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9 June 2020

Opposition - Dismissal

Arcadia Intellectual Property
L 2
420 Collins St
Melbourne VIC 3000
Australia

Your reference	AR/G100044P
Application number	2017261483
Applicant name	Dow AgroSciences, LLC
Opponent	Nufarm Australia Limited

Dear Sir/Madam,

We acknowledge a request from the applicant for dismissal of the above opposition matter on 28 May 2020.

A copy of the request is attached for the opponent.

The opponent is provided **one (1) week** from the date of this letter to make any submissions in rebuttal.

Yours sincerely,

Belinda Sillis
Oppositions and Hearings
Phone: (02) 6283 2455

28 May 2020

The Commissioner of Patents
IP Australia

FPA ref: M53055640:KAB:EV:sw
Principal: Karen Bentley PhD
By email

Dear Commissioner

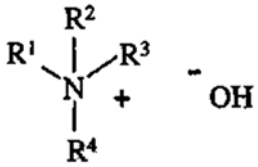
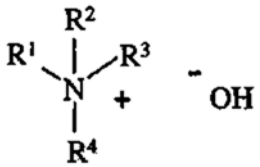
Dow AgroSciences, LLC
Australian patent application no 2017261483
Compounds derived from herbicidal carboxylic acids and tetraalkylammonium or (arylalkyl) trialkylammonium hydroxides
and
Opposition by Nufarm Australia Limited

The Applicant requests the Commissioner exercise her discretionary powers under Regulation 22.22 of The Patent Regulations to dismiss the above mentioned opposition in full. In the alternative, dismissal of grounds already resolved in the Applicant's favour in the opposition to the parent application, AU2016202508, is requested.

Background to these proceedings

The current application is a divisional of granted patent AU2016202508. This patent proceeded to grant after an opposition filed by Nufarm was wholly unsuccessful. See decision dated 31 January 2020. The only difference between the allowed claims of this application and those the Commissioner has already deemed patentable is the final step (herein "the isolation step").

AU2016202508	AU2017261483
1. An herbicidal compound comprising the reaction product produced by the process of combining: 2,4-dichlorophenoxyacetic acid; and a (tetraalkyl) ammonium hydroxide; in which the (tetraalkyl)ammonium hydroxide is a compound of the formula	1. A herbicidal compound comprising the reaction product produced by the process of combining 2,4-dichlorophenoxyacetic acid; and a (tetraalkyl) ammonium hydroxide; in which the (tetraalkyl)ammonium hydroxide is a compound of the formula

	
wherein when R^1, R^2 and R^3 are methyl, R^4 is not methyl; and - isolating the reaction product, thereby producing the herbicidal compound.	wherein when R^1, R^2 and R^3 are methyl, R^4 is not methyl.

Relevant general principles

An opposition (or ground thereof) need not be "clearly untenable" or "manifestly groundless" in order for it to be dismissed. Rather, an opposition (or ground thereof) may be dismissed if it is considered to have no reasonable prospects of success.

It is submitted that the opposition has no reasonable prospects of success given:

- The evidence filed by the Opponent is substantially the same; and
- The grounds being relied upon are the same and the alleged issues are substantially the same; and
- The Commissioner has already decided those very same issues and confirmed that those grounds were not successful.

Accordingly, one does not even have to speculate on the “prospects” of this opposition being successful or conduct an in-depth consideration of the substantive opposition. The Commissioner herself, by virtue of the hearing decision on AU2016202508, has already confirmed that these grounds will not be successful.

Basis for the dismissal request

The Opponent’s evidence in support is substantially the same as that already filed on AU2016202508, and is largely unrelated to the isolation step. Being the only difference between the opposition already decided in the Applicant’s favour. This can be clearly seen by the attached copy of the Opponent’s evidence in support, being a declaration by Nufarm employee Phillip Maxwell Hay. The Applicant has highlighted the main sections of the evidence, which are additional to what was filed by Mr Hay in the AU2016202508 opposition. There is very little if any ‘new’ evidence. Rather, Mr Hay has just expanded on his previous evidence.

Not only has Mr Hay had the benefit of having considered the exact same issues in depth during the AU2016202508 opposition, but this time he also has the benefit of the Commissioner’s opinion and decision in respect of those exact same issues.

It is submitted that the Opponent should not be given the opportunity to agitate issues the Commissioner has already decided. Nor should they be given a “second chance” to run the same opposition again particularly with the benefit of the Commissioner’s decision. If the Opponent was unhappy with the Commissioner’s decision and reasons then the correct course of action was an appeal. To agitate the exact same issues again, is vexatious and a waste of the Applicant’s and the Commissioner’s time and resources.

Timing of the dismissal application

The deadline for filing a request for dismissal under regulation 5.17(1) is within one month from the day the Commissioner gives the applicant a copy of the statement of grounds and particulars. This would have been 28 February 2020. In the normal course of proceedings, the

Applicant would have known by then that the Commissioner had dismissed the opposition to AU2016202508 in its entirety and would have sought dismissal in accordance with regulation 5.17(1). However due to an error by the Commissioner in notifying the parties of the decision, the Applicant was not in a position to file a request in time.

Accordingly, if the Commissioner is not inclined to consider the dismissal application under Regulation 22.22, in the alternative, the Applicant seeks an extension of time in order to file the dismissal request under regulation 5.17(1).

Yours sincerely

Karen Bentley PhD
Principal
FPA Patent Attorneys Pty Ltd

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

IN THE MATTER of Australian Patent Application 2017261483 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 am the Coordinator Health and Environmental Sciences for the Nufarm corporate group. The Nufarm corporate group includes the companies Nufarm Limited and Nufarm Australia Limited ("**Nufarm**").

2. I have previously made Declarations in respect of related proceedings including Australian Patent Application 2016202508, Australian Patent Application 2016203677 and Australian Patent Application 2008219657 ("**my earlier Declarations**"). My comments concerning common general knowledge has not changed since making my earlier Declarations.

MY EXPERIENCE

3. I hold the degree of Bachelor of Applied Science in Applied Chemistry, which was conferred on me by the Tasmanian College of Advanced Education in 1980. I was also awarded a Graduate Diploma in Agribusiness from Monash University in 1991.

4. Between 1983 and 1987 I was employed by Dow Chemical Australia Ltd as a Research Chemist. In that role I was responsible for technical service and development of styrene-butadiene latex for use in the paper industry, throughout the Pacific region including New Zealand, Indonesia and China.

5. In 1988 I commenced work at Nufarm as a Development Chemist, reporting to the Chief Chemist. I was responsible for the development of agricultural adjuvants and industrial chemicals from laboratory synthesis through to production and market support in this role.

6. In 1994 I was appointed the Formulation Development Manager at Nufarm and I held that position until June 2003. In this role I was responsible for the development of new agricultural chemical formulations, including formulations comprising 2,4-dichlorophenoxyacetic acid ("**2,4-D**") and other phenoxyalkanoic acid herbicides. Aspects of this role included formulation of new agricultural chemicals and undertaking physical and chemical property studies of various chemicals to support registration of products. I also supervised two Senior Development Chemists working on formulation development and physical property studies in the laboratory at Nufarm.

7. In June 2003 I was appointed to my current role. My role involves coordinating health and environmental science matters at Nufarm. In particular, I am responsible for preparing and reviewing material safety data sheets and determining the dangerous goods classification of chemicals for Nufarm's Australian operation, as well as providing advice on the effect of chemicals on health and the environment. For example I provided advice and input on Nufarm's response to the Australian Pesticides & Veterinary Medicines Authority's ("**APVMA**") review of the environmental risks associated with all forms of 2,4-D (acid, salts and esters) and its refined environmental risk assessment of high volatile esters 2,4-D ethyl ester, 2,4-D butyl esters, 2,4-D isobutyl esters conducted in 2005/2006. The preliminary findings were published as a Report entitled *"The reconsideration of approvals of the active constituent 2,4-D, registrations of products containing 2,4-D and their associated labels."* Preliminary Review Findings (Environment) Part 1: 2,4-D Esters in April 2006 ("**the APVMA 2006 Preliminary Review Findings**").

8. Between 2008 and 2015 I conducted a series of 14 studies on the volatility of esters and salts of 2,4-D. In these studies, 2,4-D, as either a salt or ester, was applied to a test plot in the open air. The concentration of 2,4-D in air was measured at the centre of the locus of application at discrete time intervals up

to 24 hours post application. The studies on 2,4-D ester were conducted to address issues concerning the use of esters of 2,4-D raised by the APVMA 2006 Preliminary Review Findings.

9. Since joining Nufarm as a Development Chemist in 1988 I have been involved in the development of new agricultural chemical formulations including extensive physical and chemical property studies, developing the manufacturing processes for such formulations and the associated field trials of the products which are required to support registration of products in both Australia and overseas. In particular, I have had extensive experience with various types of agricultural formulations used for controlling weeds or unwanted vegetation and preventing injury to neighbouring sensitive crops including, but not limited to:

   (a) glyphosate-based herbicides;

   (b) herbicides of the phenoxy acid family including 2,4-D; 2-methyl-4-chlorophenoxyacetic acid or MCPA and 4-(2,4-dichlorophenoxy) butyric acid or 2,4-DB and salts and esters of herbicides of the phenoxy acid family;

   (c) paraquat herbicides;

   (d) dinitroaniline herbicides such as trifluralin; and

   (e) herbicides of the pyridine family such as triclopyr.

10. I am named as an inventor on four patents relating to herbicidal compositions:

   (a) Australian Patent No. 674464: *"Herbicidal composition containing glyphosate and a C_1-C_6 alkyl ammonium sulphate"*;

   (b) Australian Petty Patent No. 725067: *"Herbicidal composition and adjuvants"*;

   (c) Australian Patent No. 2002325065: *"Glyphosate Composition"*; and

   (d) Australian Innovation Patent No. 2004100006: *"Herbicidal Composition"*.

11. Since about 1994, I have regularly carried out searches for information on herbicides, including 2,4-D in journals such as *Pest Management Science* (this journal was known as *Pesticide Science* prior to 2000), *Weed Science, Weed Technology and Weed Research* as well as patents and patent applications filed by third parties such as "Dow AgroSciences", "Bayer Crop Science (ex Aventis)", "Syngenta", BASF and "Monsanto" because these companies are known as being very commercially active in the field of herbicides including 2,4-D formulations. As a result of my regular contact with colleagues over the years I am aware that they too carry out regular searches using both general and specialised databases to locate relevant references.

12. Throughout my career and since joining Nufarm I have often referred to a number of well-known reference materials for information on herbicides, including 2,4-D, such as:

    (a) *"The Phenoxyalkanoic Herbicides"* by S. Qhue Hee and R Sutherland, CRC Press, Boca Raton (Florida) 1981.

    (b) *"The Pesticide Manual"* a Crop Protection publication produced by the British Crop Protection Council and the Royal Society of Chemistry (multiple editions).

    (c) *"Infopest: the complete reference of Australian registered agricultural and veterinary (Agvet) chemicals and their uses"*, formerly published by The Department of Primary Industries, Queensland Government, in March, July and November of each year, now a database regularly updated, owned and managed by Growcom, the peak industry body for the Queensland production horticulture industry.

    (d) *"Australian Weed Control Handbook"* edited by JM Parsons and published by Reed International Books Australia (1995).

    From my discussions with various colleagues over the years I also understand the above references were well known and often referred to by others working on the development of herbicides in Australia.

13. I am a member of the Royal Australian Chemical Institute.

14. In the period 2005 and 2006 I was involved in the APVMA's assessment of the risks associated with all forms of 2,4-D and between 2006 and 2013 I coordinated Nufarm's technical response to the APVMA 2006 Preliminary Review Findings requiring the suspension of high volatile esters of 2,4-D. This involved designing and conducting a series of studies over the period 2008 to 2015 referred to in paragraph 7 to measure:

    (a) atmospheric 2,4-D ester concentration resulting from commercial application over a wide area of Western Australia,

    (b) the volatility of 2,4-D ester and 2,4-D dimethylamine and choline salts applied to large scale test plots using micrometeorological techniques, and

    (c) the effect of 2,4-D ester and dimethylamine on a sensitive plants species.

15. Now produced and shown to me and marked **PMH-1** is a copy of my curriculum vitae.

MY INSTRUCTIONS

16. I have been informed by Arcadia Intellectual Property, patent attorneys acting on behalf of Nufarm, that this proceeding concerns Australian Patent Application 2017261483 ("**the opposed Patent Application**"). The abstract of the opposed Patent Application states that the alleged invention is directed to compounds formed by combining a carboxylic acid herbicide with N-((C_1-C_{16}) alkyl or arylalkyl) tri(C_1-C_{16})alkyl)ammonium hydroxide having herbicidal activity on an acid equivalent basis at least as active as the commercially used carboxylic acid herbicide salts, but are less volatile.

17. I have been requested by Arcadia Intellectual Property to provide this Declaration for the purpose of this proceeding. In so doing I have been provided with a copy of the Expert Evidence Practice Note as issued by Chief Justice Allsop of the Federal Court of Australia on 25 October 2016 (**the Practice Note**). I have read Annexure A to the Practice Note titled "*Harmonised Expert Witness Code of Conduct*" (**the Code**) which applies to any expert witness engaged or appointed to give opinion evidence in

proceedings. Now produced and shown to me and marked **PMH-2** is a copy of the Code.

18. I have been informed by Arcadia Intellectual Property that the opposed Patent Application was filed on 14 November 2017. I am informed by Arcadia Intellectual Property that the opposed Patent Application is said to be a divisional of Australian Patent Application No 2016202508 filed on 20 April 2016, which in turn is said to be a divisional of Australian Patent Application No. 2015200368 filed on 27 January 2015, which in turn is said to be a divisional of Australian Patent Application No. 2013203406 filed on 10 April 2013, which in turn is said to be a divisional of Australian Patent Application No. 2008219657 filed on 26 February 2008, which is said to be based on International Patent Application No. PCT/US2008/002488 filed on 26 February 2008, which in turn is said to claim priority from USSN 60/903,417 filed on 26 February 2007. I am further informed that a copy of opposed Patent Application as filed on 14 November 2017 is identified as **D39** in the Statement of Grounds & Particulars; Australian Patent Application 2016202508 as filed on 20 April 2016 is identified as **D40**; Australian Patent Application 2015200368 is identified as **D41**; Australian Patent Application 2013203406 is identified as **D42**; Australian Patent Application 2008219657 is identified as **D43**; International Patent Application PCT/US2008/002488 as published on 4 September 2008 as WO2008106107 is identified as **D44** and a copy of USSN 60/903,417 as filed on 26 February 2007 is identified as **D45**.

19. I have been further informed that the claims of the opposed Patent Application were amended on 17 December 2018 and that these amendments were incorporated into the opposed Patent Application at acceptance which I am informed occurred on 5 July 2019. Now produced and shown to me and marked "**PMH-3**" is a copy of the amendments filed on 17 December 2018.

20. I have been asked by Arcadia Intellectual Property to describe:

    (a) the state of the knowledge in Australia as at 26 February 2007 being the so-called earliest priority date of the opposed Patent Application in relation to herbicidal carboxylic acids such as 2,4-D; and

(b) what I would have done if I was asked to address the volatility issue of the herbicidal carboxylic acid 2,4-D so that its use would not damage nearby sensitive crops while maintaining an acceptable level of the herbicidal activity in controlling unwanted vegetation. In undertaking such a task I have been asked to use the knowledge that was part of my working knowledge and experience at the particular date in question.

21. Arcadia Intellectual Property has provided me with copies of the documents set out in the Schedule of Documents that accompanied the Statement of Grounds & Particulars dated 28 January 2020. Now produced and shown to me and marked "**PMH-4**" is a copy of the Schedule of Documents dated 28 January 2020 ("**the Schedule**"). I have been requested to comment on what I understand is described in a number of the documents referred to in the Schedule and these comments are set out in this Declaration. My decision not to comment on all of the documents should not be taken as an indication that I do not regard them to be of relevance to the alleged invention as claimed in the opposed Patent Application. In this regard publications and other documents to which I refer to in this Declaration and which are identified by the designation "D-[numbered]" are annexed to the Schedule.

THE STATE OF KNOWLEDGE AT OR BEFORE 26 FEBRUARY 2007

22. I have been asked to provide the state of the knowledge in Australia as at 26 February 2007 in relation to herbicidal carboxylic acids, more particularly 2,4-D. In undertaking this task, I have been informed to use only the knowledge that was part of my working knowledge and experience as at 26 February 2007 and no knowledge that I acquired after that time. My working knowledge and experience is as a result of my work at Dow Chemical Australia in the early 1980's as a research chemist and at Nufarm as a Development Chemist in the 1980's, as a Formulation Development Manager in the mid 1990's and as the Coordinator Health and Environmental Sciences which role I have held since June 2003. It also includes the advice and input I provided to the APVMA on behalf of Nufarm in respect of the Department's review of the environmental risks associated with all forms of 2,4-D (acid, salts and esters) in 2005/2006.

23. As a result of my ongoing interaction with other formulators working in the herbicidal field, I am aware that the following matters were also generally known by my colleagues in the industry well before 26 February 2007.

Herbicides

24. Herbicides, also commonly known as weedkillers, are chemical substances that are commonly used to control unwanted plants in crops, pasture or non-crop situations such as roadsides or recreational areas e.g. parklands. They have played a critical role in integrated weed management programmes and have been in widespread use worldwide since the late 1940s.

25. There are eight types of herbicides and they may be categorised according to their mode-of-action (MOA) (a herbicide may have more than one mode of action):

    a. Translocated herbicides which move to the site of action via the transport mechanisms within the plant; the xylem and phloem. The xylem transports water and nutrients from the soil to growth sites and the phloem transports products of photosynthesis (for instance, sugars) to growth and storage sites. It may take up to two weeks for symptoms to develop on the target weeds depending on herbicide rate, conditions and species.

    b. Contact herbicides which have limited movement within the plant, so complete coverage of the target is critical. Compared to translocated herbicides (for example, glyphosate), contact herbicides (for example, paraquat, oxyfluorfen, diquat and bromoxynil) tend to show symptoms rapidly, usually within 24 hours.

    c. Selective herbicides which will kill the target weeds and not desired plants (the crop or pasture) when applied at a specified application rate.

    d. Non-selective herbicides (also called knockdown herbicides or total weedkillers) such as glyphosate or paraquat will damage most plants with which they come into contact.

e. Residual herbicides which remain active in the soil for an extended period of time (months) and can act on successive weed germinations.

f. Non-residual herbicides, such as the non-selective paraquat and glyphosate, which have little or no soil activity and are quickly deactivated in the soil. They are either broken down or bound to soil particles, becoming less available to growing plants. They also may have little or no ability to be absorbed by roots.

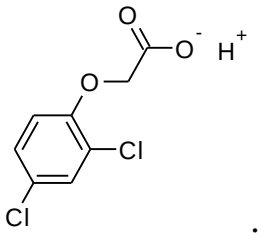
g. Post-emergent and pre-emergent are terms that refer to the target and timing of herbicide application. Post-emergent refers to foliar application of the herbicide after the target weeds have emerged from the soil, while pre-emergent refers to application of the herbicide to the soil before the weeds have emerged.

h. Herbicide mixtures and sequential applications involve the application of more than one herbicide, usually to increase the spectrum of weed species controlled but also for resistance management. A mixture involves the application of multiple products in a single application. Where herbicides are antagonistic and cannot be mixed together in a single tank, they are applied sequentially.

26. Of the types listed above the selective post-emergent herbicides such as 2,4-dichlorophenoxyacetic acid, dicamba and pyridinecarboxlyic acid (picloram) were the first herbicides to be developed. These particular herbicides were known to control weeds that emerged upon the establishment of the particular crop or pasture and could be applied with little damage over the top of the crop or pasture.

2,4-Dichlorophenoxyacetic acid (2,4-D)

27. Phenoxy herbicides have been commercially available for over 60 years and are the most widely used family of herbicides worldwide for the control of broadleaf and grass weeds. 2,4-Dichlorophenoxyacetic acid (2,4-D) is the most common of the phenoxy herbicides, and is one of the most-studied agricultural chemicals and has the following structure:



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28. The herbicidal properties of 2,4-D were first identified by a US Government research program during World War II and commercial sales of the herbicide commenced in about 1945. Its development triggered a worldwide revolution in agricultural output and 2,4-D became the first successful selective herbicide. It allowed for greatly enhanced weed control in crops such as wheat, maize (corn), rice and similar cereal grass crops, because it was found to kill dicots (broadleaf plants), but not most monocots (grasses). In 2006 the consulting firm Phillips McDougall reported the estimated global sales of 2,4-D at USD 325 million.

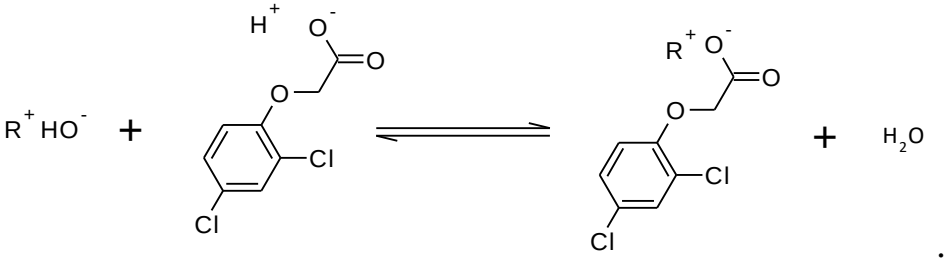
29. It was widely known before February 2007 both in Australia and abroad that products containing 2,4-D could be used to selectively control broadleaf and grass weeds in an extensive range of crops and non-cropping situations. Major agricultural uses of the phenoxy herbicide included pasture, stubble and fallow maintenance, cereal crops (including wheat, oats, barley, rye, triticale) and grain crops (including sorghum, millet, maize) as well as cotton, citrus crops (particularly to inhibit post-harvest abscission of buttons), sugar cane/beet, sweetcorn, peanuts and control of banana suckers. 2,4-D was used extensively for weed control in non-cropping situations, including commercial and industrial areas, turf and aquatic areas. Aerial spraying, handheld and the more traditional on-ground method of application were techniques commonly employed before February 2007 to control weeds in agricultural and non-agricultural situations. It was widely known that the application technique employed was dependant on the size of the infestation, the available resources, access and personal preferences.

Modifying the chemical structure of 2,4-D into a useful product

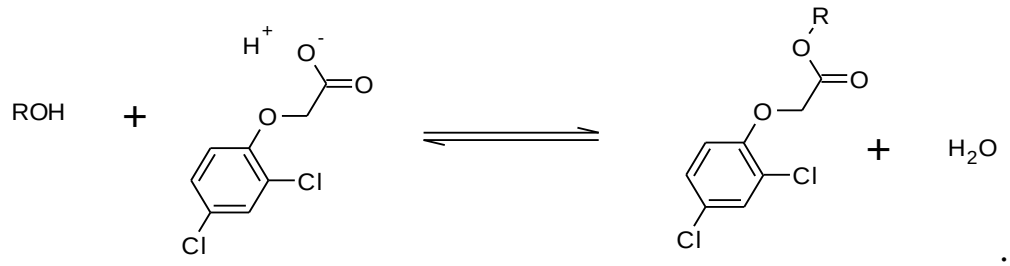
30. It was known before February 2007 for 2,4-D to be made in the free acid form as this allowed a manufacturer to prepare the "end use" composition in the desired form whether that is the ester or salt form to make it a more useful product for the end user.

31. In their acid form, phenoxy herbicides are solids. As their solubility is relatively low (about 23 g/L at pH 7) they cannot readily penetrate plant leaves and they are therefore of little use in that particular form. To increase the water miscibility of 2,4-D, manufacturers commonly used two approaches.

32. In the first approach 2,4-D acid was neutralised with a base, to form a water soluble salt, which is readily dilutable with water. The overall reaction for a hydroxide salt is:



33. In the second approach, the 2,4-D acid was reacted with an alcohol to form an ester of 2,4-D. Such esters are dissolved in an organic solvent together with surfactants selected to spontaneously form an oil-in-water emulsion of the 2,4-D ester and solvent on addition of water:



34. Both approaches were in common use in Australia before February 2007 for the formulation of 2,4-D as well as other phenoxy herbicides such as 2-methyl-4-chlorophenoxyacetic acid ("MCPA"). The Farmnote publication

entitled *"Organic acid herbicides: volatility and side reactions"* by T. Piper *Farmnote* 47/97 (12 March 1998) (**D5** to the Schedule) provides a useful summary of the chemistry associated with the formulation of esters of 2,4-D and MCPA.

Volatility of 2,4-D ester formulations

35. It was well known in Australia before February 2007 that the ethyl, isopropyl and butyl ester forms (collectively known as high volatile esters or "**HVE**") of 2,4-D were highly volatile. Certainly, this was understood and in fact was being closely monitored by various internationals groups such as the World Health Organisation ("**WHO**") and key local authorities including the APVMA and the Agriculture Departments of various State Governments in Australia. In its report entitled "*Environmental Aspects - 2,4-Dichlorophenoxyacetic acid (2,4-D)"* Environmental Health Criteria 84 published in 1989 (**D6** to the Schedule) the WHO made it clear that the volatility of 2,4-D esters was an issue which needed to be urgently addressed as it influenced *"the effectiveness of their application to target crops, their effects on neighbouring crops, and the degree of contamination of the atmosphere"*. This publication followed an earlier report published by the WHO on 2,4-D in 1984 and was the culmination of a meeting of the WHO Task Group in the United Kingdom in 1987. This Group was given the task of revising the draft criteria and to evaluate the risks to the environment from the exposure to 2,4-D.

36. The Farmnote article published by NSW Agricultural Department (**D5** to the Schedule) also recognised that volatility of the 2,4-D esters and highlighted the increased potential for off-target damage to crops such as tomatoes, cotton, sunflowers, soybeans and grapes when the ester forms of phenoxy herbicides were used. In 1998 the Department called on users of these herbicides to be *"extra careful to prevent off-target movement"* to neighbouring crops and sensitive areas and made it clear that there was a "*moral and legal responsibility* [on users] *to prevent it"* from occurring.

37. Likewise, in its 2006 Preliminary Review Findings report published the APVMA highlighted the environmental risks associated with the high volatility of 2,4-D esters and the need for a strengthening of the management

surrounding spray drift. In fact as an interim measure and pending the completion of its review, the APVMA in consultation with State and Territory authorities developed additional instructions to be included on all 2,4-D labels by 30 November 2005 including *inter alia* that the 2,4-D products can *"cause severe damage to susceptible crops such as cotton, grapes, tomatoes, oilseed crops and ornamentals"* and that there be a restriction on the use of such products in circumstances where the wind speed was more than 15km/hour as measured at the application site (pages 9 and 21 of the APVMA 2006 Preliminary Review Findings Report). A copy of the APVMA 2006 Preliminary Review Findings Report is **D29** to the Schedule. As noted above I provided input and advice to the APVMA in 2005/2006 on behalf of Nufarm in respect of the Department's review of the environmental risks associated with all forms of 2,4-D (acid, salts and esters).

38. Accordingly, the volatility problems associated with the ester form of 2,4-D were widely known in Australia before February 2007. The recognition that phenoxy herbicides could be used to control unwanted vegetation was well known and extra care was needed to prevent off-target movement to sensitive plants growing nearby was also widely known in Australia before February 2007.

Spray Drift

39. It was well understood before February 2007 that sprayed herbicides can drift as "droplets", as "vapours" and/or as "particles".

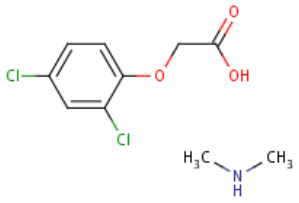
40. The "*Australian Weed Control Handbook*" 10th Edition edited by JM Parsons and published by Reed International Books Australia (1995) describes how both spray drift, which occurs when droplets of spray are blown away by the wind, and vapour drift, which occurs when a herbicide vaporises into the air from a plant surface or soil, may cause damage to susceptible plants at some distance from the locus of application. A copy of page 17 of the "*Australian Weed Control Handbook*" is **D30** to the Schedule.

41. The Agnote published in 2004 (**D7** to the Schedule) describes "droplet drift" as being the most common cause of off-target damage to nearby crops and

"vapour drift" as being confined to volatile herbicides such as 2,4-D ester. This document makes it clear that it was certainly well known before February 2007 that vapours could arise directly from the spray or evaporation of herbicide from sprayed surfaces and that use of 2,4-D esters under certain conditions e.g. in the summer months was shown to lead to vapour drift damage of highly susceptible crops. D7 describes very small quantities of drifting herbicide causing severe damage to highly sensitive plants and in many instances several hours after the herbicide has been applied. In this regard I refer to an article by Nice G. et al entitled *"Amine or Ester, Which is Better?"* Weed Science Purdue Extension 25 May 2004. This paper makes it clear that herbicides with 2,4-D are implicated in noticeable drift situations partly due to *"the fact that many broadleaf plants can be sensitive to 2,4-D, even at low rates. Such sensitive broadleaf plants include, but are not limited to, soybeans, tomatoes, grapes, and maples*." Characteristic symptoms of 2,4-D drift are described in the Nice article as *"leaf puckering and strapping (Figure 2)"*. A copy of the Nice article is **D31** to the Schedule.

Alternative salt forms of 2,4-D

42. The conversion to a water soluble salt such as the 2,4-D dimethylamine salt (shown below), 2,4-D isopropylamine salt, 2,4-D triisopropanolamine salt and 2,4-D diethanolamine salt was well known before February 2007. Table 1 of the Agnote published in 2004 (**D7** to the Schedule) sets out various amine salt forms of 2,4-D that were widely available in the marketplace in Australia in February 2004. This Table clearly shows that the amine salt form of 2,4-D was known to be less volatile than the 2,4-D esters and that conversion to an amine salt form was certainly one way the volatility issue could be managed. In fact, "Australian Weed Control Handbook" 10th Edition (1995) reported that amine formulations and those esters that have long side chains, such as butoxy-ethanols, as being less susceptible to vapour drift than ethyl esters (see **D30** to the Schedule):



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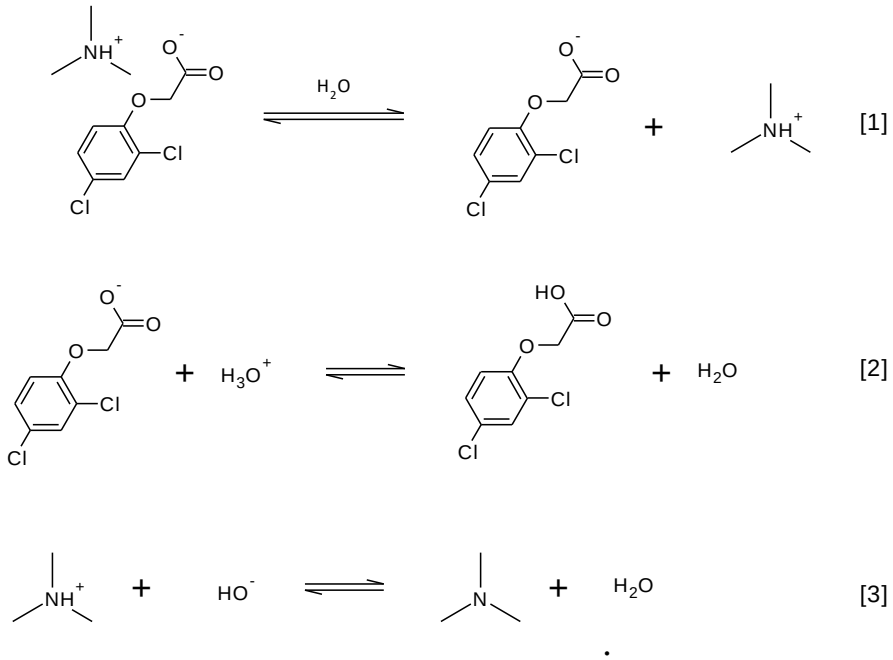
43. However it was well known before February 2007 that dimethylamine salt of 2,4-D would dissociate rapidly to form the dimethylammonium ion and the conjugate base of 2,4-D (see Table 1 in the Farmnote publication (**D5** to the Schedule)) and that increased volatilisation of 2,4-D was known to be linked with the loss of dimethylamine base from a spray solution:



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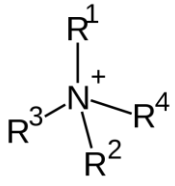
44. It was also known before February 2007 that the volatilisation of dimethylamine from dilute aqueous compositions of 2,4-D caused a strong ammonia-like odour of dimethylamine to be released into the atmosphere, was clearly an additional problem associated with this amine formulation. For this reason I, and my colleagues, were very reluctant to use the dimethylamine base. I looked at alternative bases which were less volatile than the ester formulation and that had a reduced propensity to evaporate from solution and therefore less likely to release any odour. Certainly, this was our focus at Nufarm in the early 1980s. In fact, low odour formulations of 2,4-D using the

non-volatile bases of diethanolamine and triethanolamine were produced and sold by Nufarm in the early 1980s under the Trade names Nufarm AMICIDE LO*-500A (**D15** to the Schedule) and Nufarm AMICIDE 625-Low Selective Herbicide (**D16** to the Schedule) respectively. Nufarm AMICIDE 625-Low Selective Herbicide was first registered in October 2002. The labels for both products prominently show that they are low odour formulations.

45. It was known to me and I believe others working in the field before February 2007 that the need to minimise the spray drift could not be to the detriment of the effectiveness of the herbicide in controlling unwanted vegetation. As noted in the Agnote (**D7** to the Schedule) this was the principal objective when applying the herbicides.

46. It was certainly an established chemical principle before February 2007 that volatility decreases with increasing molecular weight. In fact, Nufarm's low odour low odour formulations of AMICIDE LO*-500A (**D15** to the Schedule) and AMICIDE 625-Low Selective Herbicide (**D16** to the Schedule) are examples of this principle. As quaternary ammonium salts have higher molecular weights than primary, secondary or even tertiary amine salts, it is clear to me and it would have been clear to others working in the field in February 2007, that the volatility of 2,4-D salts could be reduced by using quaternary ammonium compounds.

47. Quaternary ammonium compounds such as tetramethylammonium hydroxide, tetramethylammonium acetate, tetramethylsulfonium hydroxide and trimethylanilinium hydroxide were readily available before February 2007 as the major component in disinfectants, surfactants, fabric softeners and as antistatic agents (e.g. in shampoos):



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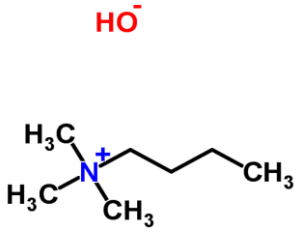
48. Other examples of quaternary ammonium compounds commercially available before February 2007 include octyltrimethylammonium hydroxide (aka

trimethyloctylammonium hydroxide), dodecyltrimethylammonium hydroxide, benzyltrimethylammonium hydroxide (aka Triton B), cetyltrimethylammonium hydroxide (aka hexadecyltrimethylammonium hydroxide), octyldimethylbenzylammonium hydroxide, decyldimethylbenzylammonium hydroxide, stearyldimethylbenzylammonium hydroxide, didodecyldimethylammonium hydroxide and dioctadecyldimethylammonium hydroxide as well as hydroxy-N,N,N-trimethylethanaminium hydroxide (aka choline hydroxide). Choline hydroxide is a basic constituent of lecithin which is found in many plants and animal organs. It is important as a precursor of acetylcholine, as a methyl donor in various metabolic processes and in lipid **D9** to the Schedule).

49. The synthesis and properties of quaternary ammonium compounds were also well known and understood before February 2007. An extract from an elementary organic chemistry text from M.F. Grundon and H.B. Henbest 5th Edition (1971) is **D32** to the Schedule. This extract shows the synthesis of the tetraalkylammonium halides and the conversion into the corresponding base. The example shown is butyltrimethylammonium hydroxide with the structure provided below. This extract also shows that it was well known before February 2007 that quaternary ammonium hydroxides are comparable in base strength to sodium hydroxide (NaOH). The extract from Kirk-Othmer Encyclopaedia of Chemical Technology 4th Ed – (**D9** to the Schedule) states that choline hydroxide has a pH of approximately 14 and I am aware that tetramethylammonium hydroxide, 25% (aqueous solution) has a pH of greater than 13:



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50. With a base strength that is comparable to sodium hydroxide it is clear to me that quaternary ammonium hydroxides would be able to readily react with

carboxylic acids, including herbicidal carboxylic acids to form salts in the same way sodium hydroxide reacts with carboxylic acids.

51. Therefore, to reduce volatility it would have been simply a matter of preparing and assessing a series of 2,4-D salts with amines of different molecular weights. This would have involved very routine laboratory techniques. The amines would be selected from primary, secondary, tertiary and quaternary amines, as 2,4-D salts with primary, secondary, tertiary and quaternary amines were known at the time, and other than DMA there would have been no grounds to exclude any amine from such an investigation including quaternary amines.

52. In fact, my thoughts of the use of amines including quaternary ammonium compounds as an alternative low volatility form of 2,4-D are further strengthened by the results reported in a paper 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*". A copy of the paper by Que Hee and Sutherland (1974) is **D34** to the Schedule. The abstract to this paper clearly states that vapour drift can be *"eliminated by use of the amine salts"* and Table 4 on page 317 headed *"The volatilisation of pure amine salts of 2,4-D …"* shows that the n-tetradecylamine salt of 2,4-D had the lowest volatility of all the amine salts tested. Table 4 on page 317 of D34 reports the vapour pressure of methylamine, dimethylamine (a secondary amine), n-butylamine, n-dodecylamine and n-tetradecylamine salts of 2,4-D and the volatilisation of these salts after 48 hours at 38˚C, 0% relative humidity, based on measurements of ^{14}C ring labelled 2,4-D. Most importantly, the concluding paragraph of D34 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".*

53. Accordingly, the Que Hee and Sutherland paper showed that in 1974 the problem of vapour drift associated with 2,4-D esters had been addressed by

the use of amine salts instead of esters. It is my view that the reference to amine salts in D34 refers to primary, secondary, tertiary and quaternary salts which are all ionic in nature. By contrast, 2,4-D esters are covalently bonded and do not dissociate to form ions in aqueous solution.

54. An extract from 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 is **D33** to the Schedule. This text has been in my possession since 1988 and, as stated in paragraph 12 above, is one of the references that I have regularly referred to throughout my career. Appendix 3 on page 54 of the extract shows the melting points of various alkylamine salts and amides of 2,4-D including the n-tetradecylamine salt of 2,4-D. D33 also includes reference to quaternary ammonium salts as will be set out below.

Synthesis of 2,4-D salts

55. It was also very well known that as with other amines, quaternary ammonium compounds could be readily formulated to form the corresponding salt of 2,4-D using standard laboratory techniques. The "Phenoxyalkanoic Herbicides" text (D33 to the Schedule) makes it clear that it is simply a matter of reacting equimolar amounts of amine and acid together in a compatible solvent to precipitate the salt. This text includes reference to 2,4-D quaternary ammonium salts. The first paragraph of the section entitled "B. Amine Salts" on page 117 of the "Phenoxyalkanoic Herbicides" text (**D33** to the Schedule) footnotes "188-220" and pages 143 to 144 list relevant references to these footnotes. Reference 189 on page 143 is *"Harwood, J., US 2,900,411"* (**D24** to the Schedule referred to further below). Likewise, the reference 214 on page 144 is *"May & Baker Ltd., Netherlands Patent 6,506,449, 1965"* with GB 1,056,235 being the GB equivalent (**D28** to the Schedule referred to further below).

56. I note that the procedure used to synthesize and isolate the tetramethylammonium salt of 2,4-D and reported in GB 1,056,235 in the name of May & Baker Ltd and published in January 1967 is very straightforward involving the use of standard laboratory techniques. A copy

of GB 1,056,235 is **D28** to the Schedule. Page 5, lines 72 to 86 of D28 describes the routine steps of adding equimolar amounts of a solution of tetramethylammonium chloride (2.8g; 0026 mol) in ethanol to a solution of the sodium salt of 2,4-D (6.2g; 0.026 mole). After refluxing for 2 hours, the reaction mixture is cooled and filtered to remove sodium chloride and the alcohol is evaporated. The patent states that the resulting product being the solid tetramethylammonium 2,4-D has a melting point range of 212-214˚C. I note that GB 1,056,235 is referenced in the text "Phenoxyalkanoic Herbicides" (**D33** to the Schedule).

57. I also note the teachings in US 2,900,411 in the name of Armour & Co, Chicago, Illinois and published in November 1950. A copy of US 2,900,411 is **D24** to the Schedule. D24 is also referenced in the text "Phenoxyalkanoic Herbicides" (**D33** to the Schedule) and is referred to on page 2, lines 30 to 44 of GB 1339315 in the name of the Ciba-Geigy Canada Ltd (published in April 1981) (**D3** to the Schedule). US 2,900,411 describes the development of compositions which may be selectively applied to weed infested areas to eradicate the noxious vegetation, while at the same time leaving the desirable plants unharmed. The composition is the reaction of an aliphatic amine having at least 6 carbon atoms in an aliphatic radical thereof with a plant hormone carboxylic acid such as 2,4-D to form the salt. Column 2, lines 17 to 21 describes the *aliphatic amine "involved in the present invention"* as including *"quaternary amines or quaternary ammonium compounds*. This patent describes the procedure to produce the corresponding salt as involving the very routine steps of mixing the aliphatic amine and the carboxylic acid in a solvent, warming the mixture until a homogenous solution is obtained and then cooling the solution to precipitate the salt. The product may then be filtered and dried. D24 therefore describes the use of routine standard laboratory techniques wherein equimolar amounts of the amine and the acid are reacted in a compatible solvent to precipitate the salt. Column 2, lines 26 to 33 of D24 describes the amines which may be used as including *"quaternary compounds, such as trimethyloctylammonium hydroxide and trimethyldodecylammonium hydroxide"*.

58. US 2,900,411 also describes the resulting compositions as being used in large scale agriculture, such as in corn farming, where they can be spread on the soil of a field seeded with corn to *"prevent the growth of weeds for a sufficient length of time to enable the corn to grow tall and strong enough to develop to maturity unaffected by weeds"* as well as in eradicating weeds when applied in a spray or dust form (column 2, lines 58 to 67 of **D24** to the Schedule).

59. I am not at all surprised by this and in fact this reinforces my view that quaternary ammonium compounds would be an alternative low volatility form of 2,4-D.

Resistance and Tolerance to 2,4-D

60. It was certainly known well before February 2007 that it was possible to artificially induce tolerance or resistance in crops whether through genetic manipulation or selective breeding to reduce the level of damage from accidental spray drift. One such example is reported in a paper published by C Bayley et al. in *Theor Appl Genet* (1992) Vol 83 pages 645-649. A copy of this paper is **D35** to the Schedule. Bayley et al. reported that cotton could be made resistant to 2,4-D by genetic transformation with the *tfdA* gene. This resulted in a 50- to 100-fold increase in tolerance to 2,4-D compared to untransformed controls and it was found that the degree of tolerance achieved was more than adequate to protect cotton from drift-levels of the herbicide.

61. In a paper issued from the CSIRO Division of Plant Industry in May 1993 titled *"Cotton plants transformed with a bacterial degradation gene are protected from accidental spray drift damage by the herbicide 2,4,-dichlorophenoxyacetic acid*" and published in *Transgenic Res* Vol 2: 162-169 Bruce Lyon et al reported that the *"2,4-D tolerance gene is currently being transferred into to all our existing commercial cotton varieties …and this material should be ready for commercial release as 2,4-D drift-tolerant cultivars within the next five years"* i.e. 1998. A copy of this paper is **D36** to the Schedule.

62. In addition, the AMICIDE 625 label (**D16** to the Schedule) shows wheat as tolerant to 2,4-D, being a crop over which 2,4-D is applied.

Discussion as to a non-volatile 2,4-D formulation

63. Certainly, the adverse effects of volatility arising from the ester forms of 2,4-D were widely known before February 2007 and that the use of other forms of the carboxylic acid 2,4-D such as the amine or metal salt was necessary for careful management of volatility. It was well known that changing to a less volatile or non-volatile formulation reduced this risk by selecting a salt form of 2,4-D in preference to an ester form. It was also well known that 2,4-D could form salts with amines and this would have certainly one way managing the issue without any detrimental effect on the effectiveness of the herbicide in controlling unwanted vegetation.

64. It was well understood in February 2007 that when applying herbicides the aim was to maximise the amount reaching the target and to minimise the amount reaching off-target areas caused by spray drift. Accordingly, if I had been faced with the task in February 2007 of addressing the volatility problem by reducing the volatility of the carboxylic acid 2,4-D so that its use would not damage nearby sensitive crops while maintaining an acceptable level of the herbicidal activity in controlling unwanted vegetation I would have immediately looked at an amine salt form. Given the known problems associated with dimethylamine salt form, I would have immediately considered changing to another less volatile amine such as a diethanolamine, triethanolamine or triisopropanolamine to reduce the risks of volatility and prevent injury to nearby sensitive crops. For the reasons provided above I would have also considered using quaternary ammonium compounds such as the quaternary ammonium hydroxide form as they were known before February 2007 to have a base strength comparable to sodium hydroxide (**D32** and **D9** to the Schedule); known that they could form a salt with 2,4-D (**D28** and **D24** to the Schedule) and known that vapour drift could be eliminated by use of such salts (**D34** to the Schedule). In my opinion there would have been no grounds to exclude quaternary amines from the equation and I would have considered using them in any research program.

65. As stated above it was certainly known before February 2007 that the volatility of 2,4-D salts could be reduced by increasing the molecular weight of the amine base. As a formulator with over 30 years' experience in Australia in

the manufacture of herbicidal formulations and their use before February 2007, it would have been a matter of routine to prepare a series of 2,4-D salts with amines of higher molecular weight and assess these for volatility. I would have selected amines from primary, secondary, tertiary and quaternary class of amines, as 2,4-D salts with primary, secondary, tertiary and quaternary amines were known at the time. In my opinion there would have been no basis to exclude any amine form from such an investigation other than dimethylamine due to the odour issue. While it is always a matter of trial and experiment, I would have been reasonably confident of successfully preparing a low volatile form of 2,4-D and I would have no doubt that this could be readily achieved.

66. Further I would certainly not have ruled out other bases. It is well known that organic acids can react with bases such as sodium hydroxide (caustic soda) to form a sodium salt. In my view and having regard to the chemistry involved 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.

THE OPPOSED PATENT APPLICATION

Overview of the opposed Patent Application

67. As noted above the Abstract of the opposed Patent Application provides that the alleged invention is directed to compounds formed by combining a carboxylic acid herbicide with N-((C_1-C_{16}) alkyl or arylalkyl) tri(C_1-C_{16})alkyl)ammonium hydroxide that have herbicidal activity on an acid equivalent basis at least as active as the commercially used carboxylic acid herbicide salts, but are less volatile and the opposed Patent Application is titled *"Compounds derived from herbicidal carboxylic acids and tetraalkylammonium or (arylalkyl)trialkylammonium hydroxides"*.

68. By way of background the opposed Patent Application states that acid herbicides such as 2,4-D have long been used to control unwanted vegetation and that the herbicide is normally converted into liquid formulations by conversion to water soluble salts or emulsifiable ester compositions This is

certainly my understanding and, as stated above in paragraphs 32 and 33 (see also paragraph 34), was well known in Australia before February 2007.

69. The opposed Patent Application further states that the ester formulations have been found to be more effective than the salts on an acid equivalent basis but that there is a volatility issue associated with the ester formulation resulting in unacceptable damage to sensitive plants. As noted above the adverse effects of volatility arising from high volatile ester forms of 2,4-D were widely known in Australia and reported in publications such as APVMA 2006 Preliminary Review Findings Report (**D29** to the Schedule) and the 2004 Agnote (**D7** to the Schedule).

70. The opposed Patent Application at page 1, lines 14 to 17 then suggests an alternative form of 2,4-D being the dimethylamine salt as a means of solving the volatility problem, however this solution was considered less than satisfactory because upon volatilization of the amine, the herbicide reverts back to its initial acid form, which, in itself under certain unfavourable conditions, has sufficient volatility to cause damage to sensitive crops. The reversion of the 2,4-D to its initial acid form upon volatilisation of the dimethylamine salt and its effect on susceptible plants was certainly well known and reported before February 2007 (see paragraph 43 and the Farmnote publication (**D5** to the Schedule)).

71. When I carefully consider the "background discussion" provided on page 1 of the opposed Patent Application and the language on page 2, lines 1 to 4 it seems to me that the central problem sought to be addressed is the issue of volatility of known 2,4-D formulations and their impact on sensitive crops.

72. With the issue of volatility in mind it is stated that the aim of the alleged invention is to provide 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.

73. The opposed Patent Application purports to achieve this aim by providing compounds formed by combining a carboxylic acid herbicide with either a tetraalkylammonium or an (arylalkyl)trialkylammonium hydroxide having a

herbicidal activity on an acid equivalent basis which is at least comparable to the commercially used carboxylic acid herbicides salts, but with reduced volatility (see page 2, lines 5 to 9 of the opposed Patent Application). Lines 9 and 10 describe the compounds being *"conveniently formulated as aqueous concentrates or emulsified liquids"*.

74. When I first read this, I wondered what was new or inventive about the "invention" given that it was widely known and recognised in the literature of there being problems associated with the volatility of 2,4-D and providing an alternative form of the compound through the use of selecting a salt form of a herbicide more particularly 2,4-D, that was less volatile was certainly common practice in Australia before February 2007. The use of amine salts including quaternary ammonium salts of 2,4-D to "eliminate vapour drift" had already been reported in paper by S. S. Que Hee and R. G. Sutherland published in *Weed Scienc*e in July 1974 (**D34** to the Schedule). This paper was referenced in the text "Phenoxyalkanoic Herbicides" (**D33** to the Schedule).

75. The process adopted in the opposed Patent Application to produce the reaction product and the so-called "improved" herbicide carboxylic acid derivative was certainly very routine before February 2007. The "first" method set out on page 4, lines 6 to 12 (and duplicated on page 9, lines 2 to 8) of the opposed Patent Application involves the simple and very general process of reaction of the herbicidal carboxylic acid with an appropriate N-($(C_1$-$C_{16})$ alkyl or arylalkyl)tri-($(C_1$-$C_{16})$alkylammonium hydroxide, by mixing the 2,4-D with the tetraalkylammonium hydroxide in a solvent, isolating the product through the evaporative removal of the solvent (and any water) and then purifying the product using *"methods known in the art to provide the compounds of the present invention as liquids or solids*" (page 9, lines 6 to 8). This is consistent with the methods used to synthesize amine salts of 2,4-D reported in the text "Phenoxyalkanoic Herbicides". See paragraphs 55 to 57 above.

76. The alternative "third" method described on page 9, lines 13 to 20 of the opposed Patent Application using the tetraalkylammonium halide as the starting amine is similar to the procedure used to synthesize and isolate the

tetramethylammonium salt of 2,4-D described in GB 1,056,235 (**D28** to the Schedule). As noted above this patent was referenced in the text "Phenoxyalkanoic Herbicides" (**D33** to the Schedule).

77. Finally, the "second" method described at page 9 lines 8 and 9 where the "*products of the invention may be prepared in water solvent and used as obtained"* was also very routine before February 2007. I note that unlike the first and third preparative methods, this method does not include an isolation step. I further note that this procedure is similar to the procedures described in D1, D2, D3 and D28 to the Schedule which each describe a herbicidal composition comprising the reaction product of the quaternary ammonium compound choline hydroxide with 2,4-D.

78. The process described in the opposed Patent Application to formulate the "improved" herbicide carboxylic acid derivative as an aqueous concentrate or emulsified liquid was also well known before February 2007. Page 7, lines 2 and 3 of the opposed Patent Application describes water as being the carrier of choice for the dilution of the concentrate (see also page 8, lines 11 and 12 of the opposed Patent Application).

79. The "invention" is also said to include herbicidal compositions comprising an herbicidally effective amount of such compounds in admixture with an agriculturally acceptable adjuvant or carrier as well as a method of use of the compounds and their compositions of the "invention" to kill or control undesirable vegetation by application of an herbicidal amount of the compound to the vegetation or to the locus of the vegetation as well as to the soil prior to emergence of the vegetation (page 2, lines 14 to 20).

80. It is not clear to me what is new or inventive about adding an agriculturally acceptable adjuvant or carrier to a formulation given this was very common practice in the industry well before February 2007. An adjuvant or carrier was often added to a formulation of spray mix to improve its performance and stability. This is something that we were doing at Nufarm well before February 2007. Now produced and shown to me and marked **PMH-5** is a copy of the Material Safety Data Sheet for Nufarm AMICIDE 625 Low Selective Herbicide dated August 2011 which shows water as being the liquid

carrier. As noted above in paragraph 44 AMICIDE 625-Low Selective Herbicide was first registered in October 2002. My comments are consistent with the description on that pages 6 to 8 of the opposed Patent Application which states that preparation of the herbicidal compositions involves simple and very general processes and the conventional agricultural adjuvants and carriers used are "well known to those skilled in the art" (page 6, lines 22 and 23 refers).

81. The use of the herbicidal compounds/compositions to kill or control undesirable vegetation by application of an herbicidal amount of the compound to the vegetation or to the locus of the vegetation as well as to the soil prior to emergence of the vegetation was also widely known and recognised in the literature and certainly common practice in Australia before February 2007. This is evident from various articles published before February 2007 such as *"Phenoxy Reference Guide"* 2005 (see pages 16 to 18 of **D21** to the Schedule); the APVMA 2006 Preliminary Review Findings Report (**D29** to the Schedule) and Agnote 2004 (**D7** to the Schedule).

Discussion of the Claims

Claims 1 to 7

82. The opposed Patent Application contains three independent claims which are said to define a herbicidal compound comprising the reaction product produced by the process of combining:

    a. 2,4-D and (tetraalkyl)ammonium hydroxide of the formula as provided for in claims 1 and 3 (and dependant claims 2, 4 to 6); or

    b. 2,4-D and choline hydroxide having the formula as provided for in claim 7.

83. Firstly, I refer to my comments under paragraphs 74 to 77 above. I further note that the claims do not refer to isolating the reaction product and so I would consider this claim to include both a reaction product which has not been isolated as well as a reaction product which has been isolated. While specific matters relating to ambiguous and unclear terms in the claims will be

discussed and dealt with in the later part of this Declaration at this point I set out my opinion on what I understand by the word "isolating" to mean both in a scientific sense and in the context the claims when read in light of the opposed Patent Application.

84. As to a general chemical dictionary definition the word "isolating" means to "separate the (chemical) compound of interest from the matrix (most commonly a solution) in which the chemical compound has been prepared". It is the act of separating the compound of interest from the matrix using techniques such as filtering or precipitation. When I read claims 1, 3 and 7 I understand that "isolating" to mean that once reaction product has been produced by the process of combining 2,4-D with (i) (tetraalkyl)ammonium hydroxide of claims 1 and 3 (and dependant claims 2, 4 to 6); or (ii) choline hydroxide of claim 7, then the resulting product maybe "separated" from the solution in which it was prepared but may also be used as prepared. The resulting product need not be "pure".

85. When I review the opposed Patent Application I note the General Preparative Example on page 9 which describes three methods of preparation. When I consider the first procedure at lines 2 to 8 I note that the product is "isolated" by evaporation of the methanol reaction solvent. This appears to be consistent with my understanding of the word "isolating". Likewise, in the third preparative example the product is "isolated" by (i) evaporating the methanol reaction solvent and by (ii) washing the mixture so obtained to with water to remove water soluble sodium chloride (see lines 13 to 20). I note however that the second preparative example of the *"product of the invention"* being "*prepared in water solvent*" does not involve an isolation step because it is said to be *"used as obtained"* (see page 9, lines 13 to 20). Accordingly, it seems to me that this particular preparative example is an example which would result in a herbicidal compound of any one of claims 1 to 7 which is not isolated. Of the three methods I note that the "first" and "second" preparation methods are the only methods describing a reaction of 2,4-D with a (tetraalkyl)ammonium hydroxide. I would comment here however that the actual reaction occurring to produce the reaction product is between 2,4-D and a (tetraalkyl)ammonium moiety. The hydroxide plays no part in the

formation of the final product but merely dissociates in solution from the (tetraalkyl)ammonium moiety. It follows that the actual reactive processes in method 1, method 2 and method 3 on page 9 of the opposed Patent Application are the same.

86. I further note that my view that the resulting product does not need to be "pure" as first this would involve an extra step and secondly is confirmed when I read the opposed Patent Application. Lines 5 to 8 on page 9 make it clear that after the reaction product has been "isolated by evaporative removal of the methanol (and any water present), it *"may be purified"*. From my reading of this it appears that the purification step was undertaken to obtain the melting points of the compounds listed in Table 1 on page 10. I further note that the second and third preparative examples on page 9 of the opposed Patent Application do not involve a purification step.

87. In the industrial context if the amine is water soluble then the corresponding salt can be prepared directly in aqueous solution without the need for any isolation step. In such circumstances an isolation step will only be needed to determine the physical and chemical properties of the salt. The techniques used to separate the salt from the reaction mixture including are very routine techniques such as filtering or precipitation.

<u>Claims 8 to 11</u>

88. The opposed Patent Application also contains an independent claim which defines a herbicidal composition comprising a herbicidally effective amount of a compound of any one of claims 1 to 7, or mixtures thereof, in an admixture with an agriculturally acceptable adjuvant or carrier (see claim 8) and three associated dependant claims 9 to 11.

<u>Claims 12 and 13</u>

89. The opposed Patent Application further contains two claims directed to a method of controlling undesirable vegetation which comprises contacting the vegetation of the locus thereof with, or applying to the soil to prevent the emergence of vegetation, a herbicidally effective amount of a compound

according to any one of claims 1 to 7 or of a composition according to any one of claims 8 to 11.

Claims 14 and 15

90. Finally, the opposed Patent Application contains two claims directed to a method of controlling undesirable vegetation in a crop that has been made tolerant or resistant to 2,4-D, which comprises contacting the vegetation of the locus thereof with, or applying to the soil to prevent the emergence of vegetation, a herbicidally effective amount of a compound according to any one of claims 1 to 7 or of a composition according to any one of claims 8 to 11.

INVENTIVE STEP

91. I was asked to consider whether as at 26 February 2007 the invention disclosed in the opposed Patent Application and defined in the claims involved an 'inventive step'. For the purposes of this further analysis, I was informed that the claimed invention will involve an inventive step unless it would have been obvious to a person skilled in the relevant art in light of the common general knowledge as it existed in Australia as at 26 February 2007. I was asked to assume that I was a 'person skilled in the relevant art', being in the field of herbicidal formulations and their use, in Australia as at 26 February 2007. I was further advised that the test of inventive step has been described in case law in Australia in the following terms:

> *"The test is whether the hypothetical addressee faced with the same problem would have taken as a matter of routine whatever steps might have led from the prior art to the invention, whether they be steps of the inventor or not."*

92. I have also been instructed that the Courts have endorsed the use and application of the reformulated "Cripps question" to assist with determining whether the claimed invention is obvious, such a question being:

> *"Would the person skilled in the art (in all the circumstances) directly be led as a matter of course to try the claimed invention in the expectation that it might well produce a solution to the problem?*

93. I was advised that the test of inventive step is to be considered in light of the 'common general knowledge' of the person skilled in the relevant art as at 26 February 2007. As noted in paragraph 22 above, I had been advised that 'common general knowledge' is the background knowledge and experience which is available to, or held by, all persons in the relevant field when considering making new products or processes. I was asked to adopt this definition for the purposes of considering the issue of inventive step. I have been asked to consider this issue without any regard to the disclosure in the specification itself.

Obviousness in light of the Common General Knowledge

Claims 1 to 7

94. As to claims 1 to 7 the phenoxy herbicide 2,4-D was known well and in widespread use in Australia and overseas before February 2007 as was quaternary ammonium compounds such as tetramethylammonium hydroxide, octyltrimethylammonium hydroxide (aka trimethyloctylammonium hydroxide), dodecyltrimethylammonium hydroxide, benzyltrimethylammonium hydroxide (aka Triton B), cetyltrimethylammonium hydroxide (aka hexadecyltrimethylammonium hydroxide), octyldimethylbenzylammonium hydroxide. Choline hydroxide was also certainly known before February 2007.

95. As noted above it was also widely known and understood well before February 2007 that stoichiometric quantities of an amine could be reacted with 2,4-D acid in a compatible solvent to form the corresponding salt. The text "Phenoxyalkanoic Herbicides" (**D33** to the Schedule) published in 1981 describes there being *"an enormous patent literature"* concerning amine salts of 2,4-D and that the techniques commonly used to formulate *"amine salts of 2,4-D"* were standard in the laboratory and extremely straightforward. One such example is the procedure used to synthesis the n-tetradecylamine salt of 2,4-D (see page 117 of **D33**). This procedure involved combining equimolar amounts of the amine to the 2,4-D acid.

96. Another example is the procedure used to synthesize and isolate the tetramethylammonium salt of 2,4-D as described in GB 1,056,235 (**D28** to the Schedule) which again involved very standard laboratory techniques. Specifically, the procedure in **D33** involved combining equimolar amounts of the tetramethylammonium chloride in ethanol to a solution of the sodium salt of 2,4-dichlorophenoxyacetic acid. GB 1,056,235 reports the melting point of the resulting herbicidal compound as 212-214˚C. As noted above this patent was referenced in the text "Phenoxyalkanoic Herbicides" (**D33** to the Schedule).

97. Given that the process of producing a quaternary ammonium salt of 2,4-D involved the use of very standard laboratory techniques namely to combine equimolar amounts of known ingredients, I would have had the expectation that the resulting salt being the herbicidal compound would have also been known before February 2007. My view is reinforced by the procedure used to synthesize and isolate the tetramethylammonium salt of 2,4-D described in GB 1,056,235 (**D28** to the Schedule) which was published in 1967.

Claim 8

98. As to claim 8 it was certainly common practice in the industry before February 2007 to add adjuvants and/or carrier to a formulation of spray mix to improve its performance and stability. As noted above this is certainly something that we were doing at Nufarm well before February 2007 (see the Material Safety Data Sheet for Nufarm AMICIDE 625 which was first registered in October 2002 (**PMH-5**). I also refer to my comments under paragraphs 78 to 80 above.

Claim 9

99. As to claim 9 it was certainly common practice before February 2007 to use one or more other herbicides to improve the herbicidal effect of the formulation in controlling weeds particularly in circumstances where it was known that certain broad-leafed weeds were resistant to certain herbicides and not others. At Nufarm we often used formulations which contained two or more herbicides in the one formulation. One such example is Nufarm's

herbicidal composition Tillmaster comprising the isopropylamine salt form of 2,4-D and glyphosate. A copy of the extract from the APVMA for Tillmaster is **D37** to the Schedule.

100. GB 1,056,235 published in 1967 also describes the use of "*other herbicidally active compounds"* that may be included in the herbicidal compositions to overcome resistance (see page 4 line 74 to page 5, line 8 of **D28** to the Schedule). I also refer to my comments under paragraphs 78 to 80 above.

Claims 10 and 11

101. As to claims 10 and 11 I do not believe that there is anything magical in the particular "percent by weight" concentrations of the active ingredients stipulated in these claims. GB 1,056,235 describes it as being "known" at least before 1967 (when the patent was published) for the concentrates of the herbicidal active ingredient to contain *"at least 25% w/v ..., preferably at least 40% w/v"* (page 1, lines 24 to 27 of **D28** to the Schedule). GB 1,056,235 describes the subject herbicidal compositions as containing *"0.05 to 90% by weight"* of the active ingredient (see page 3 lines 35 to 37 of **D28**) and when the compositions contain two herbicides *"at least 25% w/v of the active ingredient or ingredients"* (see page 5 lines 36 to 38 of **D28**). Likewise, the Nufarm AMICIDE 625-Low Selective Herbicide (**D16** to the Schedule) has the active ingredient 2,4-D at a concentration of 48.34% by weight and Nufarm's Tillmaster herbicide has the active ingredients of 2,4-D and glyphosate at a concentration of 15.36% by weight and 7.68% by weight respectively. A copy of my calculations for Tillmaster is **D38** to the Schedule. I refer to my comments under paragraphs 78 to 80 above.

Claims 12 and 13

102. As to claims 12 and 13 it was certainly known to use of herbicidal compounds/compositions to kill or control undesirable vegetation by application of an herbicidal amount of the compound to the vegetation or to the locus of the vegetation as well as to the soil prior to emergence of the vegetation. This was certainly common practice in Australia as is evident from various articles published before February 2007 such as *"Phenoxy Reference*

Guide" 2005 (see pages 16 to 18 of **D21**); the APVMA 2006 Preliminary Review Findings Report (**D29** to the Schedule) and Agnote 2004 (**D7** to the Schedule). I refer to my comments under paragraphs 78 to 80 above.

Claims 14 and 15

103. As to claims 14 and 15 it was widely known in the field that it was possible to induce tolerance or resistance in crops whether through genetic manipulation or selective breeding to reduce the level of damage from accidental spray drift and this was certainly done before February 2007 (see **D36** in respect of cotton). Also, as mentioned the AMICIDE 625 label (**D16**) shows wheat as tolerant to 2,4-D, being a crop over which 2,4-D is applied. I refer to my comments under paragraphs 60 to 62 regarding resistance and tolerance to 2,4-D.

COMPARISON OF THE PATENT APPLICATION AND THE PRIOR ART

GB 1,056,235 in the name of May & Baker Ltd (Publication date 25 January 1967) - D28 to the Schedule

104. D28 is relevant because it is directed to herbicidal carboxylic acids and addresses the problem of volatility/crop damage to sensitive crops. D28 is directed to quaternary ammonium derivatives of benzonitriles and herbicidal compositions containing them. D28 describes a second component being included in the herbicidal composition (the ammonium derivative of benzonitrile being the first component) and being a quaternary ammonium salt of 2,4-D with the cation of the quaternary ammonium salt of 2,4-D being of the formula $N^+R_1R_2R_3R_4$ with R_1 to R_4 being the same or different and each representing a methyl or ethyl group (see page 5, lines 22 to 31 and claim 25 of D28). Page 5, lines 22 to 31 indicates that the quaternary group is the same quaternary group as the benzonitrile first component and D28 describes two methods of preparation for the first component (which clearly would be appropriate methods of preparation) for the second component) including (a) a double decomposition reaction of a soluble salt (e.g. sodium) of the herbicide with a quaternary ammonium salt of the formula $R_1R_2R_3R_4N^+,Y^-$ where Y is an anion such as chloride and bromide and (b) reaction of the

herbicide with a quaternary ammonium hydroxide of the $R_1R_2R_3R_4N^+,OH^-$. Example III on page 5, lines 60 to 70 describes a preparation containing a mixture of tetramethylammonium salt of 3,5-diiodo-4-hydroxybenzonitrile and the tetramethylammonium salt of 2,4-D being dissolved in water to produce a solution suitable for use as an aqueous herbicidal concentrate containing 27% (total phenol and acid equivalent) of active ingredient. Page 5, lines 72 to 86 describes the tetramethylammonium salt of 2,4-D being prepared by adding *"a solution of tetramethylammonium chloride (2.8 g.; 0.026 mole) in ethanol (20 cc.) to a refluxing solution of the sodium salt of 2,4-dichlorophenoxyacetic acid (6.2 g.; 0.026 mole) in ethanol (200 cc.)*" in a 1:1 molar ratio and refluxing for 2 hours. This method clearly falls within the double decomposition reaction referred to under (a) above. It is noted that D28 states that the use of water as a solvent (and hence reaction (b)) is particularly convenient as a concentrate of the desired quaternary benzonitrile ammonium salt can be directly prepared ready for dilution for use as a herbicide without the need for isolating the solid salt. This clearly indicates that preparation by the reaction described in (b) is to be preferred.

105. As noted above the synthesis procedure described in Example III described in D28 and represented by the procedure (a) is very close to the alternative "third" method described on page 9, lines 13 to 20 of the opposed Patent Application using the tetraalkylammonium halide as the starting amine. I note that D28 reports the melting point of the resulting herbicidal compound as 212-214˚C. This melting point is within the melting point range reported for compound 1a in Table 1 on page 10 of the opposed Patent Application. I further note that the synthesis procedure referred to in D28 under procedure (b) above is very close to the "first" and "second" method described on page 9, lines 13 to 20 of the opposed Patent Application using tetraalkylammonium hydroxide as the starting amine.

106. In addition to the quaternary ammonium group of 2,4-D being tetramethylammonium this patent describes the quaternary derivative as having R_1 to R_4 being *"the same or different and each representing a methyl or ethyl group"* (see claims 23 and 25 of **D28**) and therefore includes other

tetraalkylammonium compounds other than tetramethylammonium compound.

107. GB 1,056,235 further describes the herbicidal composition including a compatible diluent and/or surface active agent (see claim 5 of **D28**). The diluent is described on page 3, lines 23 as being *"a liquid such as water or an animal, vegetable or mineral oil; or a solid, both liquid and solid compositions optionally containing a surface active agent"*. Page 3, lines 57 to 61 provides examples of suitable solid diluents as including "aluminium silicate, talc, calcined magnesia, powered cork, absorbent carbon black and clays such as kaolin or bentonite" and lines 82 to 89 on page 3 provides examples of suitable liquid diluents. These are described as including "*water (which is preferred), tetrahydrofurfuryl alcohol, acetophenone, cyclohexanone, isophorone, dimethylformamide, methylcellosolve (the monomethyl ether of ethylene glycol), toluene, xylene and mineral, animal and vegetable oils"*. A number of examples of possible surface active agents are described on page 3, lines 40 to 56. **D28** describes a herbicidal composition containing a quaternary ammonium derivative of 2,4-D and a herbicidal quaternary ammonium benzonitrile derivative in an admixture which takes the form of liquid concentrates which are diluted with water to give compositions ready for use (see page 5, lines 32 to 35 of **D28**).

108. GB 1,056,235 describes aqueous concentrate containing at least 25% (total phenol and acid equivalent) weight by volume of the herbicidally active quaternary ammonium salts of benzonitrile and 2,4-D (see Claim 27 of **D28**). The aqueous herbicidal concentrate of Example III contains 27% (total phenol and acid equivalent) weight by volume of the active ingredient.

109. GB 1,056,235 describes the herbicidal composition being applied to a crop-growing area containing, for example, grass, sugar-cane, cereal, a legume, flax, linseed, onions or a cruciferous crop at a rate sufficient to control the growth of weeds without causing substantial permanent damage to the crop (page 2, lines 84 to 87 and claim 32 of **D28**). The patent also describes the application of the herbicidal composition to a crop-growing area containing broad-leafed

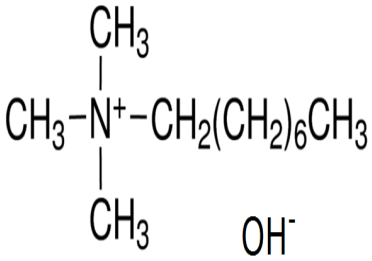
weeds that are sensitive to the composition containing the quaternary ammonium salts of 2,4-D (claim 30 of **D28**).

110. GB 1,056,235 describes a method of preparing the tetramethylammonium salt of 2,4-D and its use as a herbicide. D28 is therefore is relevant as it relates to the combination of an auxinic herbicidal carboxylic acid, which is the same class of compound as described in the opposed Patent Application, together with a phenolic benzonitrile compound and the opposed Patent Application covers such combinations. It is my view that at least claims 1 to 4, 6 and 8 to 13 of the opposed Patent Application are anticipated by the disclosure in D28. Now produced and shown to me and marked **PMH-6** is a Table summarising my conclusions.

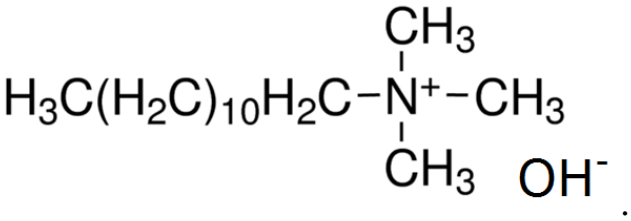
US 2,900,411 in the name of Armour & Co, Chicago, Illinois (Publication date: 18 August 1959) - D24 to the Schedule

111. D24 is relevant because it is directed to herbicidal carboxylic acids and addresses the problem of volatility/crop damage to sensitive crops. This patent describes the development of herbicidal compositions which may be selectively applied to weed infested areas to eradicate the noxious vegetation, while at the same time leaving the desirable plants unharmed. The composition is the reaction of an aliphatic amine having at least 6 carbon atoms in an aliphatic radical thereof with a plant hormone carboxylic acid such as 2,4-D to form the salt. Column 2 lines 26 to 33 of D24 describes the *aliphatic amine "involved in the present invention"* as including *"quaternary amines or quaternary ammonium compounds", such as "trimethyloctylammonium hydroxide and trimethyldodecylammonium hydroxide"*. The resulting compositions are described as being used in large scale agriculture, such as in corn farming, where they can be spread on the soil of a field seeded with corn to *"prevent the growth of weeds for a sufficient length of time to enable the corn to grow tall and strong enough to develop to maturity unaffected by weeds"* as well as in eradicating weeds when applied in a spray or dust form (column 2, lines 58 to 67 of D24).

112. The structure of the quaternary ammonium compound trimethyloctylammonium hydroxide is:



113. The structure of the quaternary ammonium compound trimethyldodecylammonium hydroxide is:



114. D24 describes the process of producing the herbicidal compositions by mixing the amine and the carboxylic acid in a "*solvent and warmed until a homogenous solution is obtained and then cooled until precipitation of the desired salt is complete, after which it may be filtered and dried"* (column 2 lines 42 to 45 of D24) and Example 9 has the active ingredient present in an amount of 26.8%. At the very least, US 2,900,411 instructs me to prepare a herbicidal composition by reacting 2,4-D with either trimethyloctylammonium hydroxide or trimethyldodecylammonium hydroxide.

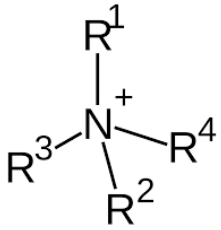
115. This patent describes the resulting composition being readily "dispersed or suspended in water or other media for easy application to crops or soil" (see column 1, lines 64 to 66 of D24).

116. It is my view that at the very least claims 1 to 4, 5, 8 and 10 to 13 are anticipated by the disclosure in D24. Now produced and shown to me and marked **PMH-7** is a Table summarising my conclusions.

GB 1339315 in the name of Ciba-Geigy Canada Ltd (Publication date of 5 December 1973) – D3 to the Schedule

117. D3 is relevant because it is directed to herbicidal carboxylic acids and addresses the problem of volatility/crop damage to sensitive crops. The authors of D3 describe the principal objective as being "non-volatile" form of a herbicidal composition having a performance equal to or better than the corresponding esters of the same herbicidal acids (see page 5, lines 71 to 92 of D3). I note that the authors reference the disclosure in US Patent 2,900,411 (**D24 to the Schedule**) as being the starting point to the extent that it describes the salt of a carboxylic acid and an amine and I propose to read D3 in that context.

118. D3 describes a herbicidal composition formed by reacting at least two bases with at least one herbicidally active compound such as 2,4-D to form a mixture of salts. The bases described as being employed are chosen from a number of amine salts including specifically a quaternary ammonium salt of the formula:



wherein the radicals may be selected from *"alkyl, hydroxyl-substituted alkyl and alkoxy groups having one to six carbon atoms, ammonium and alkali metal salts"* (page 2, lines 103 to 113 of D3). It is my view that the reference to hydroxyl-substituted alkyl in D3 would, without a doubt, include choline hydroxide. Further D3 also describes 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 D3 includes a reaction between 2,4-D and "choline hydroxide".

119. D3 further describes the resulting mixture of salts being "*dissolved in an aqueous or polar liquid carrier, and upon evaporation of the carrier"* being capable of remaining as a liquid for an extended period of time (page 2, lines 72 to 78 of D3).

120. D3 also describes the herbicidal composition comprising a particular acid or combinations of acids being chosen "primarily on the activity and spectrum of selectivity for controlling undesired vegetation" and includes derivatives of phenoxy acids such as 2,4-D and derivatives of benzoic acids (page 3, lines 52 to 72 of D3). D3 also describes the addition of surfactants to address surface tension requirements (page 4, lines 92 to 121 of D3) and *"other conventional expedients commonly employed in the art … for example one or more chelating agents"* (page 5, lines 24 to 28 of D3).

121. D3 describes the application of a herbicidally effective amount of the composition to the locus to control undesired vegetation and 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.

122. D3 describes the importance of producing a herbicidal composition having low volatility to avoid damage to areas adjacent to the locus being treated. The "volatility factor" is unequivocally stated in this document as being a *"critical factor"* (page 2, line 19 of D3) in producing a herbicidal composition having a "performance equal to or better than the corresponding esters of the

same herbicidal acids" (page 5, lines 89 to 92 of D3). 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). I further note the statement at line 59 to 64 on page 1 of D3 that compared to an ester derivative *"a salt of a herbicidally active acid (the amine salts being the most widely used group of salts) is substantially always non-volatile due to ionization of the salt in an aqueous carrier"*.

123. D3 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 one of the radicals R, R_1, R_2 and R_3 may be a "hydroxy-substituted alkyl" which would include 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. It is my view that at least claims 1 to 4 and 6 to 13 are anticipated by the disclosure in D3. Now produced and shown to me and marked **PMH-8** is a Table summarising my conclusions.

JP51106728 in the name of Mitsubishi Gas Chemical Co (Publication date: 21 September 1976) – D2 to the Schedule

124. Now produced and shown to me and marked **PMH-9** is a copy of the English translation of D2. Now produced and shown to me and marked **PMH-10** is a copy of the Declaration of Kyoko UENO dated 23 July 2014 filed in the opposition proceeding relating to Australian Patent Application 2008219657.

125. D2 is relevant because it is directed to herbicidal carboxylic acids and addresses the problem of volatility/crop damage to sensitive crops. D2 which was published in 1976, relates to herbicides *"for the eradication of broad-leaved weeds"*. More particularly D2 relates to herbicides containing phenoxy compounds that have *"hitherto been widely used as herbicides for broad-leaved weeds and cholines"* (page 2 of **PMH-9**). I note that 2,4-

dichlorophenoxyacetic acid is specifically referred to and is abbreviated as DCP (see fourth paragraph of page 3 of **PMH-9**).

126. This document describes a phenoxy-based herbicide that contains *"cholines"* (page 3, lines 7 and 8 of **PMH-9**) having a *"greater selectivity and is safer to use"* such that it *"very rapidly penetrates the epidermal cells of the plants and reaches the site of action, rapidly killing the broad-leaved weed, while at the same time greatly reducing the risk of chemical damage to the crop"* (see second paragraph of page 5 of **PMH-9**). The phenoxy-based herbicide of D2 is described as having greater herbicidal effects than the phenoxy compounds alone so can be used at much lower quantities with the same effect (see first paragraph of page 5 of **PMH-9**). I note that the rapid penetration solves the volatility problem since the herbicide will not be present to drift to neighbouring crops. The specification of the opposed Patent Application clearly shows the correlation between volatility and damage.

127. D2 also describes the risk of chemical damage to different kinds of crops as being *"reduced through the reduced amounts applied, or through the effectiveness of the herbicide at lower concentrations and through its mechanism of action*" and the security of sensitive neighbouring crops as being *"increased through the greatly enhanced selectivity of the herbicidal effect*". It is also stated that *"[s]uch reductions in the amounts applied are also highly advantageous as regards the problem of environmental pollution from the spreading of agricultural chemicals and the economics of farming"* (see third paragraph on page 5 of **PMH-9**).

128. The third full paragraph on page 3 states that *"the present invention is a herbicide that contains phenoxy compounds and cholines"*. DCP is explicitly mentioned as an example of a phenoxy compound later in this paragraph. In the following paragraph, I note that D20A states that *"[t]he cholines of the present invention are <u>choline or choline salts</u>"*, and specific examples of choline salts are provided being *"salts of choline with inorganic acids such as oxalic acid and ascorbic acid and like"*; and *"salts of choline with inorganic acid such as phosphoric acid and carbonic acid and the like"*.

129. In the following paragraph on page 3, it is recited that *"[i]t is inferred that choline salts of phenoxy substituted lower aliphatic acids are formed when phenoxy substituted lower aliphatic acids are mixed with choline"*.

130. It is my view that the reference to choline in D2 means "choline hydroxide". It was well known in the field that choline does not exist as a separate entity and that the reference to "choline" absent a qualifying description of its salt form means that it is referring to "choline hydroxide". In my view this is consistent with the definition of "choline" in various pharmaceutical/chemistry handbooks such as Hawley's Condensed Chemical Dictionary 12th ed with a publication date of 1993 (**D8 to the Schedule**); Kirk-Othmer Encyclopaedia of Chemical Technology 4th Ed with a publication date of December 2000 (**D9 to the Schedule**); Handbook of Pharmaceutical Salts: Properties, Selection, and Use with a publication date of 2002 (**D10 to the Schedule**); CRC Handbook of Chemistry and Physics 58th Ed with a publication date of 1977-1978 (**D11 to the Schedule**) and Handbook of Chemistry and Physics 8th Ed with a publication date of 1920 (**D12 to the Schedule**) showing that it was accepted convention well before February 2007 that a reference to "choline" and/or "choline base" in the absence of any qualifying description of its salt form was a reference to "choline hydroxide. I also refer to EP 2 421 372 B1 in the name of the Applicant (**D13 to the Schedule**) and US 8,877,973 (**D14 to the Schedule**) with a publication date of 14 July 2011. In Tables 1 and 2 as appearing on pages 4 and 5 of D13, I note that there is a reference made to choline hydroxide with "choline" referred to in parentheses immediately thereafter. See also Formulation ID Nos 30 to 34 in Table 4 on pages 5 and 6. In D14 I note that choline is referred to as being *"also known as choline hydroxide (2-hydroxyethyltrimethyl-ammonium hydroxide) .... with the chemical formula* $[(CH_3)_3N^+CH_2CH_2OH][OH]^-$" (see column 2, lines 47 to 50 of D14).

131. My comments in above paragraph 130 are confirmed when I consider the molar ratios for choline to phenoxy compounds as listed on page 3 of **PMH-9** in the context of the Practical Embodiments. At paragraph 7 on page 3 the molar ratio is stated as being *"1:1.2, preferably 1:1 to 1:1.1"* to achieve the stated objectives. When I analysed the molar ratios of the herbicidal

composition of each of the Practical Embodiments using various "salt" forms of choline including those mentioned in the fourth paragraph on page 3 of **PMH-9**. My analysis is summarized in the following Tables. For ease of calculation, each table assumes 100g of formulation is to be prepared by weight as directed in the Practical Embodiments of D2. An example of the determination of the molar amount is shown below:

The molecular weight DCP (2,4-D) is 221g/mol
To prepare 100g of embodiment 1, 40g of DCP is to be added to the formula
Therefore 40g ÷221g/mol = 0.1810 mole of DCP

Practical Embodiment 1

Phenoxy acid:	DCP
Weight of Phenoxy Acid:	40
Molecular Weight of Phenoxy Acid:	221
Number of mole of Phenoxy Acid:	0.181

Choline "Salt"	MW	Weight in grams	mol	MOLAR RATIO of DCP:choline
choline hydroxide	121.18	22	0.1815	**1.0**
choline chloride	139.62	22	0.1576	**0.9**
choline bicarbonate	165.19	22	0.1332	**0.7**
choline phosphate	182.13	22	0.1208	**0.7**
choline oxalate	193.197	22	0.1139	**0.6**
choline salicylate	241.28	22	0.0912	**0.5**
choline bitartrate	253.25	22	0.0869	**0.5**
choline dihydrogen citrate	295.29	22	0.0745	**0.4**
choline gluconate	299.33	22	0.0735	**0.4**
choline ascorbate	368.31	22	0.0597	**0.3**

Practical Embodiment 2

Phenoxy acid: MCP
Weight of Phenoxy Acid: 40
Molecular Weight of Phenoxy Acid: 200.62
Number of mole of Phenoxy Acid: 0.199

Choline "Salt"	MW	Weight in grams	mol	MOLAR RATIO of MCP:choline
choline hydroxide	121.18	25	0.2063	**1.0**
choline chloride	139.62	25	0.17906	**0.9**
choline bicarbonate	165.19	25	0.15134	**0.8**
choline phosphate	182.13	25	0.13726	**0.7**
choline oxalate	193.197	25	0.1294	**0.6**
choline salicylate	241.28	25	0.10361	**0.5**
choline bitartrate	253.25	25	0.09872	**0.5**
choline dihydrogen citrate	295.29	25	0.08466	**0.4**
choline gluconate	299.33	25	0.08352	**0.4**
choline ascorbate	368.31	25	0.06788	**0.3**

Practical Embodiment 3

Phenoxy acid: MCCP
Weight of Phenoxy Acid: 40
Molecular Weight of Phenoxy Acid: 214.65
Number of mole of Phenoxy Acid: 0.186

Choline "Salt"	MW	Weight in grams	mol	MOLAR RATIO of MCCP:choline
choline hydroxide	121.18	23	0.1898	**1.0**
choline chloride	139.62	23	0.16473	**0.9**
choline bicarbonate	165.19	23	0.13923	**0.7**
choline phosphate	182.13	23	0.12628	**0.7**
choline oxalate	193.197	23	0.11905	**0.6**
choline salicylate	241.28	23	0.09532	**0.5**
choline bitartrate	253.25	23	0.09082	**0.5**
choline dihydrogen citrate	295.29	23	0.07789	**0.4**
choline gluconate	299.33	23	0.07684	**0.4**
choline ascorbate	368.31	23	0.06245	**0.3**

Practical Embodiment 4

Phenoxy acid: MCPB
Weight of Phenoxy Acid: 40
Molecular Weight of Phenoxy Acid: 228.67
Number of mole of Phenoxy Acid: 0.175

Choline "Salt"	MW	Weight in grams	mol	MOLAR RATIO of MCPB:choline
choline hydroxide	121.18	21	0.1733	**1.0**
choline chloride	139.62	21	0.15041	**0.9**
choline bicarbonate	165.19	21	0.12713	**0.7**
choline phosphate	182.13	21	0.1153	**0.7**
choline oxalate	193.197	21	0.1087	**0.6**
choline salicylate	241.28	21	0.08704	**0.5**
choline bitartrate	253.25	21	0.08292	**0.5**
choline dihydrogen citrate	295.29	21	0.07112	**0.4**
choline gluconate	299.33	21	0.07016	**0.4**
choline ascorbate	368.31	21	0.05702	**0.3**

Practical Embodiment 5

Phenoxy acid: DP
Weight of Phenoxy Acid: 40
Molecular Weight of Phenoxy Acid: 235.06
Number of mole of Phenoxy Acid: 0.170

Choline "Salt"	MW	Weight in grams	mol	MOLAR RATIO OF DP:choline
choline hydroxide	121.18	21	0.1733	**1.0**
choline chloride	139.62	21	0.15041	**0.9**
choline bicarbonate	165.19	21	0.12713	**0.7**
choline phosphate	182.13	21	0.1153	**0.7**
choline oxalate	193.197	21	0.1087	**0.6**
choline salicylate	241.28	21	0.08704	**0.5**
choline bitartrate	253.25	21	0.08292	**0.5**
choline dihydrogen citrate	295.29	21	0.07112	**0.4**
choline gluconate	299.33	21	0.07016	**0.4**
choline ascorbate	368.31	21	0.05702	**0.3**

132. The above Tables clearly show that the only form of choline that could achieve the stated molar ratio of choline to phenoxy acid of between "*1:1.2, more preferably 1:1.1*" is choline hydroxide.

133. I note that the third main paragraph on page 4 of **PMH-9** describes the herbicides as being used for the *"eradication of broad-leaved weeds in rice paddies"* as well as *"in a broad range of other applications such as for the eradication of weeds, and particularly broad-leaved weeds, in the cultivation of agricultural and horticultural crops such as wheat, dry-land rice, maize, direct planting in dry fields, orchards and lawns"*.

134. On page 6 of **PMH-9** the first practical embodiment shows a mixture being a reaction product of 40 parts by weight of 2,4-D, 22 parts by weight of choline hydroxide, 3 parts per weight of a surfactant and 35 parts by weight of water to form *"the herbicide"*. The surfactant is described on page 6 as being Sorvol 8043 (polyoxyethylene alkylallyl ether).

135. This herbicide of the first practical embodiment 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-9** (D2) shows that, with the concentration of 300 or 1000ppm of the 2,4-D formulation, there was no green growth of Daikon and beans (Indicator 5 = 0% mass of green growth) and no chemical damage to the maize or wheat. The results clearly show that the herbicide of practical embodiment (1) demonstrated no injury to neighbouring sensitive crops and must therefore equate to the composition of D2 having a reduced volatility.

136. To further support my view that the term "choline" in D2 is "choline hydroxide" I comment as follows: According to D2 the characteristics of "choline" are:

    a. It is <u>not</u> 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);

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

c. 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).

137. To further 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, molar ratio 1:1).

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 (molar ratio 1:1).

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 (molar ratio 1:1).

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).

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

Expt #	T (°C) Initial	T (°C) after addition	T(°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

139. Dr McKerrow's experiments showed that 2,4-D acid reacts with choline hydroxide in equimolar proportions immediately 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.

140. 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).

141. 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.

142. As the herbicides envisaged by D2 are water soluble chemicals comprising phenoxy substituted lower aliphatic acids and choline (PMH-28 in the sentence bridging pages 3 and 4), Dr McKerrow's experiments clearly demonstrate the "choline" of D2 is choline hydroxide.

143. D2 clearly describes the reaction product of 2,4-D, choline hydroxide, a surfactant and water to form a "herbicide" and its use to eradicate broad-leaved weeds. Accordingly, when I consider the disclosure in **PMH-9** (**D2**) against the claims it is my view all the integers of at least claims 1 to 4 and 7 to 13 are found in this prior art reference. Now produced and shown to me and marked **PMH-11** is a Table summarising my conclusions.

DD203677 in the name of Schilling (Publication date: 2 November 1983) – D1 to the Schedule

144. Now produced and shown to me and marked **PMH-12** is a copy of the English translation of D1.

145. PMH-12 describes its primary object as being to *"improve the proportion of economically relevant harvest products in the total biomass (harvest index)"* (see page 4, first paragraph). PMH-12 describes the treatment of cultivated plants with solutions which contain, in addition to choline (and optionally ethanolamine), 2-4-D or esters thereof and/or dichloroisobutyric acid or salts thereof and conventional auxiliary substances and carrier substances (pages 1 and 4).

146. Example 2 describes *"medium combinations"* being sprayed as *"aqueous solutions"* onto dry plant crops (page 6) with Table 2, the body of which is set out on page 7, containing three entries referring to data obtained from application of combinations of *"choline"* (given the label (I)) and 2,4-D (given the label (III)).

147. It is my view that the reference to "choline" in PMH-12 means choline hydroxide. As stated above in paragraph 130, it is well known in the field that choline does not exist as a separate entity - it is always present as an ion and therefore as a salt. Therefore in my opinion a reference to "choline" absent a

qualifying description of its salt form is a reference to "choline hydroxide". This is consistent with the definition of "choline" in documents D8 to D12.

148. Further "Tables 1 and 2" of D1, in the original German document, reference "Cholin" as one of the active ingredients. Page 720 of *Beilstein Handbuch der Organische Chemie* defines "Cholin" as *"Trimethyl-[β-oxy-äthyl]-ammonium hydroxid"* with the chemical structure "$C_5H_{15}O_2N = (CH_3)_3N(OH)CH_2CH_2OH$" (see D25). At the time D1 was published *Beilstein Handbuch der Organische Chemie* was the definitive reference for chemistry in the German language. This is further affirmed by the dictionary definition of "Cholin" in RÖMPP CHEMIE LEXIKON (see **D27** to the Schedule). Both these references demonstrate that the reference to "Cholin" in D1/ "Choline" in PMH-12 means choline hydroxide.

149. Table 2 of PMH-12 shows that the four combinations that comprise both choline hydroxide and 2,4-D alter the relative ratio of Beet:Leaf of the sugar beet treated with these aqueous solutions, whereby the amount of the (non-yielding and hence undesirable) leaf is reduced relative to that of the (commercially valuable, yielding and hence desired) beet when compared with the control plants. The selective down regulation of the non-yielding portion of the plant (leaves) allows more energy and nutrients to be made available to the yielding "harvest product" portion (beet). This consideration is consistent with the use of the substances in the formulations of D1, such as 2,4-D and 2,4-D choline (hydroxide), and is also consistent with the application of herbicides in agriculture generally.

150. This is also consistent with the teachings in the opposed Patent Application with respect to the term "herbicide". Page 4, lines 13 to 19 of the opposed Patent Application defines the term "herbicide" to mean *"an active ingredient that kills, controls, or otherwise adversely modifies the growth of plants. An herbicidally effective or vegetation controlling amount is an amount of active ingredient which causes an adversely modifying effect and includes deviations from natural development, killing, regulation, desiccation, retardation, and the like. The terms plants and vegetation included germinant seeds, emerging seedlings and established vegetation."* From this

definition, it is clear to me that the term "herbicide" is not to be understood as an ingredient that kills the unwanted vegetation but rather controls or otherwise adversely modifies its growth and therefore in addition to "killing", the herbicidal effect may be "non-lethal" such as "causing deviation from natural development, regulation desiccation, retardation and the like" and therefore the selective toxicity demonstrated in D1 is the same as what is contemplated by the method of claims 12 and 13 of the opposed Patent Application. 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.

151. PMH-12 (D1) describes mixing ratios of the choline, and 2,4-dichlorophenoxy carboxylic acids of 1:1 (see page 1) for direct application to crops.

152. Accordingly, when I consider the disclosure in **PMH-12** (D1) against the claims of the opposed Patent Application it is my view all the integers of at least claims 1 to 4 and 7 to 13 are found in this prior art reference.

COMPARISON OF THE PATENT APPLICATION AND THE PRIOR ART - SUMMARY

D28 to the Schedule

153. For the reasons provided in paragraphs 104 to 110 a herbicidal compound comprising the reaction product produced by the process of combining 2,4-D and (tetraalkyl)ammonium hydroxide of the formula as provided for in claims 1 and 3 (and dependant claims 2, 4 and 6) to produce the herbicidal compound was already described in D28 and there is certainly nothing new about this herbicidal compound.

154. As noted above in paragraphs 104 and 105, D28 describes the quaternary derivative of 2,4-D (see page 5, lines 22 to 31 and claim 25) Example III

provides a mode of preparation whereby the tetramethylammonium salt of 2,4-D is prepared by adding *"a solution of tetramethylammonium chloride (2.8 g.; 0.026 mole) in ethanol (20 cc.) to a refluxing solution of the sodium salt of 2,4-dichlorophenoxyacetic acid (6.2 g.; 0.026 mole) in ethanol (200 cc.)*" in a 1:1 molar ratio and refluxing for 2 hours. D28 describes a two stage "isolation" procedure wherein sodium chloride is precipitated and removed from the ethanol reaction solvent by filtration and then the ethanol reaction solvent is removed by evaporation. The melting point of the tetramethylammonium salt of 2,4-D is reported as being 212-214 C, which is within the melting point range reported for compound 1a in Table 1 on page 10 of the opposed Patent Application.

155. Further D28 describes R^1, R^2, R^3 and R^4 all being the *"same or different"* and each representing a "methyl" group (e.g. tetramethylammonium) or an "ethyl group" (see claims 23 and 25). In addition D28 describes two preparation methods for the benzonitrile herbicide which could equally be used to produce a 2,4-D herbicide derivative including (a) a double decomposition reaction of a soluble salt (e.g. sodium) of the herbicide with a quaternary ammonium salt of the formula $R_1R_2R_3R_4N^+,Y^-$ where Y is an anion such as chloride and bromide and (b) reaction of the herbicide with a quaternary ammonium hydroxide of the $R_1R_2R_3R_4N^+,OH^-$. Accordingly it is my view that there is nothing new in the herbicidal compound of claims 1 and 3 (and dependant claims 2, 4 and 6).

156. D28 also describes a quaternary ammonium derivatives of 2,4-D and benzonitrile in an admixture with at least one compatible diluent and/or surface active agent (see claim 5). As noted above in paragraph 105 the diluent is described on page 3, lines 23 as being *"a liquid such as water or an animal, vegetable or mineral oil; or a solid, both liquid and solid compositions optionally containing a surface active agent"*. Page 3, lines 57 to 61 provides examples of suitable solid diluents as including "aluminium silicate, talc, calcined magnesia, powered cork, absorbent carbon black and clays such as kaolin or bentonite" and lines 82 to 89 on page 3 provides examples of suitable liquid diluents. These are described as including "*water (which is preferred), tetrahydrofurfuryl alcohol, acetophenone,*

cyclohexanone. Isophorone, dimethylformamide, methylcellosolve (the monomethyl ether of ethylene glycol), toluene, xylene" etc. A number of examples of possible surface active agents are described on page 3, lines 40 to 56. D28 also describes the herbicidal composition containing a quaternary ammonium derivative of 2,4-D and quaternary ammonium benzonitrile derivative in an admixture which takes the form of liquid concentrates which are diluted with water to give compositions ready for use (see page 5, lines 32 to 35) Accordingly, it is my view that there is nothing new about the herbicidal composition of claim 8 or claim 9.

157. Likewise D28 describes the herbicidal composition of claims 10 and 11. Specifically D28 describes the aqueous herbicidal concentrate of Example III as containing 27% (total phenol and acid equivalent) weight by volume of the active ingredient. Claim 27 describes the aqueous concentrate containing at least 25% total phenol and acid equivalent) weight by volume of the herbicidally active quaternary ammonium salts of benzonitrile and 2,4-D. Page 2, lines 10 to 12 has the aqueous concentrate containing 40% w/v (as the phenol).

158. The herbicidal composition of D28 is described as being applied to a crop-growing grass, sugar-cane, cereal, a legume, flax, linseed, onions or a cruciferous crop at a rate sufficient to control the growth of weeds without causing substantial permanent damage to the crop (claim 32). D28 also describes the directional application of the herbicidal composition to a crop-growing area containing broad-leafed weeds that are sensitive to the composition containing the quaternary ammonium salts of 2,4-D (page 3, lines 3 to 9 and claim 30). Accordingly it is my view that there is nothing new about the methods of claims 12 and 13.

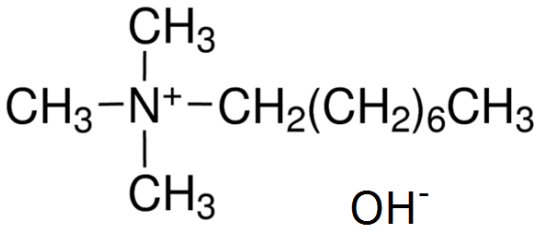
D24 to the Schedule

159. For the reasons provided in paragraphs 111 to 116 a herbicidal compound comprising the reaction product produced by the process of combining 2,4-D and (tetraalkyl)ammonium hydroxide of the formula as provided for in claims 1 and 3 (and dependant claims 2 and 4) to produce the herbicidal compound

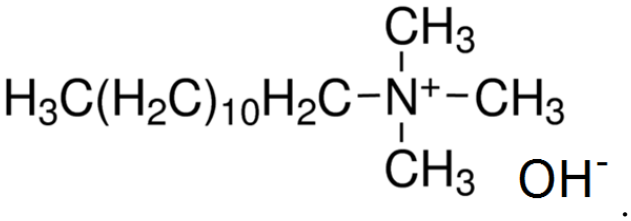
was already described in D24 and there is certainly nothing new about this herbicidal compound.

160. As noted above in paragraph 111, D24 describes a herbicidal composition being the reaction of an aliphatic amine having at least 6 carbon atoms in an aliphatic radical thereof with a plant hormone carboxylic acid such as 2,4-D to form the salt. Column 2, lines 26 to 33 describes the *aliphatic amine "involved in the present invention"* as including *"quaternary amines and quaternary compounds", such as trimethyloctylammonium hydroxide and trimethyldodecylammonium hydroxide"*. D24 further describes the process of producing the herbicidal compositions by mixing the amine and the carboxylic acid in a "*solvent and warmed until a homogenous solution is obtained and then cooled until precipitation of the desired salt is complete, after which it may be filtered and dried"* (see column 2 lines 42 to 45). Specifically examples 1 to 5 show the reaction product being cooled to precipitate the salt which is then followed by filtration and drying.

161. As noted above in paragraphs 110 and 111 the quaternary ammonium compound trimethyloctylammonium hydroxide has a structure of



and the structure of the quaternary ammonium compound trimethyldodecylammonium hydroxide is:



162. US 2,900,411 clearly, at the very least, instructs me to prepare a herbicidal composition by mixing 2,4-D with either trimethyloctylammonium hydroxide

or trimethyldocylammonium hydroxide. Accordingly it is my view that there is nothing new in the herbicidal compound of claims 1 and 3 (and dependant claims 2, 4 and 5).

163. D24 further describes the resulting composition being readily "dispersed or suspended in water or other media for easy application to crops or soil" (see column 1, lines 64 to 66 of D24). Accordingly it is my view that there is nothing new in the herbicidal composition of claim 8.

164. Example 9 of D24 has the active ingredient 2,4-D present in an amount of 26.8%. Accordingly it is my view that there is nothing new in the herbicidal composition of claims 10 and 11.

165. D24 also describes the development of herbicidal compositions so that they can be selectively applied to weed infested areas to eradicate the noxious vegetation, while at the same time leaving the desirable plants unharmed. Accordingly it is my view that there is nothing new about the methods of claims 12 and 13.

D3 to the Schedule

166. For the reasons provided in paragraphs 117 to 123 a herbicidal compound comprising the reaction product produced by the process of combining 2,4-D and (tetraalkyl)ammonium hydroxide of the formula as provided for in claims 1 and 3 (and dependant claims 2, 4 to 6) or 2,4-D and choline hydroxide having the formula as provided for in claim 7 to produce the herbicidal compound was already described in D3 and there is certainly nothing new about this herbicidal compound.

167. As noted above D3 describes a herbicidal composition being the result of mixing or combining a herbicidally active compound such as 2,4-D acid and a quaternary ammonium salt wherein the radicals R, R_1, R_2 and R_3 may be selected from *"alkyl (more desirably lower alkyl containing from 1 to 6 carbon atoms), hydroxyl-substituted alkyl (most desirably hydroxy-substituted lower alkyl containing from 1 to 6 carbon atoms) and alkoxy groups having one to six carbon atoms, ammonium and alkali metal salts"*

(page 2, lines 103 to 113 of D3) and the resulting mixture being "*dissolved in an aqueous or polar liquid carrier, and upon evaporation of the carrier"* being capable of remaining as a liquid for an extended period of time (page 2, lines 72 to 78 of D3). As stated above it is my view that the reference to "hydroxyl-substituted alkyl" in D3 would, without a doubt, include choline hydroxide. Accordingly, it is my view there is nothing new in the herbicidal compound of claims 1, 3 and 7 (and dependant claims 2 and 4).

168. D3 also describes the herbicidal composition being miscible in a polar liquid carrier such as water and/or a non-aqueous liquid carrier known in the art for application to the locus of the undesirable vegetation to be controlled (see page 4, lines 24 to 53 of D3). Specifically D3 states at page 4 lines 24 to 36:

> *As it was previously outlined, a characteristic of the herbicidal compositions of the present invention is that the mixture of salts forming the active ingredients thereof, is miscible in a polar liquid carrier. To this end, the individual salts, or the resulting combination of two or more salts, are chosen so as to have this property for a selected polar liquid carrier. Most preferably and advantageously, the polar liquid carrier is water; if, however, the polar liquid carrier is a non-aqueous medium, it may be mixed with water subsequently.*

169. D3 also describes at page 5, lines 24 to 28 the addition of a surfactant and *"other conventional expedients commonly employed in the art … for example one or more chelating agents"*. Page 4, lines 92 to 122 of D3 makes it clear that the addition of one or more surfactants to the composition to *"impart the required surface tension characteristic"* and are commercially available. Accordingly it is my view that there is nothing new about the herbicidal composition of claim 8.

170. Likewise D3 describes the herbicidal composition of claims 9 to 11. Specifically page 3 line 130 to page 4, line 23 makes it clear that the herbicidal composition may contain a mixture of two or more different salts in varying amounts by weight such as from 25 to 75% and *"most desirably in a 50:50 percent by mixture*" (page 4, lines 15 and 16). The disclosure on page 3, lines 52 to 72 of D3 makes it clear that the particular acid or combinations of acids

are chosen *"primarily on the activity and spectrum of selectivity for controlling undesired vegetation"* and includes derivatives of phenoxy acids such as 2,4-D and derivatives of benzoic acids. Accordingly, it is my view that there is nothing new about the herbicidal composition of claim 9, 10 and 11.

171. D3 describes in general terms the application of the herbicidal compositions to a locus in *"varying dosages depending on the type of undesired vegetation and the active ingredients in the compositions"* using techniques that are well known to those skilled in the art. Specifically page 6, line 17 to 21 states that the compositions are used to "*control undesired weeds in cereal crops and brush control work"*. The examples of D3 demonstrate the compositions being used to control undesired weeds in cereal crops and brush control work and their biological effectiveness in preventing the re-emergence of any unwanted vegetation but at the same time causing no injury to the nearby sensitive crops. Accordingly, it is my view that there is nothing new about the methods of claims 12 and 13.

D2 to the Schedule

172. For the reasons provided in paragraphs 125 to 143 a process of combining 2,4-D and (tetraalkyl)ammonium hydroxide of the formula as provided for in claims 1 and 3 (and dependant claims 2 and 4) or 2,4-D and choline hydroxide having the formula as provided for in claim 7 to produce the herbicidal compound was already described in D2 and there is certainly nothing new about this herbicidal compound.

173. The composition of "practical embodiment 1" of **PMH-9** (D2) is a herbicidal compound comprising the reaction product of a herbicidal carboxylic acid (2,4-D) and a (tetraalkyl)ammonium hydroxide (choline hydroxide, conventionally referred to in the art as choline). It is understood that the choline cation has the formula $(CH_3)_3N^+(CH_2)_2OH$ and therefore it has the formula as recited in claim 2 whereby R^1, R^2 and R^3 are each C_1 alkyls (CH_3) and R^4 is a C_2 alkyl substituted with a hydroxy substituent as well as the formula as recited in claim 4 in which R^1, R^2 and R^3 are CH_3 and R^4 is C_2 alkyl. Choline hydroxide therefore falls within the definition of the

(tetraalkyl)ammonium hydroxide in claim 1 and claim 7 explicitly recites choline hydroxide.

174. For the reasons given above I do not believe that there is anything new about the herbicidal compound of any one of claims 1 to 4 or 7.

175. As discussed above "practical embodiment 1" on page 6, lines 1 to 6 of **PMH-9** (D2) describes the preparation of herbicidal composition comprising the addition of 40 parts by weight of 2,4-D to 22 parts by weight of choline hydroxide, a surfactant and water. The surfactant is Sorvol 8043 (polyoxyethylene alkylallyl ether) in the amount of 3 parts per weight, and water in an amount of 35 parts by weight. This herbicidal composition is equivalent to the herbicidal composition of claim 8 and therefore it is my view that this claim is simply not new.

176. Likewise the use of two or more herbicides or the active ingredient being in a specific concentration as defined in claims 9 to 11 is simply not new in light of the disclosure in PMH-27 (D2). The Practical embodiments on page 6 clearly have the phenoxy compound 2,4-D being present in an amount within the scope of claims 10 and 11 and **PMH-9** (D2) contemplates the use of more than one phenoxy compound in the herbicide composition.

177. It is my view that there is nothing new about the methods of claims 12 and 13 directed to controlling undesirable vegetation. As noted above **PMH-9** (D2) describes the selective use of a phenoxy-based herbicide that contains choline hydroxide *"for the eradication of broad-leaved weeds"* which *"rapidly penetrates the epidermal cells of the plants and reaches the site of action, rapidly killing the broad-leaved weed, while at the same time greatly reducing the risk of chemical damage to the crop"*.

178. As previously stated in paragraph 131 the herbicide of "practical embodiment 1" of **PMH-9** (D2) 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 (see page 7). The data in Table 2 on page 8 shows that, at a concentration of 300 or 1000ppm and after 17 days, the 2-4,D formulation containing choline hydroxide was highly effective in

eradicating the Daikon and beans but at the same time it did not cause any chemical damage to the nearby maize or wheat crops.

179. In my view the results of Table 2 shows that the choline salt of 2,4-D provided an improved herbicidal effect especially when I compare these with the results obtained for the sodium salt of 2,4-D. Specifically, comparing "practical embodiment 1" with the corresponding formulation with the sodium salt of 2,4-D, I note that at 1000ppm both formulations have the same effect in against the unwanted Daikon and bean plants however, the sodium salt also has unwanted activity against the nearby cereal crops. In addition I note that at 300ppm and 1000ppm, there was no chemical damage to the cereal crops with either the choline or sodium salts of 2,4-D, however the sodium salt formulation was less effective against the unwanted bean plants.

180. Accordingly **PMH-9** (D2) describes a method of controlling undesirable vegetation (Daikon and beans) comprising contacting the vegetation with an herbicidally effective amount of a compound/composition falling within the scope of any one of claims 1 to 11 being the reaction product of 2,4-D and choline hydroxide and therefore claims 12 and 13 are simply not new.

D1 to the Schedule

181. As stated above in paragraphs 145 to 151, there is simply nothing new about the claims of the opposed Patent Application in light of D1. This document discloses a product of 2,4-D and a (tetraalkyl)ammonium hydroxide of choline hydroxide. Therefore claims 1 to 4 and 7 are not novel.

182. Likewise the herbicidal composition of claim 8; the use of one or more other herbicides as defined in claim 9 or the active ingredient being in a specific concentration as defined in claims 10 and 11 are not new in light of the disclosure in **PMH-12** (D1). D1 discloses compositions containing the reaction product of 2,4-D and choline hydroxide together with *"conventional auxiliary and carrier substances*" (see page 8 of **PMH-12**).

183. As stated on page 4, lines 2 to 4 of **PMH-12** the primary object of D1 is to "improve the proportion of economically relevant harvest products in the total

biomass (harvest index)". D1 describes the treatment of cultivated plants with solutions which contain, in addition to "choline" (and optionally ethanol amine), 2,4-D or esters thereof and/or dichloroisobutyric acid or salts thereof, and conventional auxiliary substances and carrier substances (see page 1, lines 10 to 16 and page 4, lines 11 to 18).

184. Example 2 on page 6 describes "medium combinations" being sprayed as "aqueous solutions" onto dry crop plants, with Table 2 containing three entries referring to data obtained from the application of combinations of "choline" (given the label (1)) and 2,4-D (given the label (III)). As stated above in paragraph 84 the results in this Table show that the four combinations that comprise both choline hydroxide and 2,4-D alter the relative ratio of Beet:Leaf of the sugar beet treated with these aqueous solutions, whereby the amount of the (non-yielding and hence undesirable) leaf is reduced relative to that of the (commercially valuable, yielding and hence desired) beet (row 1 of Table 2) when compared with the control plants. Thus, D1 discloses a method of controlling undesirable vegetation (i.e. the leaves of sugar beet), comprising contacting the leaves of sugar beet or their locus with the aqueous solutions of four combinations comprising choline hydroxide and 2,4-D and therefore the methods of claims 12 and 13 are not new.

Obviousness in light of the Common General Knowledge in Combination with Information disclosed in a Prior Art Document

185. After setting out my opinions in relation to what was common general knowledge before 26 February 2007 in paragraphs 94 to 103 above, I was asked to further consider the issue of inventive step in the context of reading a different way. I was provided with several prior art documents. I was then asked to consider whether, in my opinion, the invention disclosed in the opposed Patent Application did not involve an inventive step as at 26 February 2007 in light of the common general knowledge at that time together with the contents of any of those prior art documents considered. In providing my response, I was asked to identify which part or parts of the prior art documents I could have combined with the common general knowledge to

reach the conclusion that the invention disclosed in the Specification of the opposed Patent Application did not involve an inventive step as at 26 February 2007.

Common general knowledge + D28 to the Schedule

186. GB 1,056,235 (**D28**) is relevant because it is directed to herbicidal carboxylic acids and addresses the problem of volatility/crop damage to sensitive crops.

187. May and Baker Ltd, which was part of the Rhone-Poulenc group, was a significant player in the agrochemical industry particularly in the 1960s with manufacturing sites in Sweet Briar Road, Norwich, Barton Moss in Manchester and Belvedere in Kent, a research station at Ongar in Essex and a Head Office at Regent House in nearby Brentwood. Nufarm acquired the May and Baker manufacturing facility at Belvedere, Kent in 1994.

188. As noted above in paragraph 12, the text "Phenoxyalkanoic Herbicides" has been in my possession since 1988 and is one of the well-known references that I have regularly referred to throughout my career. May and Baker Ltd's Netherlands Patent 6,506,449, which is the counterpart of D28, is referenced in the section in "Phenoxyalkanoic Herbicides" text relating to Amine Salts as footnote "214" (see paragraph 55 above). I became aware of this patent as a result of my review of this section of the text.

189. I have concluded that D28 anticipates at least claims 1 to 4 and 6 to the extent that this Patent describes the routine steps of obtaining the tetramethylammonium salt of 2,4-D which is used as the *"starting material"* in the Example III preparation and to the extent that the patent describes the quaternary derivative as having R_1 to R_4 being *"the same or different and each representing a methyl or ethyl group"* (see page 5, lines 22 to 31 and claims 23 and 25 of D28). In addition D28 describes two preparation methods for the benzonitrile herbicide which could equally be used to produce the 2,4-D herbicide derivative including (a) a double decomposition reaction of a soluble salt (e.g. sodium) of the herbicide with a quaternary ammonium salt of the formula $R_1R_2R_3R_4N^+,Y^-$ where Y is an anion such as chloride and bromide and

(b) reaction of the herbicide with a quaternary ammonium hydroxide of the $R_1R_2R_3R_4N^+,OH^-$.

190. I have further concluded that D28 describes:

a. the importance of producing a herbicidal composition which can be applied at a rate such that the neighbouring crops do not suffer substantial damage;

b. herbicidal composition containing a quaternary ammonium derivatives of 2,4-D and benzonitrile and in an admixture with at least one compatible diluent and/or surface active agent;

c. a herbicidal composition wherein the concentration of active ingredients in the composition is at least 25% by weight;

d. the directional application of a herbicidally effective amount of the composition to control undesired vegetation growing in crop-growing areas such as plantations, orchards and vineyards containing broad-leafed weeds without causing substantial permanent damage to the crop; and

that as a result and in addition to claims 1 to 4 and 6 all the integers of claims 8 to 13 are found in this document (see **PMH-6**).

Claim 5

191. As to dependent claim 5 I have already stated quaternary ammonium compounds including benzyltrimethylammonium hydroxide and hexadecyltrimethylammonium hydroxide were commercially available well before February 2007. Accordingly when considering the disclosure in D28 in light of the common general knowledge I would not regard there to be anything inventive in the choice of these particular quaternary ammonium compounds and therefore I regard claim 5 to be obvious.

Claim 7

192. As to independent claim 7 as noted above the phenoxy herbicide 2,4-D was known well and in widespread use in Australia and overseas before February 2007 as was quaternary ammonium compound choline hydroxide. It was also widely known and understood well before February 2007 that stoichiometric quantities of an amine could be reacted with 2,4-D acid in a compatible solvent to form the corresponding salt. The text "Phenoxyalkanoic Herbicides" (**D33** to the Schedule) published in 1981 describes there being *"an enormous patent literature"* concerning amine salts of 2,4-D and that the techniques commonly used to formulate *"amine salts of 2,4-D"* were standard in the laboratory and extremely straightforward. Accordingly when I consider the disclosure in PMH-18 (which includes a specific procedure to synthesize and isolate the tetramethylammonium salt of 2,4-D) in light of the common general knowledge, I would not regard there to be anything inventive in the herbicidal compound produced by the process of combining two known ingredients and to produce the resulting product. I therefore regard claim 7 to be obvious.

Claim 14 and 15

193. As to method claims 14 and 15 as already noted it was certainly known to use herbicidal compounds/compositions to kill or control undesirable vegetation by application of an herbicidal amount of the compound to the vegetation or to the locus of the vegetation as well as to the soil prior to emergence of the vegetation. This was certainly common practice in Australia as is evident from various articles published before February 2007 such as *"Phenoxy Reference Guide"* 2005 (see pages 16 to 18 of **D21**); the APVMA 2006 Preliminary Review Findings Report (**D29**) and Agnote 2004 (**D7**). It was also widely known that it was possible to induce tolerance or resistance in crops whether through genetic manipulation or selective breeding to reduce the level of damage from accidental spray drift and this was certainly done before February 2007 (see **D35** in respect of cotton). Also as mentioned the AMICIDE 625 label (**D16**) shows wheat as tolerant to 2,4-D, being a crop over which 2,4-D is applied. Accordingly when considering the disclosure in D28

in light of the common general knowledge I would not regard there to be anything inventive in the application of known herbicidal compounds/compositions to kill or control undesirable vegetation in a crop that has been made tolerant or resistant to 2,4-D. I therefore regard claims 14 and 15 to be obvious.

Common general knowledge + D24 to the Schedule

194. US 2,900,411 (**D24**) is relevant because it is directed to herbicidal carboxylic acids and addresses the problem of volatility/crop damage to sensitive crops.

195. I am aware that Armour & Company was very active in 1950-1960s and held a number of patents relating to herbicides specifically 2,4-D.

196. As noted above in paragraph 12, the text "Phenoxyalkanoic Herbicides" has been in my possession since 1988 and is one of the well-known references that I have regularly referred to throughout my career. As noted above in paragraph 57, D24 is referenced in the section in "Phenoxyalkanoic Herbicides" text relating to Amine Salts as footnote "189". I also note that this particular patent is referred to on page 2, lines 30 to 44 of GB 1339315 in the Ciba-Geigy Canada Ltd being **D3** to the Schedule.

197. I have concluded that D24 describes:

a. the development of herbicidal compositions which may be selectively applied to weed infested areas to eradicate the noxious vegetation, while at the same time leaving the desirable plants unharmed;

b. a herbicidal composition being the reaction product of an aliphatic amine having at least 6 carbon atoms in an aliphatic radical thereof with a plant hormone carboxylic acid such as 2,4-D to form the salt;

c. the aliphatic amine as including *"quaternary amine and quaternary compounds, such as trimethyloctylammonium hydroxide and trimethyldodecylammonium hydroxide"*. The patent clearly, at the very least, instructs me to prepare a herbicidal composition by

mixing 2,4-D with either trimethyloctylammonium hydroxide or trimethyldocylammonium hydroxide;

d. the resulting compositions as being used in large scale agriculture, such as in corn farming, where they can be spread on the soil of a field seeded with corn to *"prevent the growth of weeds for a sufficient length of time to enable the corn to grow tall and strong enough to develop to maturity unaffected by weeds"*;

e. the resulting composition being readily "dispersed or suspended in water or other media for easy application to crops or soil" (see column 1, lines 64 to 66);

f. the active ingredient being present in an amount of 26.8 (see Example 9);

g. the process of producing the herbicidal compositions by mixing the amine and the carboxylic acid in a "*solvent and warmed until a homogenous solution is obtained and then cooled until precipitation of the desired salt is complete, after which it may be filtered and dried"* (column 2 lines 42 to 45 of PMH-18); and

that as a result all the integers of at least claims 1 to 4, 5, 8 and 10 to 13 are found in this document (see **PMH-7**).

Claim 5 and 6

198. As to dependent claims 5 and 6 I note that an aliphatic amine having at least 6 carbon atoms in an aliphatic radical would include hexadecyl and I have already stated quaternary ammonium compounds such as tetramethylammonium hydroxide, benzyltrimethylammonium hydroxide, and hexadecyltrimethylammonium hydroxide were commercially available well before February 2007 and in fact the reference to trimethyloctylammonium hydroxide and trimethyldodecylammonium hydroxide in D24 is by way of example of the type of quaternary compounds contemplated. Accordingly when considering the disclosure in D24 in light of the common general knowledge I would not regard there to be anything

inventive in the choice of these particular quaternary ammonium compounds over any of the specific quaternary compounds cited in D24 and therefore I regard these claims to be obvious.

Claim 7

199. As to independent claim 7 as noted above the phenoxy herbicide 2,4-D was known well and in widespread use in Australia and overseas before February 2007 as was quaternary ammonium compound choline hydroxide. It was also widely known and understood well before February 2007 that stoichiometric quantities of an amine could be reacted with 2,4-D acid in a compatible solvent to form the corresponding salt. The text "Phenoxyalkanoic Herbicides" (**D33** to the Schedule) published in 1981 describes there being *"an enormous patent literature"* concerning amine salts of 2,4-D and that the techniques commonly used to formulate *"amine salts of 2,4-D"* were standard in the laboratory and extremely straightforward. Accordingly when I consider the disclosure in D24 (which includes a procedure to synthesize the quaternary ammonium salt of 2,4-D) in light of the common general knowledge, I would not regard there to be anything inventive in the herbicidal compound produced by the process of combining two known ingredients. I therefore regard claim 7 to be obvious.

Claim 9

200. As to dependent claim 9 as noted above it was common practice before February 2007 to use one or more other herbicides to improve the herbicidal effect of the formulation in controlling weeds particularly in circumstances where it was known that certain broad-leafed weeds were resistant to certain herbicides and not others. At Nufarm we often used formulations which contained two or more herbicides in the one formulation. One such example is Nufarm's herbicidal composition Tillmaster comprising the isopropylamine salt form of 2,4-D and glyphosate (**D37** to the Schedule). Accordingly when I consider the disclosure in D24 in light of the common general knowledge, I would not regard there to be anything inventive in the herbicidal composition of claim 8 further comprising one or more other herbicides and I therefore regard claim 9 to be obvious.

Claims 10 and 11

201. Whilst I have concluded that Example 9 of D24 has the active ingredient at 26.8% there is nothing magical in the particular "percent by weight" concentrations of the active ingredients stipulated in claims 10 and 11. GB 1,056,235 describes it as being "known" at least before 1967 (when the patent was published) for the concentrates of the herbicidal active ingredient to contain *"at least 25% w/v ..., preferably at least 40% w/v"* (page 1, lines 24 to 27 of **D28** to the Schedule). GB 1,056,235 describes the subject herbicidal compositions as containing *"0.05 to 90% by weight"* of the active ingredient (see page 3 lines 35 to 37 of **D28** to the Schedule) and when the compositions contain two herbicides *"at least 25% w/v of the active ingredient or ingredients"* (see page 5 lines 36 to 38 of **D28**). Likewise, the Nufarm AMICIDE 625-Low Selective Herbicide (**D16**) has the active ingredient 2,4-D at a concentration of 48.34% by weight and Nufarm's Tillmaster herbicide has the active ingredients of 2,4-D and glyphosate at a concentration of 15.36% by weight and 7.68% by weight respectively. Accordingly when I consider the disclosure in D24 in light of the common general knowledge, I would not regard there to be anything inventive in the herbicidal composition of claims 10 and 11.

Claim 14 and 15

202. As to method claims 14 and 15 as already noted it was certainly known to use herbicidal compounds/compositions to kill or control undesirable vegetation by application of an herbicidal amount of the compound to the vegetation or to the locus of the vegetation as well as to the soil prior to emergence of the vegetation. This was certainly common practice in Australia as is evident from various articles published before February 2007 (see pages 16 to 18 of **D21, D29** and **D7**). It was also widely known that it was possible to induce tolerance or resistance in crops whether through genetic manipulation or selective breeding to reduce the level of damage from accidental spray drift and this was certainly done before February 2007 (see **D36** in respect of cotton). Also as mentioned the AMICIDE 625 label (**D16**) shows wheat as tolerant to 2,4-D, being a crop over which 2,4-D is applied. Accordingly when

considering the disclosure in D24 in light of the common general knowledge I would not regard there to be anything inventive in the application of known herbicidal compounds/compositions to kill or control undesirable vegetation in a crop that has been made tolerant or resistant to 2,4-D. I therefore regard claims 14 and 15 to be obvious.

Common general knowledge + D3 to the Schedule

203. GB 1339315 (**D3**) is relevant because it is directed to herbicidal carboxylic acids and addresses the problem of volatility/crop damage to sensitive crops.

204. Ciba Geigy was known to be a significant player in the pesticide industry well before February 2007. It is an antecedent of Syngenta.

205. I became aware of this patent following a search, for a unrelated project, for 2,4-D where the two more amine bases are used to form the "mixed salt". The patent was located when the files for the unrelated project were digitised for filing.

206. I have concluded that D3 describes:

a. the principal objective being to produce a "non-volatile" form of a herbicidal composition having a performance equal to or better than the corresponding esters of the same herbicidal acids (see page 5, lines 71 to 92 of D3);

b. a herbicidal composition formed by reacting at least two bases with at least one herbicidally active compound such as 2,4-D to form a mixture of salts. The bases described as being employed are chosen from a number of amine salts including specifically a quaternary ammonium compound wherein the radicals may be selected from *"alkyl, hydroxyl-substituted alkyl and alkoxy groups having one to six carbon atoms, ammonium and alkali metal salts"* (page 2, lines 103 to 113 of D3);

c. the quaternary ammonium compound being choline hydroxide;

d. the resulting mixture of salts being "*dissolved in an aqueous or polar liquid carrier, and upon evaporation of the carrier"* being capable of remaining as a liquid for an extended period of time (page 2, lines 72 to 78 of D3);

e. the herbicidal composition comprising a particular acid or combinations of acids being chosen "primarily on the activity and spectrum of selectivity for controlling undesired vegetation" and includes derivatives of phenoxy acids such as 2,4-D and derivatives of benzoic acids (page 3, lines 52 to 72 of D3);

f. the addition of surfactants to address surface tension requirements (page 4, lines 92 to 121 of D3) and *"other conventional expedients commonly employed in the art … for example one or more chelating agents"* (page 5, lines 24 to 28 of D3);

g. the application of a herbicidally effective amount of the composition to the locus to control undesired vegetation and 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;

h. the importance of producing a herbicidal composition having low volatility to avoid damage to areas adjacent to the locus being treated. The "volatility factor" is unequivocally stated in this document as being a *"critical factor"* (page 2, line 19) in producing a herbicidal composition having a "performance equal to or better than the corresponding esters of the same herbicidal acids" (page 5, lines 89 to 92 of D3); and

that as a result all the integers of at least claims 1 to 13 are found in this document (see **PMH-8**).

Claim 14 and 15

207. As to method claims 14 and 15 as already noted it was certainly known to use herbicidal compounds/compositions to kill or control undesirable vegetation by application of an herbicidal amount of the compound to the vegetation or to the locus of the vegetation as well as to the soil prior to emergence of the vegetation. This was certainly common practice in Australia as is evident from various articles published before February 2007 (see pages 16 to 18 of **D21, D29** and **D7**). It was also widely known that it was possible to induce tolerance or resistance in crops whether through genetic manipulation or selective breeding to reduce the level of damage from accidental spray drift and this was certainly done before February 2007 (see **D36** in respect of cotton). Also as mentioned the AMICIDE 625 label (**D16**) shows wheat as tolerant to 2,4-D, being a crop over which 2,4-D is applied. Accordingly when considering the disclosure in D3 in light of the common general knowledge I would not regard there to be anything inventive in the application of known herbicidal compounds/compositions to kill or control undesirable vegetation in a crop that has been made tolerant or resistant to 2,4-D. I therefore regard claims 14 and 15 to be obvious.

Common general knowledge + D2 to the Schedule

208. JP51106728 (**D2**) is relevant because it is directed to herbicidal carboxylic acids and addresses the problem of volatility/crop damage to sensitive crops.

209. The Patentee of D2, Mitsubishi Gas Chemical Co, was known to be active in pesticides, particularly in Japanese industry, before 2007. I visited their research facility in Tokyo in 1996.

210. As noted above, I regularly carry out searches for information on herbicides, including 2,4-D in in patents and patent applications filed by third parties, and I have done this since about 1994. I would have located this patent on a database using the search terms “phenoxy” and “choline”.

211. I have concluded that D2 describes:

a. The use of herbicides containing phenoxy compounds including 2,4-D and choline hydroxide to rapidly killing the broad-leaved weed, while at the same time greatly reducing the risk of chemical damage to the sensitive neighbouring agricultural and horticultural crops such as wheat, dry-land rice, maize, direct planting in dry fields, orchards and lawns;

b. the application of a 2,4-D formulation containing 2,4-D and choline hydroxide to the undesirable broad-leaved plants in a cereal (maize/wheat) crop and showed that, after 17 days, the 2,4-D formulation was highly effective against the undesirable broad-leaved plants with there being no green growth of the Daikon and beans and importantly no chemical damage caused to the neighbouring cereal crop (Table 2 on page 8 of **PMH-9**); and

that as a result all the integers of at least claims 1 to 4 and 7 to 13 are found in this document (see **PMH-11**).

Claim 5 and 6

212. As to dependent claims 5 and 6 I have already stated quaternary ammonium compounds such as tetramethylammonium hydroxide, benzyltrimethylammonium hydroxide, and hexadecyltrimethylammonium hydroxide were commercially available and in widespread use well before February 2007. Accordingly when considering the disclosure in D2 in light of the common general knowledge I would not regard there to be anything inventive in a quaternary ammonium compound wherein R^4 is benzyl or hexadecyl (claim 5) or R^1, R^2, R^3 and R^4 are all methyl, ethyl, propyl, or butyl (claim 6) over the use of choline hydroxide as cited in D2 and therefore I regard these claims to be obvious.

Claim 14 and 15

213. As to method claims 14 and 15 as already noted it was certainly known to use herbicidal compounds/compositions to kill or control undesirable vegetation

by application of an herbicidal amount of the compound to the vegetation or to the locus of the vegetation as well as to the soil prior to emergence of the vegetation. This was certainly common practice in Australia as is evident from various articles published before February 2007 (see pages 16 to 18 of **D21, D29** and **D7**). It was also widely known that it was possible to induce tolerance or resistance in crops whether through genetic manipulation or selective breeding to reduce the level of damage from accidental spray drift and this was certainly done before February 2007 (see **D36** in respect of cotton). Also as mentioned the AMICIDE 625 label (**D16**) shows wheat as tolerant to 2,4-D, being a crop over which 2,4-D is applied. Accordingly when considering the disclosure in D2 in light of the common general knowledge I would not regard there to be anything inventive in the application of known herbicidal compounds/compositions to kill or control undesirable vegetation in a crop that has been made tolerant or resistant to 2,4-D. I therefore regard claims 14 and 15 to be obvious.

Common general knowledge + D1 to the Schedule

214. DD203677 (**D1**) is relevant because it is directed to herbicidal carboxylic acids.

215. As noted above, I regularly carry out searches for information on herbicides, including 2,4-D in in patents and patent applications filed by third parties, and I have done this since about 1994. I would have located this patent on a database using the search terms “phenoxy” and “choline”.

216. I have concluded that D1 describes the treatment of cultivated plants with solutions which contain *inter alia* 2-4-D and choline hydroxide as well as conventional auxiliary substances and carrier substances for the selective down regulation of the non-yielding portion of the plant (leaves) so that more energy and nutrients are available to the yielding “harvest product” portion (beet).

217. For the reasons set out above in paragraphs 145 to 151 it is my view all the integers of at least claims 1 to 4 and 7 to 13 are found in this D1.

Claim 5 and 6

218. As to dependent claims 5 and 6 I have already stated quaternary ammonium compounds such as tetramethylammonium hydroxide, benzyltrimethylammonium hydroxide, and hexadecyltrimethylammonium hydroxide were commercially available and in widespread use well before February 2007. Accordingly when considering the disclosure in D1 in light of the common general knowledge I would not regard there to be anything inventive in a quaternary ammonium compound wherein R^4 is benzyl or hexadecyl (claim 5) or R^1, R^2, R^3 and R^4 are all methyl, ethyl, propyl, or butyl (claim 6) over the use of choline hydroxide as cited in D1 and therefore I regard these claims to be obvious.

Claim 14 and 15

219. As to method claims 14 and 15 as already noted it was certainly known to use herbicidal compounds/compositions to kill or control undesirable vegetation by application of an herbicidal amount of the compound to the vegetation or to the locus of the vegetation as well as to the soil prior to emergence of the vegetation. This was certainly common practice in Australia as is evident from various articles published before February 2007 (see pages 16 to 18 of **D21, D29** and **D7**). It was also widely known that it was possible to induce tolerance or resistance in crops whether through genetic manipulation or selective breeding to reduce the level of damage from accidental spray drift and this was certainly done before February 2007 (see **D36** in respect of cotton). Also as mentioned the AMICIDE 625 label (**D16**) shows wheat as tolerant to 2,4-D, being a crop over which 2,4-D is applied. Accordingly when considering the disclosure in D1 in light of the common general knowledge I would not regard there to be anything inventive in the application of known herbicidal compounds/compositions to kill or control undesirable vegetation in a crop that has been made tolerant or resistant to 2,4-D. I therefore regard claims 14 and 15 to be obvious.

OTHER MATTERS

Lack of Utility

220. It is my view that the "invention" as claimed in any claim of claims 1 to 15, lacks utility in that it includes subject matter does not achieve the result promised.

221. As stated above in paragraph 72 the aim of the alleged invention is to provide 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. However claims 1 to 11 encompass embodiments that do not achieve the stated promise. In particular I note from the results of the efficacy testing as presented in Table II of the opposed Patent Application that the substituted tetraalkylammonium salt, Compound 1e being the choline salt of 2,4-D, was shown to have significantly less activity at 68% on Broadleaf Dock (*Rumex obtusifolia*) compared to the commercial control (2,4-D dimethylamine salt) which gave an activity of 77% and the same activity as the commercial control on Kochia (Kochia scoparia) at 86%.

222. Further 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. Page 11, lines 11 to 13 makes it clear that *"percent visual injury assessments were made on a scale of 0 to 100% as compared to the untreated control plants (where 0 is equal to no injury and 100 is equal to complete death of the plant)"*. Thus the most relevant data in Table III shows that at least two of the compositions tested being 2b and 4a, which fall within the scope of claims 1 to 11, do not attain the result promised in the opposed Patent Application of the prevention of injury to neighbouring crops. .

223. In addition, I note that there is no data in Table III for herbicidal compositions produced using a substituted (tetraalkyl)ammonium hydroxide. Accordingly, there is no relevant data showing that the claimed compositions could attain the result promised in the opposed Patent Application.

224. Further I note that the claims of the opposed Patent Application has the effect of excluding (tetramethyl)ammonium salt of 2,4-D. It is not clear to me how the properties of the remaining quaternary ammonium salts of 2,4-D differ from the properties of (tetramethyl)ammonium salt of 2,4-D now excluded especially when I consider the experimental data provided in the opposed Patent Application. If the properties of the claimed herbicidal compounds are that they are (i) at least as active as the commercially used carboxylic acid herbicide salts; and (ii) less volatile so that its use would not damage nearby sensitive crops, this is not borne out by the results reported in opposed Patent Application. This issue is further compounded when the results reported for the excluded herbicidal compound tetramethylammonium salt of 2,4-D as well as the triclopyr quaternary ammonium salts, which do not fall within the scope of claims 1 to 7, are compared with those herbicidal compounds that are considered to part of the invention. It is my view that from the results reported in the opposed Patent Application, the herbicidal compounds of the prior art including the tetramethylammonium salt of 2,4-D and the triclopyr quaternary ammonium salts are no different from the quaternary ammonium salts of 2,4-D that fall within the scope of claims 1 to 7 both in respect to their (a) herbicidal effect and (b) volatility in an enclosed test system.

225. In terms of herbicidal activity I have reproduced Table II of the opposed Patent Application noting that compound 1a (2,4-D tetramethylammonium salt) has been specifically excluded from the claims and compounds 2a to 2c do not fall within the scope of herbicidal compound of claims 1 to 7:

Compound	Treatment number	Rate g a.e / ha	Broadleaf Dock *Rumex obstusifolia*	Kochia *Kochia scoparia*
			%Control	
2,4-D dimethylamine salt	***Commercially used herbicidal salt***	**560**	77	**86**
2,4-D tetramethylammonium salt	**1a *(excluded herbicidal compound - not within the scope of the herbicidal compound of claims of the opposed Patent Application)***	**560**	77	**83**
2,4-D tetraethylammonium salt	1b	560	79	89
2,4-D tetrapropylammonium salt	1c	560	73	83
2,4-D choline salt	1e	560	68	86
Triclopyr triethylamine salt	***Commercially used herbicidal salt***	**560**	**81**	**91**
triclopyr tetramethylammonium salt	**2a *(not within the scope of the herbicidal compound of claims of the opposed Patent Application)***	**560**	**85**	**79**
Triclopyr tetraethylammonium salt	**2b *(not within the scope of the herbicidal compound of claims of the opposed Patent Application)***	**560**	**79**	**88**
triclopyr tetrapropylammonium salt	**2c *(not within the scope of the herbicidal compound of claims of the opposed Patent Application)***	**560**	**79**	**95**

226. The results of above Table show that the excluded compound 2,4-D tetramethylammonium salt and the commercially used dimethylamine salt of 2,4-D had a significantly better herbicidal activity against Broadleaf Dock (*Rumex obstusifolia*) at 77% than compound 1c being 2,4-D tetrapropylammonium salt at 73% and the herbicidal compound of claim 7 - compound 1e (2,4-D choline salt) at 68%. Likewise, the known herbicidal salt triclopyr triethylamine had a significantly better herbicidal activity against Broadleaf Dock (*Rumex obstusifolia*) and Kochia (*Kochia scoparia*) at 81% and 91% respectively compared to quaternary ammonium salt forms of 2,4-D of the alleged invention including relevantly the 2,4-D choline salt.

227. The results of above Table also show that the quaternary ammonium salt forms of the herbicide triclopyr had a significantly better herbicidal activity against both Broadleaf Dock (*Rumex obstusifolia*) and Kochia (*Kochia scoparia*) than the corresponding quaternary ammonium salt forms of 2,4-D. As noted in the above Table the triclopyr quaternary ammonium salts do not fall within the scope of claims 1 to 7.

228. As it stands therefore the claimed herbicidal compounds do not exhibit a herbicidal activity that is in any way as active as the commercially used carboxylic acid herbicide salt or the tetramethylammonium salt of 2,4-D.

229. Further 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. 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.

Lack of Disclosure

230. As noted above Claims 1 to 11 are directed the reaction product produced by the process of combining 2,4-dichlorophenoxyacetic acid and a (tetraalkyl) ammonium hydroxide or hydroxy-substituted tetraalkylammonium hydroxide such as choline hydroxide (claim 7) and a composition thereof. Claims 12 to 15 are said directed to a method for controlling undesirable vegetation in a crop or otherwise by contacting the vegetation or the locus thereof with, or applying to the soil to prevent the emergence of vegetation, a herbicidal compound of any one of claims 1 to 7 or a composition of any one of claims 8 to 11. As it stands the herbicidal compound of claim 1 (and consequentially the composition of claim 11) contemplates and defines two groups of quaternary amines being:

(i) unsubstituted (tetraalkyl)ammonium hydroxides; and

(ii) substituted (tetraalkyl)ammonium hydroxides with one or more substituent selected from the group consisting of halogen, hydroxyl, alkoxy and alkylthio (when regard is given to the definition of "alkyl" on page 2 lines 21 to 27).

However, I note that the compositions tested in Table III were all generated using unsubstituted (tetraalkyl)ammonium salts; specifically tetraethylammonium hydroxide for compositions 1b and 2b and tetramethylammonium hydroxide for composition 4a. No data has been provided in Table III for any herbicidal compositions produced using a substituted (tetraalkyl)ammonium hydroxide such as compositions 1e and 2e of Table I. Therefore, the opposed Patent Application does not provide me with the means necessary to determine whether the invention would work across the scope claimed.

231. Further to compare the volatility of salts included in Table III with other salts encompassed by claim 1 (and consequentially claim 11), it is necessary to determine the vapour pressure of each of the salts of Table III and compare those with the vapour pressures of the other salt of the claim. The test methodology and test temperature must be same for the test salt and the

Table III comparison salts. However, the opposed Patent Application does not provide any data for vapour pressure for any salt of claim 1 or the comparison salts provided in the Examples. To provide this data across the range of (tetraalkyl)ammonium and substituted (tetraalkyl)ammonium salts contemplated by the claims would represent an undue burden. Indeed the experiment described in Table III would need to be replicated for the range of (tetraalky)ammonium and substituted (tetraalkyl)ammonium salts of claim 1. This would present an undue burden.

232. With regard to claim 7 in particular, this claim is directed to a specific embodiment, namely a herbicidal compound comprising the reaction product of 2,4-D and choline hydroxide. However, there is simply no teaching to support the reduced volatility of the herbicidal compound of claim 7. Not only are the data presented in Table Ill on page 13 of the opposed Patent Application in respect of a completely different herbicidal compound, the data *per se* do not support any asserted reduced volatility. As it stands, I could not legitimately extrapolate the results obtained at an artificially high application rate and in a semi-enclosed system as reported in Table Ill to determine whether there is any basis for the asserted activity of the compound of claim 7 at normal application rates and in an open environment as would occur in practice. Indeed, from the data in Table III, I would assume that grapes (and potentially other Vitales plants) are simply less susceptible to herbicides comprising quaternary ammonium salts than they are to herbicides comprising less substituted ammonium salts. For this further reason, the opposed Patent Application does not provide a clear and complete enough disclosure for the invention of claim 7.

233. Further it is my view that the specification is insufficient because the results of the volatility testing as presented in Table III on page 13 do not show or demonstrate that a herbicidal carboxylic acid formed by combining a carboxylic acid herbicide with a choline hydroxide (as defined in claim 7) would be less volatile than the commercially used carboxylic acid herbicide salt. As it stands there is simply nothing to suggest that its use would not damage nearby sensitive crops.

234. The opposed Patent Application is also insufficient because the operating conditions required to perform the method of claims 12 to 15 and required to achieve the selective herbicidal properties have not been provided. In my opinion there are a number of factors which are critical to achieve a herbicidal effect including the application rate, concentration and the like. Indeed, this can be seen from the description, which states that the application rate of 2,4-D is in the range "1-2,000 a.e./ha". I would have to test the herbicide composition across a range of concentrations and application rates for any given crop to see whether the claimed herbicidal activity could be obtained. This would involve a great number of experiments.

235. Further, it is my view that the opposed Patent Application is insufficient because the specification is silent as to how the method of claims 12 to 15 could be reproduced to achieve the selective herbicidal properties purported to be provided. In particular the results of the efficacy testing as presented in Table II of the opposed Patent Application which are said to demonstrate the "control of undesirable vegetation" show that the herbicidal compound of claim 7 i.e. compound 1e being the choline salt of 2,4-D had significantly less activity at 68% on Broadleaf Dock (Rumex obtusifolia) compared to the commercial control (2,4-D dimethylamine salt) which gave an activity of 77% and the same activity as the commercial control (2,4-D dimethylamine salt) on Kochia (Kochia scoparia) at 86%. Accordingly as it stands the opposed Patent Application does not provide me with the means necessary to determine whether the alleged invention would work across the scope claimed and to achieve the desired result without undue burden.

Lack of Best Mode

236. In my opinion the opposed Patent Application does not provide any information as to how the alleged invention can be put into effect and in the absence of all the operating conditions required to perform the method of claims 12 to 15 and required to achieve the selective herbicidal properties purported to be provided.

Lack of Definition

237. As noted above the claims do not define the operating conditions required to perform the method of any one of claims 12 to 15. In particular the claims do not define the conditions required to carry out a method of controlling unwanted vegetation using the reaction product of a herbicidal carboxylic acid and a (tetraalkyl) ammonium hydroxides but at the same time achieving the aim of the invention namely to have a herbicidal carboxylic acid derivative that is at least as active than the commercially used carboxylic acid herbicide salts but less volatile so that its use would not damage nearby sensitive crops.

238. In my view the claims do not define the alleged invention because the claims encompass herbicidal compounds and/or compositions which are not adequately described in the specification and/or demonstrated Examples of the opposed Application. Specifically the efficacy testing as presented in Table II of the opposed Application which is said to demonstrate the so-called "control of undesirable vegetation" shows that the herbicidal compound of claim 7 i.e. compound 1e being the choline salt of 2,4-D had significantly less activity at 68% on Broadleaf Dock (Rumex obtusifolia) compared to the commercial control (2,4-D dimethylamine salt) which gave an activity of 77% and the same activity as the commercial control (2,4-D dimethylamine salt) on Kochia (Kochia scoparia) at 86%.

Lack of Support

239. The data concerning indirect application of the compositions of the opposed Patent Application is found in Table III and it relates to unsubstituted (tetraalkyl)ammonium salts; specifically tetraethylammonium hydroxide for compositions 1b and 2b and tetramethylammonium hydroxide for composition 4a. However, there is no data in Table III for herbicidal compositions produced using a substituted (tetraalkyl)ammonium hydroxide such as choline hydroxide or any other herbicidal compound/composition which falls within the scope of claims 1 to 11.

240. Based on the limited experimental data in the opposed Patent Application and the results provided in Table III it is simply not plausible that I would be able

to legitimately extrapolate the results obtained for composition 1b and be confident that any other herbicidal compound/composition within the scope of any one of claims 1 to 11 would not cause injury to a sensitive crop. Most notably I would not be able to legitimately extrapolate the results reported in Table III to determine whether there is any basis for the asserted activity of the compound of claim 7 wherein the (tetraalkyl) ammonium hydroxide is choline hydroxide.

241. It is my view that method claims 12 to 15 directed to the selective administration of a herbicidal compound/composition to control of undesirable vegetation are not supported by the disclosure in the opposed Patent Application. The results of the efficacy testing as presented in Table II show that the substituted tetraalkylammonium salt, Compound 1e being the choline salt of 2,4-D, was shown to have significantly less activity at 68% on Broadleaf Dock (*Rumex obtusifolia*) compared to the commercial control (2,4-D dimethylamine salt) which gave an activity of 77% and the same activity as the commercial control (2,4-D dimethylamine salt) on Kochia (*Kochia scoparia*) at 86%. It is therefore my view that the claims are not supported by the specification.

Lack of Clarity and Succinctness

242. The open-ended definition of alkyl in the claims is unclear. The structure in Claim 1 and 3 extends well beyond the description at line 21 on page 3 to page 4, line 3 of the opposed Patent Application which limits the (tetraalkyl) ammonium hydroxide structure to one in which:

- R^1, R^2 and R^3 independently represents (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;

- R^4 represents a (C_1-C_{16})alkyl or arylalkyl

- where "alkyl" groups may be substituted by any group including halogen, hydroxy, alkoxy or alkylthio and "arylalkyl" refers to a C_1-C_4 alkyl group substituted with an aryl group (the aryl group being phenyl, indanyl or naphthyl). Further the "aryl" groups may be substituted by halogen, hydroxyl, C_1-C_6 alkyl or C_1-C_6 alkoxy (see page 2, lines 21 to page 3, line 4

of the description). The structure claimed in Claim 1 includes (tetraalkyl)ammonium hydroxides which do not fulfil these limitations. Further, I note that the reference to any two of R^1, R^2 and R^3 represent $-(CH_2)_n-$ where n is an integer from 3-5 is unclear.

243. Claims 1 and 3 are unclear to the extent that it refers to two distinct alternatives:

a) the reaction product formed by the specific method of manufacture consisting of combining 2,4-dichlorophenoxyacetic acid with a (tetraalkyl)ammonium hydroxide and possibly isolating the reaction product, and not by any alternative method of manufacture, or

b) a reaction product defined as the chemical reaction of combining 2,4-dichlorophenoxyacetic acid with a (tetraalkyl)ammonium hydroxide and possibility isolating the reaction product but which could be manufactured by any of the first, second or third methods provided at page 9 of the opposed Patent Application.

244. In this declaration I will assume that the first alternative (a) is appropriate and that only methods 1 and 2 on page 9 of the specification of the opposed Patent Application apply such that the presence of the (tetraalkyl)ammonium hydroxide in the reaction is required however I note that the actual reaction occurring is the same for all three methods (the hydroxide does not take part in the reaction) and such a reaction is already taught by the prior art which describes association of 2,4-D with a tetraammonium cation and their use as herbicides (D1, D2, D3 and PMH-18). I note that there is no difficulty in conducting any of the methods and there does not seem any reason to prefer one over the other.

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

Declared at Harcourt

this 20th day of April 2020

Phillip Hay

(Signature of person making declaration)