to do with "reduced volatility" only "*prevention* of injury".

126. In response to Dr Wright's opening statement in paragraph 142 I again restate my earlier comments concerning the claims of the opposed Patent Application. Specifically claim 1 is NOT, as Dr Wright contends, merely directed to a method of "utilising a herbicide composition comprising a reaction product of a herbicidal carboxylic acid and a (tetraalkyl)ammonium hydroxide". Rather and most importantly, claim 1 is directed to a method for "preventing a herbicidal composition that has been administered to a locus of unwanted vegetation from injuring a crop that neighbors the locus and to which the herbicidal composition has not been administered, the method comprising administering to the locus of unwanted vegetation but not to the crop, a herbicidal composition ….".

127. At paragraph 142 Dr Wright states the composition of Claim 1 is described in the opposed Patent Application at page 2, lines 5 to 13 and that this is a clear disclosure to him and, "in his belief, to others in the field". I note that the relevant passage reads, in part:

> "It has now been found that compounds formed by combining a carboxylic acid herbicide with either a tetraalkylammonium or an (alkylary)trialkylammonium hydroxide have herbicidal activity on an acid equivalent basis at least comparable to commercially used carboxylic acid herbicide salts, but with reduced volatility."

128. In response to Dr Wright's assertions I make the following comments:

(a) I refer to my comments above in paragraphs 22 to 24 with respect to the results reported in Table II of the opposed Patent Application. The

herbicidal activity of the so-called inventive compositions being “at least as active as the commercially used herbicidal salts” is simply not shown.

(b) Table III shows that herbicidal compositions 2b and 4a having a % grape injury of 6% and 12% respectively are comparable with the results reported by Mr. Ouse in paragraph 44 of the Ouse Declaration in respect of compositions 2,4-D triethylamine (TEA) and 2,4-D diethylethanolamine (DEEA), being % grape injury of 11% and 10% respectively. Accordingly, these results show that the reaction products of the opposed Patent Application do not achieve an outcome that is any better than or, most importantly, any different to the results obtained for the tertiary amine salts of 2,4-D.

(c) “reduced volatility” does not equate to zero volatility or no injury as required by claim 1. In this regard I reiterate my comments above in paragraph 92. Claim 1 is directed to a method for “preventing injury to a neighboring crop” not “reducing injury”. In this regard I again rely on Table III of the opposed Patent Application which appears shows both an alleged reduction (6% injury–composition 2b; 12% injury–composition 4a) and an alleged prevention (0% injury–composition 1b). I note that the specification does not provide any definition as to what is meant by “reducing” and by “preventing”. The only guidance is Table III.”

(d) Whilst it may be Dr Wright’s view and “belief” as to what others in the field would conclude in relation to the description on page 2, lines 5 to 13, Mr. Ouse does not agree (see paragraphs 24 and 25 of the Ouse Declaration). I note that Mr. Ouse considers that the description at page 2, lines 5 to 9 is “not critical”.

129. In response to paragraph 143 I simply note that Dr Wright makes it clear that the reaction product of a herbicidal carboxylic acid and a (tetraalkyl)ammonium hydroxide can be prepared using the “general method described on page 4, lines 6- 12” and that more detailed information regarding ”preparative examples” are provided on page 9. Dr Wright makes it clear that this is enough information to enable him and “others in the field” to prepare

the herbicidal composition of the invention. I further note that at no point does Dr Wright suggest that the methods of preparing the herbicidal compositions as provided in the opposed Patent Application are of anything other than very routine or that one particular preparative example provided on page 9 is to be preferred over another (this is consistent with Mr. Ouse's comments in paragraph 68 of the Ouse Declaration). I further note that Dr. Wright seems to be saying that the (tetraalkyl)ammonium hydroxide can be substituted with a (tetraalkyl)ammonium halide as shown on page 9 to form the reaction product. This is also consistent with Mr. Ouse's evidence (see paragraphs 41 and 68 of the Ouse Declaration).

130. I disagree with Dr Wright's suggestion in paragraph 144 that claim 1 is in any way directed to "a method of how to apply the composition to unwanted vegetation". As already stated Claim 1 defines "a method for preventing a herbicidal composition that has been administered to a locus of unwanted vegetation from injuring a crop that neighbors the locus and to which the herbicidal composition has not been administered …". That is the claim is directed to a method for preventing injury to a neighboring crop after the herbicidal composition has already been administered. Accordingly, Dr Wright's references in paragraph 144 to page 8, lines 16 to 19, the example on pages 10 and 11 as well as the application rates and concentration ranges on pages 5 and 8 respectively are simply not relevant to achieving the method of claim 1. In addition, as stated in paragraph 126 of my First Declaration, Table III shows that when herbicidal compositions 2b and 4a, which fall within the scope of claims 1 to 12, were used there was measurable visible injury/damage to the sensitive grape crops of 6% and 12% respectively. Thus, the most relevant data in the opposed Patent Application shows that at least two of the compositions tested being 2b and 4a, which fall within the scope of claim 1, do not achieve prevention of injury i.e. 0% injury as required by the claims. I remain of the view that the specification does not provide me with enough information to perform the method and to achieve the requirement of preventing the herbicidal composition from damaging or injuring a neighboring sensitive crop i.e. 0% injury and there is nothing that Dr

Wright has put forward in paragraph 144 to change my view. My comments here equally apply to Dr Wright's assertion in paragraph 145.

131. In response to paragraph 146 I note that Dr Wright makes it clear that "prevention of injury" is assessed by "a visual injury assessment on a scale of 0-100% as compared to untreated control plants (page 12)" and that these are "not plant-specific methods and can be utilised for assessing other compositions that are utilized in the claimed method." As already stated the relevant data in Table III shows that at two out of the three so-called inventive compositions showed a measurable visible injury/damage to the sensitive grape crops of 6% and 12% respectively and not prevention of injury as required by claim 1. I therefore do not accept that the opposed Patent Application provides me with enough information to assess all the compositions which fall within the scope of claim 1 and to have any confidence that the requirement for preventing the herbicidal composition, that has already been administered to a locus of unwanted vegetation, from injuring a neighboring sensitive crop i.e. 0% injury is achievable. I stand by my comments in paragraphs 142 and 143 of my First Declaration and there is simply nothing that Dr Wright has put forward in paragraph 146 to change my view.

132. In paragraph 147 Dr Wright states that he would expect herbicidal carboxylic acids within the scope of claim 1 of the opposed Patent Application to exhibit reduced volatility compared to commercially used carboxylic acid herbicidal salts and "prevent injury to nearby sensitive crops". However as already stated prevention of injury to neighboring crops is not reflected in the results reported in Table III or in the results of the new experiment reported by Mr. Ouse in paragraph 47 of the Ouse Declaration. As stated Table III showed that when herbicidal compositions 2b and 4a were used there was visible and measurable injury to the sensitive grape crops 7 days after the exposure to the vapours of those compositions. The injury was in fact measured at 6% and 12% respectively. I further note that the additional data provided by Mr. Ouse in paragraph 44 of the Ouse Declaration showed prior art compositions 2,4-D triethylamine (TEA) and 2,4-D diethylethanolamine (DEEA) having a %

grape injury of 11% and 10% respectively. In respect of the data reported by Mr. Ouse in paragraph 47 the results show that triclopyr/choline hydroxide (composition 2e of the opposed Patent Application) caused visible and measurable injury to the sensitive tomato crop after Day 1 (3%) and Day 7 (2%) and visible and measurable injury to the sensitive grape crop after Day 1 (1%). Accordingly, there is simply no basis upon which Dr Wright can reach the conclusion that he has in paragraph 147. My comments here equally apply to Dr Wright's assertions in paragraphs 149 and 150.

133. I also note that in paragraph 147 that Dr Wright has not been asked the correct question. The claims of the opposed Patent Application are directed to "prevention of injury" not "reduced volatility".

134. In response to Dr Wright's comments in paragraph 150, I again state that claim 1 of the opposed Patent Application is directed to "prevention of injury to a neighboring crop after the herbicidal composition has already been administered" not whether the "herbicidal carboxylic acids" exhibit herbicidal activity and reduced volatility.

**I make this declaration conscientiously believing the statements contained in this declaration to be true and correct.**

Declared at Laverton North

this 20th day of September 2018

Phillip Hay

(Signature of person making declaration)