Federal Court | Cour fédérale

Date : 20250613

Docket: T-1624-17

Citation: 2025 FC 1078

Ottawa, Ontario, June 13, 2025

PRESENT: Mr. Justice McHaffie

BETWEEN:

MCCAIN FOODS LIMITED

Plaintiff

and

J.R. SIMPLOT COMPANY AND
SIMPLOT CANADA (II) LIMITED

Defendants

JUDGMENT AND REASONS

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I. Overview

[1] The plaintiff, McCain Foods Limited, and the defendants, JR Simplot Company and Simplot Canada (II) Limited [collectively, Simplot] both make and sell french fries. In this bifurcated action, McCain alleges that Simplot infringed its Canadian Patent No. 2,412,841 [the ’841 Patent], prior to its expiry, by treating potatoes with an electric field before cutting them to make french fries.

[2] The ’841 Patent claims a process for treating *vegetables and fruit* before cooking them in order to *reduce their resistance to cutting*. The process involves applying a *high electric field* to the vegetables or fruit under conditions such that the *resulting increase in the temperature* of the vegetables or fruit is *almost zero* or at least *sufficiently low as to not amount to a preheating step*. McCain’s infringement allegations, and Simplot’s defences to them, turn primarily on the construction of these italicized terms, which appear in Claim 1 of the ’841 Patent as its only independent claim. Claim 6, the only other claim at issue, requires the process of Claim 1 to be applied to potatoes before cutting them into strips to make french fries.

[3] Of particular importance is the term *high electric field*. McCain argues the skilled reader of the ’841 Patent would understand this term to include a technology known as pulsed electric field [PEF], in which an electric field of many hundreds or thousands of volts per centimetre (V/cm) is applied in short pulses typically measured in microseconds (µs). On McCain’s construction, Simplot’s potato treatment process, which uses PEF, falls within the claims of the ’841 Patent. Simplot disagrees. It argues, based on the context and language of the ’841 Patent, including the descriptions and experiments disclosed in it, that the term *high electric field* as used

in the ’841 Patent is limited to electric fields of lower strength, that it does not cover PEF technologies, and that it therefore did not infringe the patent.

[4] Alternatively, Simplot argues that if the *high electric field* of the ’841 Patent does include PEF, then the patent was always invalid for a number of reasons, notably insufficiency, overbreadth, lack of demonstrated or soundly predicted utility, lack of novelty, and obviousness. It also contends that the phrase *sufficiently low as to not amount to a preheating step* is ambiguous and raises defences of acquiescence and patent exhaustion based on McCain’s interactions with the company that sold Simplot the PEF systems it uses.

[5] For the reasons set out below, I conclude the person skilled in the art of food process engineering, reviewing Claim 1 in light of their common general knowledge and in the context of the ’841 Patent at its date of publication, would understand the term *high electric field* as used in the claims to refer to electric fields in the range of about 2 to 200 V/cm. That person would have been aware that the term *high electric field* had no known or established definition in the art, and that its meaning would depend on the context it was used. The context of the ’841 Patent includes specific reference to an earlier patent discussing a range of 2 to 200 V/cm, describes experiments in which fields of 45 and 65 V/cm were applied for 3 to 5 seconds, refers to preferred parameters of electric fields of 30 to 75 V/cm being applied for 1 to 10 seconds, and contains only a single reference to PEF technologies, found in the “Background of the Invention” discussion.

[6] The skilled reader would have known that the electric fields of 30 to 75 V/cm discussed by the inventors have substantially different effects on plant cells than the electric fields in the

range of up to 1,000 V/cm (1 kV/cm) or more typically used in PEF. As McCain's own expert argues, they would also have known that PEF and the electric fields used in PEF have effects on plant cells that were understood to be undesirable in the processing of foods for consumption, such as french fries. Based on my assessment of the expert evidence filed by the parties and my review of the patent through the eyes of the skilled reader as informed by that expert evidence, I conclude on balance that the person skilled in the relevant art, reviewing the claims of the '841 Patent in context would not understand them to claim a process applying electric fields more than ten times those discussed by the inventors, in pulses thousands if not millions of times shorter than the shortest application described in the patent. As the parties agree, on this construction, the PEF systems used by Simplot did not infringe the '841 Patent during its lifetime.

[7] I also conclude that, if the *high electric field* of Claim 1 were construed to cover electric fields of the sort used by Simplot, Claims 1 and 6 of the '841 Patent (a) would be invalid as being broader than the invention made or contemplated by the inventors; (b) would be invalid for lacking demonstrated or soundly predicted utility; but (c) would not be anticipated by the one piece of prior art that Simplot argues is anticipatory. Given these findings, I have not needed to address the insufficiency and obviousness grounds of invalidity raised by Simplot or its other defences.

[8] McCain's action is therefore dismissed. As Simplot advised at trial that it was withdrawing its counterclaim, while maintaining its alternative invalidity allegations in defence of the main action, the counterclaim is also dismissed. In accordance with the parties' agreement, for which they are to be commended, costs are payable by McCain to Simplot in the lump sum

amount of C$1,700,000. After considering the parties' submissions on the timing of the costs payment, I will not order that the payment of costs be deferred pending the determination of any appeals.

[9] I thank counsel for the thorough and skillful manner in which the evidence and argument at trial, and the pre-trial steps with which I was involved, were presented. Each party's positions were very ably put forward in a manner focused on the important issues, for which both teams of counsel have the Court's gratitude.

II. The Scope of Canadian Patent 2,412,841

A. *Introduction: The Patent and the Claims in Dispute*

[10] The '841 Patent is titled "Process for Treating Vegetables and Fruit Before Cooking." It is brief, with six pages of disclosure, six claims, and one diagram. It was filed under the Patent Cooperation Treaty [PCT] on June 20, 2001, claiming priority from a French application filed a year earlier, on June 21, 2000. Its PCT publication date was December 27, 2001. It issued as a Canadian patent on January 22, 2008. By operation of section 44 of the *Patent Act*, RSC 1985, c P-4, the '841 Patent expired on June 21, 2021.

[11] The patent names four inventors: Jean-François Cousin, Fabrice Desailly, Adeline Goullieux, and Jean-Pierre Pain. When the patent was filed, Messrs. Cousin and Desailly [the McCain inventors] were both employees of McCain Alimentaire SAS, a McCain subsidiary in France. Mr. Desailly remains employed with McCain Alimentaire, while Mr. Cousin has since retired. Dr. Goullieux and Dr. Pain [the academic inventors] are both

professors who were retained by McCain when they were at the Université de technologie de Compiègne [UTC]. Dr. Pain subsequently moved from UTC to Université de Valenciennes et du Hainaut Cambrésis [Valenciennes].

[12] Of the six claims of the ’841 Patent, only two are at issue in this proceeding, namely Claim 1 and Claim 6 as it depends from Claim 1 (for ease, I will refer in these reasons to Claim 6 as it depends from Claim 1 simply as “Claim 6”). These claims read as follows, with the most contentious terms underlined:

> 1. A process for treating vegetables and fruit before cooking in order to reduce their resistance to cutting, characterized by the application of a high electric field directly to the vegetables and/or fruit under conditions such that the resulting increase in the temperature of the vegetables and/or fruit is almost zero or at least sufficiently low as to not amount to a preheating step.
>
> 6. A process as claimed in [claim 1], characterized in that the process is applied to processing of potatoes prior to cutting the potatoes into strips for the purpose of producing French fries.

[13] There are no disputed construction issues with respect to the limitations in Claim 6. Aspects of Claim 1 are also not in dispute. The parties and experts agree that Claim 1 generally claims a process for treating *vegetables and fruit* that have not yet been cooked, that (a) reduces the vegetable/fruit’s *resistance to cutting*; (b) involves a *high electric field* being applied directly to the vegetable/fruit, either through physical contact with electrodes or being placed in a medium such as water that has electrodes immersed in it; and (c) results in an *increase in the temperature* of the vegetable/fruit that is *almost zero* and/or *at least sufficiently low as to not amount to a preheating step*. They agree that each of these elements is essential to the claim.

[14] Within these elements, however, the parties differ with respect to their proposed constructions of three aspects of Claim 1:

1. *reduce their resistance to cutting* While the parties agree this means making the *vegetables and fruit* easier to cut by lowering the total work or energy required to cut it, they disagree on the required amount of reduction and how that is to be measured or determined, whether it implies that the vegetable/fruit is whole before the process is applied, and whether cutting is limited to cutting with a blade.

2. *high electric field* Most centrally, the parties disagree on whether this term encompasses electric fields as high as about 1,000 V/cm or more typically used in PEF applications or is limited to lower field strengths.

3. *resulting increase in the temperature* The parties disagree on what amount of temperature increase would fall within the claim as being *almost zero* or *at least sufficiently low as to not amount to a preheating step* and, as a corollary matter, how this element affects the construction of *vegetables and fruit*.

[15] The foregoing elements, and how they would be read and understood in the context of the ’841 Patent by a skilled reader to whom it is addressed in light of their common knowledge, were the subject of considerable argument and expert evidence. I will turn to these arguments, and the construction of the contested elements of Claim 1, after outlining the relevant principles of claims construction and introducing the expert witnesses.

B. *Principles of Claims Construction*

[16] The claims of a patent define the monopoly or exclusive privilege protected by the patent: *Patent Act*, s 27(4). How the claims are interpreted or construed will therefore determine the scope of that exclusive privilege. The Canadian approach to claims construction was confirmed by the Supreme Court of Canada almost 25 years ago in the companion cases of *Free World Trust v Électro Santé Inc*, 2000 SCC 66 and *Whirlpool Corp v Camco Inc*, 2000 SCC 67. These cases, and the subsequent cases of the Federal Court of Appeal that have interpreted and applied them, set out the following relevant principles:

a) the claims of a patent are construed purposively through the eyes of the hypothetical or fictional "person of ordinary skill in the art" [POSITA], in light of their common general knowledge [CGK], as of the date the patent is published: *Free World Trust* at paras 31(c), (e), 51, 53; *Whirlpool* at paras 53, 55; *Tearlab Corporation v I-MED Pharma Inc*, 2019 FCA 179 at para 32; *Cobalt Pharmaceuticals Company v Bayer Inc*, 2015 FCA 116 at para 14;

b) the POSITA is someone looking to understand the patent rather than misunderstand it, and to achieve success and not failure, but who is simultaneously devoid of intuition, imagination, or inventiveness: *Whirlpool* at para 49(c); *Free World Trust* at para 44; *Hospira Healthcare Corporation v Kennedy Trust for Rheumatology Research*, 2020 FCA 30 at para 79, leave to appeal ref'd 2020 CanLII 102984 (SCC);

c) the CGK possessed by the POSITA does not include all available information in the prior art but only a subset, limited to what is generally known and accepted without question by the bulk of those who are engaged in the particular art, or the "common stock of knowledge relating to the art" of the POSITA: *Whirlpool* at paras 53, 70; *Gemak Trust v Jempak Corporation*, 2022 FCA 141 at paras 93–100, citing *British Acoustic Films Ltd v Nettlefold Productions* (1936), 53 RPC 221 at p 250; *Hospira* at para 84; *Mylan Pharmaceuticals ULC v Eli Lilly Canada Inc*, 2016 FCA 119 [*Mylan Tadalafil*] at paras 23–25;

d) the Court must adhere to the language of the claims, read in an informed and purposive way, in the sense the inventor is presumed to have intended and sympathetic to accomplishing the inventor's purpose, but without resort to extrinsic evidence of the inventor's intent or to vague notions like the "spirit of the invention": *Free World Trust* at paras 31(a)–(e), 39–40, 44, 51, 61–67; *Whirlpool* at paras 49(c)–(g), 52, 54; *Tearlab* at para 31;

e) purposive construction involves looking at and understanding the words and terms used in the claims in the context of the whole patent specification, including the disclosure and the claims, but without using the disclosure to enlarge or contract the scope of the claim as written: *Whirlpool* at paras 48, 49(f), (h), 52; *Biogen Canada Inc v Pharmascience Inc*, 2022 FCA 143 at paras 71–73; *Tetra Tech EBA Inc v Georgetown Rail Equipment Company*, 2019 FCA 203 at paras 86, 104, leave to appeal ref'd 2020 CanLII 27687 (SCC); *Tearlab* at para 33; *ViiV Healthcare Company v Gilead Sciences Canada, Inc*, 2021 FCA 122 at paras 57–60; *dTechs EPM Ltd v British Columbia Hydro and Power Authority*, 2023 FCA 115 at paras 69–70, 81; *Pfizer Canada Inc v Canada (Health)*, 2007 FCA 209 [*Pfizer Quinapril (2007)*] at paras 39, 86–88, 92–93, 119–120;

f) the claim language, purposively construed, will show that some elements of the claimed invention are essential while others are non-essential: *Free World Trust* at paras 31(e), 51–60; *Whirlpool* at paras 45–48; *Biogen* at para 74;

g) claims construction is undertaken before considering infringement or validity, with a single construction to be adopted for all purposes without regard to whether the construction will affect infringement or validity issues: *Whirlpool* at paras 43, 49(a)–(b); *Tearlab* at para 34;

h) specific principles of claims construction, such as the rebuttable presumptions of claim differentiation (that different claims or claim elements are not redundant) and of claim consistency (that the same term has the same meaning throughout the claims) may apply, and the POSITA is understood to be familiar with these principles and with techniques of patent drafting in addition to being skilled in their technical field: *Whirlpool* at para 79; *Nova Chemicals Corporation v Dow Chemical Company*, 2016 FCA 216 at paras 82–83, leave to appeal ref'd 2017 CanLII 21418 (SCC); *Tetra Tech* at paras 113–115; *Teva Canada Ltd v Pfizer Canada Inc*, 2012 SCC 60 [*Teva Sildenafil*] at para 80.

[17] The Court will typically receive expert evidence regarding the identity, knowledge, and understanding of the POSITA. However, the construction of a patent's claims is ultimately an issue of law, to be undertaken by the Court after being put in the position to do so with the assistance of the expert evidence and in light of its assessment of that evidence. The Court is not

bound to the construction of any party or expert: *Whirlpool* at paras 57, 61; *Eli Lilly Canada Inc v Apotex Inc*, 2024 FCA 72 [*Lilly Tadalafil*] at para 17; *Biogen* at para 73.

[18] Conversely, the claims of a patent are to be construed without resort to extrinsic evidence of the inventors' intention, subject to a limited exception in section 53.1 of the *Patent Act* that is not applicable here: *Free World Trust* at paras 61–67. As a result, the evidence of non-expert witnesses, including the inventors themselves, is generally not relevant to the question of construction: *Bombardier Recreational Products Inc v Arctic Cat, Inc*, 2018 FCA 172 at paras 22–24, 34–35, 51, lv to appeal ref'd 2019 CanLII 42339 (SCC); *Bauer Hockey Ltd v Sport Maska Inc (CCM Hockey)*, 2020 FC 624 at paras 61–62, aff'd 2021 FCA 166. I will therefore introduce the expert witnesses here, leaving the evidence of the other witnesses for discussion in addressing infringement and validity.

C. *Expert Witnesses*

(1) The experts and their reports

[19] To assist the Court in understanding the '841 Patent, the field of the invention, and the prior art, the parties called three expert witnesses. All three are established and respected academics in the field of food process engineering, with knowledge and expertise in the use of electric fields in food processing in particular. They have each contributed to the knowledge in the area through their own academic publications and patents.

[20] McCain's sole expert was **Dr. G.S. Vijaya Raghavan**. Dr. Raghavan has been a professor in the area of agricultural and bioresource engineering at McGill University since

1974, shortly after obtaining his Ph.D. in Agricultural Engineering from Colorado State University. He has held the title of Professor since 1987 in what was then the Agricultural Engineering Department, now known as the Department of Bioresource Engineering, serving as Department Chair between 1993 and 2003. Dr. Raghavan has also held honorary positions in related departments at universities in India and China, acted as President of the Academy of Science, and is the current Treasurer of the Royal Society of Canada, among numerous other distinctions and recognitions.

[21] Dr. Raghavan has published and presented extensively in the area of agricultural and biosystems engineering, including food processing engineering, and has researched and developed various food processing techniques, including techniques that use electric fields. He has taught undergraduate and graduate courses in the area, including courses related to food engineering and food processing. Dr. Raghavan was qualified, with Simplot’s agreement, as an expert in the fields of agricultural engineering, bioresource engineering, and food processing engineering, including the use of electric fields in food processing; the research, design and development of processing techniques across the various stages of food processing, including the processing of potatoes; and the development and use of quantitative and qualitative techniques and processes to assess the texture of food products, including fruit and vegetables.

[22] Simplot’s primary expert was **Dr. Sudhir K. Sastry**. Dr. Sastry has been a professor in the field of agricultural and biological engineering since 1980, when he earned his Ph.D. in Mechanical Engineering from the University of Florida in 1980. He moved from Pennsylvania State University to the Department of Agricultural Engineering at Ohio State University in 1987, attaining his current position of Professor in 1991. In 2023, Dr. Sastry was named Distinguished

Professor of Food, Agricultural and Environmental Sciences in Food Engineering at Ohio State, and he has also been recognized by the Chinese Academy of Agricultural Sciences. In 2015, he received an International Association of Engineering and Food Lifetime Achievement Award, among other awards and recognitions.

[23] Dr. Sastry has published and presented extensively in the area of food processing and food process engineering, including in the area of electrical processing of fruit and vegetables, and has taught various courses in food engineering, food process engineering, and related fields. Dr. Sastry was qualified, with McCain's agreement, as an expert in the field of food processing and food process engineering, including electric field processing of fruit and vegetables, including the effects of electric fields on the physical, chemical, and electrical properties of food products.

[24] Simplot also called **Dr. Eugène Vorobiev** to give expert evidence. Dr. Vorobiev is Professor Emeritus at UTC, the university where the academic inventors also worked. He obtained his Ph.D. in Technical Sciences (Process Engineering) from Kiev Technological University in 1980. He then worked in various research positions with the Soviet (later Ukrainian) Research Institute of Sugar Industry, being awarded a diploma of senior scientist by the High Commission of the Soviet Union in 1984. In 1993, he moved to UTC, first as an invited researcher and lecturer and, after UTC awarded him a Dr. Habil in 1997, as full Professor of Chemical Engineering and head of the Agro-Industrial Technologies research group at UTC, a position he held until he became Professor Emeritus in 2021.

[25] Dr. Vorobiev's research in the area of food process engineering focused on the application of PEF technology involving agricultural and food products. He has published and presented frequently in the area of food process engineering, including on PEF technology, and has held a number of external appointments on French and international societies and councils in the area. As discussed below, McCain objected to Dr. Vorobiev's reports and evidence given the nature and scope of his opinions and the extent of the instructions he received from Simplot's counsel. However, subject to that objection, McCain did not object to Dr. Vorobiev's scientific qualifications, and he was qualified as an expert in the field of food process engineering, and in particular, the use of electric field-based technologies for processing food products such as fruit and vegetables, including the effects of electric fields on the physical, chemical, and electrical properties of food products.

[26] A total of ten expert reports were filed by the three experts, which I will refer to in these reasons as follows:

Initial Reports (dated June 14, 2023)

Exhibit	Report	Reference
116	Report of Dr. Raghavan	Raghavan First Report
121	Report of Dr. Sastry	Sastry First Report
128	Report of Dr. Vorobiev	Vorobiev First Report

Responding Reports (dated December 8, 2023)

Exhibit	Report	Reference
117	Report of Dr. Raghavan responding to the Sastry First Report	Raghavan Second Report

118	Report of Dr. Raghavan responding to the Vorobiev First Report	Raghavan Third Report
122	Report of Dr. Sastry responding to the Raghavan First Report	Sastry Second Report

Reply Reports (dated June 28, 2024)

Exhibit	Report	Reference
123	Report of Dr. Sastry replying to the Raghavan Second Report	Sastry Third Report
129	Report of Dr. Vorobiev replying to the Raghavan Third Report	Vorobiev Second Report

Sur-reply Reports (dated August 15, 2024)

Exhibit	Report	Reference
119	Report of Dr. Raghavan replying to the Sastry Third Report	Raghavan Fourth Report
120	Report of Dr. Raghavan replying to the Vorobiev Second Report	Raghavan Fifth Report

(2) McCain's objection to Dr. Vorobiev's reports and evidence

(a) *Overview*

[27] McCain objects to the evidence of Dr. Vorobiev, asking that it be struck or, alternatively, given no weight. It asserts that Dr. Vorobiev's evidence does not meet the four threshold requirements of admissible expert evidence, namely (1) relevance; (2) necessity in assisting the trier of fact; (3) absence of an exclusionary rule; and (4) a properly qualified expert: *White Burgess Langille Inman v Abbott and Haliburton Co*, 2015 SCC 23 at para 19, citing *R v Mohan*,

1994 CanLII 80 (SCC), [1994] 2 SCR 9 at pp 20–25. In particular, McCain argues Dr. Vorobiev's evidence is irrelevant, unnecessary, and prejudicial given the nature of his reports and the instructions he received from Simplot's counsel. McCain raised this objection prior to trial in accordance with Rule 52.5 of the *Federal Courts Rules*, SOR/98-106, but determination of the objection was appropriately deferred to trial: *McCain Foods Limited v JR Simplot Company*, 2023 FC 1480 [*McCain (re Vorobiev)*] at para 53.

[28] For the following reasons, I conclude Dr. Vorobiev's reports and his testimony with respect to them are admissible, with the exception of the section of his First Report entitled "Patent not directed to a PEF process," which I will ignore. Dr. Vorobiev's reports are somewhat unusual and do not speak to every live issue in the proceeding. However, I conclude that subject to the identified exception, they are relevant and necessary and they meet the criteria for admissible expert evidence under the *White Burgess*/*Mohan* test.

(b) *Summary of Dr. Vorobiev's reports*

[29] Dr. Vorobiev's First Report identifies four mandates he was given by Simplot's counsel: (a) review the '841 Patent; (b) describe the POSITA of the '841 Patent; (c) describe the CGK of the POSITA as of its publication date; and (d) comment on what the POSITA reading the '841 Patent "would understand the patent is teaching in terms of the technology and its use as disclosed and claimed in the '841 Patent": Vorobiev First Report, para 15.

[30] The first of these mandates was fulfilled through Dr. Vorobiev's review of the '841 Patent. With respect to the second and third mandates, Dr. Vorobiev sets out the

instructions he was given by counsel regarding the POSITA and the CGK: Vorobiev First Report, paras 21, 23. He gives his opinion on the identity of the POSITA then sets out, in four sections of his report (Sections VII to X), his opinions on their CGK in the areas of thermal and non-thermal effects of electric field technology; historical research on electric effects; PEF equipment; and determination of PEF parameters: Vorobiev First Report, paras 22, 24–96. This discussion constitutes the majority of the Vorobiev First Report.

[31] The final section of the Vorobiev First Report (Section XI), titled “Canadian Patent No. 2,412,841,” is addressed to his fourth mandate. It contains two subsections. The first is headed “Patent not directed to a PEF process.” In it, Dr. Vorobiev opines that the POSITA reading the ’841 Patent would not conclude it was directed to PEF technology based on aspects of the disclosure, including the experiments performed by the inventors. However, as is clear from the report and was confirmed in cross-examination, Dr. Vorobiev received no instructions from counsel on the principles of claims construction set out above, and he did not purport to construe the claims: Vorobiev First Report, paras 97–103; Transcript, pp 844–845, 849–850.

[32] In the second subsection, headed “Patent does not enable the skilled person to practice a PEF-based process,” Dr. Vorobiev opines that the specification of the ’841 Patent does not contain enough information for the POSITA to perform a PEF process without a large amount of trial-and-error experimentation. In particular, he notes the absence of relevant PEF parameters that would have to be defined to achieve a workable result. Again, however, he received no instructions on the principles applicable to assessing the validity of the patent, on grounds of sufficiency or otherwise: Vorobiev First Report, paras 104–107; Transcript, pp 845–848.

[33] The Vorobiev Second Report responds to the Raghavan Third Report, and in particular to Dr. Raghavan's opinions on five scientific publications. Three of these were referenced in the Vorobiev First Report as part of Dr. Vorobiev's discussion of the CGK. The other two were raised by Dr. Raghavan in response to Dr. Vorobiev's discussion.

(c) *Dr. Vorobiev's reports are largely admissible*

(i) The POSITA and their CGK

[34] I begin with consideration of Dr. Vorobiev's opinions on the POSITA and their CGK (his second and third mandates). I note that Dr. Vorobiev's opinion regarding the identity of the POSITA does not differ materially from that of the other experts, as discussed further below. The primary issue is therefore the CGK, although the following discussion applies equally to both issues.

[35] The identity of the POSITA and their CGK at the applicable dates are matters directly relevant to issues before the Court, namely the construction of the '841 Patent and its validity. They are also matters on which the Court requires the assistance of experts, as the knowledge of the skilled worker in the field of food processing at the relevant dates are not otherwise within the ken of the Court. They are, in the language used in *Abbey*, "outside the experience and knowledge of a judge": *R v Abbey*, 1982 CanLII 25 (SCC), [1982] 2 SCR 24 at p 42, citing *Turner* (1974), 60 Crim App R 80 at p 83; *Mohan* at p 23. On its face, then, Dr. Vorobiev's opinions on these issues are directed to relevant matters on which the Court requires expert evidence, and on which Dr. Vorobiev is scientifically qualified to speak.

[36] However, McCain contends that since Dr. Vorobiev did not go on to construe the claims of the ’841 Patent, his opinion on the CGK of the POSITA lacks context, and that without this “complete picture,” anything Dr. Vorobiev says about the prior art or the CGK cannot be helpful to the Court, since it is not sufficiently connected to any of the specific legal issues in the case.

[37] I disagree. Even if Dr. Vorobiev does not himself construe the claims, his evidence regarding the CGK is clearly connected to, at least, the issue of claims construction. In my view, an expert’s evidence on the POSITA and their CGK can be relevant and admissible even if the expert does not opine on other issues such as claims construction or validity.

[38] As Simplot notes, the Supreme Court of Canada has underscored that the ultimate issues of claims construction, infringement, and validity are legal questions for determination by the Court: *Whirlpool* at paras 45, 57, 61; *Tetra Tech* at para 89. Justice Binnie stated expressly that the role of the expert is “<u>not</u> to interpret the patent claims but to put the trial judge in the position of being able to do so in a knowledgeable way” [emphasis added]: *Whirlpool* at para 57; *Biogen* at para 73.

[39] Experts may, and often do, opine directly on the construction of the terms in a patent claim, assisting the Court not only with the content of the CGK, but also how that CGK would inform the POSITA’s understanding of the claims. This takes the expert’s evidence closer to giving opinion on the “ultimate issue,” a type of opinion previously considered inadmissible as usurping the function of the trier of fact: *Mohan* at pp 24–25; *R v J-LJ*, 2000 SCC 51 at para 37. There is no longer a general exclusion of expert evidence on an ultimate issue, and the Court has

come to expect experts to opine directly on issues such as claims construction. Dr. Vorobiev's evidence is therefore somewhat unusual in not doing so. However, the fact that expert opinion is admissible on the ultimate issue does not mean that it is inadmissible simply because it does not opine on an ultimate issue.

[40] Nor is an opinion inadmissible, irrelevant, or unnecessary simply because it does not address all of the issues the Court may ultimately be called upon to determine. An expert witness's evidence in a particular area may become one of many building blocks of information for the Court's use in its ultimate assessment of the factual and legal issues in the proceeding, even if other building blocks must come from other opinion or factual evidence.

[41] In this regard, McCain's argument that Dr. Vorobiev's opinion on the CGK is undermined because he did not construe the claims looks through the wrong end of the telescope. The Court approaches claims construction through the lens of the CGK; it does not assess the CGK based on its construction of the claims. While evidence regarding the CGK will evidently be directed at issues relevant to the '841 Patent, the scope or content of the POSITA's knowledge is not and should not be defined or circumscribed by the claims or any particular construction of them. To the contrary, the purpose of the exercise is to assess what relevant knowledge the POSITA would have <u>before</u> reading the patent, and thus what knowledge they bring to the understanding of the claims when they read them.

[42] Nor is Dr. Vorobiev's opinion undermined because he did not address what was known about preheating potatoes. Again, an expert need not address all relevant aspects of the CGK for

their evidence to be useful and relevant, particularly if they are not purporting to construe claims on which that CGK would have a bearing. Dr. Vorobiev's evidence on PEF or on the thermal and non-thermal effects of electric field technology, for example, is not less reliable or relevant because he does not also address traditional preheating.

[43] McCain argues that the "necessity" criterion of *Mohan* is not fulfilled simply through evidence that may be helpful to the Court: *Mohan* at p 23; *Canadian Pacific Railway Company v Canada*, 2019 FC 1531 at para 30, citing *Association of Chartered Certified Accountants v The Canadian Institute of Chartered Accountants*, 2016 FC 1076 at paras 17, 22, 26. I fully accept this proposition. As Justice Sopinka stated in *Mohan*, the word "helpful" sets too low a standard: *Mohan* at p 23. However, he went on to note that "necessity" should not be judged by too strict a standard. Rather, an opinion must be necessary in the sense that it provides information likely to be outside the experience of the judge: *Mohan* at p 23. This is precisely what Dr. Vorobiev's opinion evidence on the POSITA and their CGK does.

[44] I note for completeness that McCain does not raise any exclusionary rule or take issue with Dr. Vorobiev's scientific qualifications. I am therefore satisfied that Dr. Vorobiev's evidence with respect to the identity of the POSITA and their CGK meets the four *Mohan* requirements for admissible expert evidence. I also consider that the benefits of that evidence outweigh any risks of admitting it, as I see no potential prejudice in admitting and considering Dr. Vorobiev's opinions on the knowledge the POSITA would have had at the priority or publication dates of the '841 Patent: *White Burgess* at para 24. I therefore consider his opinions on these topics, which include Sections VI to X of the Vorobiev First Report and all of the Vorobiev Second Report, admissible.

(ii) What the POSITA would understand the patent to teach

[45] I reach the contrary conclusion with respect to the first subsection of Section XI of the Vorobiev First Report (paragraphs 97 to 103), namely Dr. Vorobiev's opinion on what the skilled person would conclude the '841 Patent is directed to. Like his opinion on the CGK of the POSITA, it is clear that this aspect of Dr. Vorobiev's evidence speaks, indirectly, to the question of claims construction. It may also be viewed as indirectly relevant to overbreadth.

[46] However, unlike his opinion on the CGK, Dr. Vorobiev's opinion on how the POSITA would read the '841 Patent is presented without a statement regarding the principles he applied to reach his conclusions, either in the form of instructions from counsel or in the form of the approach he took to the issue. This is important, as the correct reading of a patent—whether termed interpretation, construction, or understanding—is a matter of law informed by issues of expertise and knowledge in the relevant art, governed by a series of established principles. An expert's opinion on how a POSITA would understand a patent may depend, in whole or in part, on the approach they take to the exercise. Without knowing the principles an expert is applying in this nuanced area, it may be difficult to know whether, or the extent to which, their opinion is helpful in guiding the Court in its own analysis.

[47] This is not to say that an expert's opinion will invariably be inadmissible or given no weight simply because they have not referred specifically to the various principles of claims construction or expressly applied them: *Lilly Tadalafil* at paras 19–20, 33–40. However, the greater the uncertainty about the analytical framework an expert has adopted, the less the Court will be inclined to rely on that opinion in reaching its own conclusions.

[48] More importantly, though, the question for the Court is not what the ’841 Patent as a whole, or its disclosure, is “directed to,” but the scope of the claims. The disclosure has a bearing on the informed and purposive construction of the claims. However, the language of the claims, and adherence to that language, are matters of central importance in claims construction: *Whirlpool* at paras 31(a)–(e), 33–50. Dr. Vorobiev’s opinion on how a POSITA would understand the ’841 Patent does not consider the language of the claims and does not purport to address how a POSITA would understand or construe that language.

[49] Absent consideration of the claim language, and absent an indication of the principles Dr. Vorobiev applied, I conclude his opinion that the POSITA would not read the ’841 Patent to be directed to PEF technology should not be admitted. Even if this opinion might be considered technically or indirectly relevant to the issue of claims construction, I consider the potential risks of receiving an opinion that refers to the POSITA’s understanding of the patent without reference to the language of its claims and without discussion of the principles applied outweighs the benefits of that opinion. I would therefore exclude it as a discretionary matter: *White Burgess* at para 24.

(iii) Whether the POSITA would be able to practice a PEF process

[50] This leaves the final subsection of Dr. Vorobiev’s report, which addresses whether the specification of the ’841 Patent contains enough information for the POSITA to practice a PEF-based process. Although Dr. Vorobiev does not refer specifically to the concept of patent sufficiency, it appears clear to the Court that this aspect of Dr. Vorobiev’s evidence speaks to whether the specification “set[s] out clearly the various steps in a process […] in such full, clear,

concise and exact terms as to enable any person skilled in the art or science to which it pertains, or with which it is most closely connected, to […] use it”: *Patent Act*, s 27(3)(b). In other words, the evidence speaks to whether the patent is invalid for insufficient disclosure: *McCain (re Vorobiev)* at paras 44, 48–49; *Teva Sildenafil* at paras 50–52, 70–71; *Seedlings Life Science Ventures, LLC v Pfizer Canada ULC*, 2021 FCA 154 at paras 68–70. As noted at the outset, I have concluded that I need not address Simplot’s alternative arguments on insufficiency. I will nonetheless address the admissibility of this section of Dr. Vorobiev’s report so that the state of the record in respect of the expert reports is clear.

[51] As indicated, Dr. Vorobiev does not set out any instructions he received regarding the sufficiency of a patent. This can be contrasted with Dr. Sastry’s report, which includes a page of principles regarding sufficiency that he was provided by counsel: Sastry First Report, Exhibit M, paras 36–41. Nonetheless, Dr. Vorobiev’s report is clear that he is providing an opinion on whether, having only the specification, the POSITA could practice a process that incorporated the use of PEF technology without undertaking undue experimentation: Vorobiev First Report, paras 104–107. This is, in essence, the analysis required to assess sufficiency, at least at the second step: *Seedlings* at paras 68–70; *Teva Sildenafil* at paras 70–72. While Dr. Vorobiev does not purport to define the nature of the invention (the first step), his evidence is directed to an aspect or embodiment that McCain asserts is part of the nature of the invention, *i.e.*, the use of PEF technology in the process of Claims 1 or 6. I am therefore satisfied that while Dr. Vorobiev’s report does not set out instructions he received on sufficiency, the approach he took and the question he addressed in his opinion are clear and are consistent with the applicable framework for analysis of sufficiency.

[52] This being so, I conclude that Dr. Vorobiev's evidence on this point is relevant to Simplot's alternative argument that, if McCain's construction is accepted, the '841 Patent is invalid. Leaving aside my conclusion that I do not need to address the sufficiency arguments, I find that expert evidence is necessary to assist the Court in determining whether a POSITA would be able to put into practice all embodiments of the invention on this construction. No exclusionary rule arises and Dr. Vorobiev is properly qualified to give the opinion he gives with respect to PEF technologies. I therefore conclude that the *Mohan* requirements are met. Unlike Dr. Vorobiev's opinions on what the POSITA would understand the patent to teach, discussed above, I see no reason to exclude this aspect of Dr. Vorobiev's opinion based on the discretionary risk-benefit balancing exercise, since I am able to understand the approach Dr. Vorobiev took even though he did not provide a formal statement of legal principles.

(d) *Conclusion*

[53] For these reasons, I conclude Dr. Vorobiev's reports should not be struck or given no weight as they pertain to the identification of the POSITA, the CGK of the POSITA, and whether the POSITA would be able, based on the specification of the '841 Patent, to perform a PEF process without a large amount of trial-and-error experimentation. This effectively covers all of Dr. Vorobiev's reports except paragraphs 97 to 103 of the Vorobiev First Report, which relate to his opinion that the POSITA would not understand the '841 Patent to be directed to a PEF process, together with the first phrase of paragraph 20 that summarizes this opinion. As the Vorobiev First Report was admitted into evidence as a whole subject to McCain's objection, I will simply ignore these paragraphs, together with Dr. Vorobiev's testimony regarding these paragraphs, rather than striking them. I will also ignore Dr. Raghavan's response to this

evidence, although most of it is repeated in his response to Dr. Sastry in any event: Raghavan Third Report, paras 76–88; Raghavan Second Report, paras 65, 398–406.

(3) McCain's criticisms of Simplot's experts

[54] Not surprisingly, each party argued that the evidence and opinions of their own expert(s) ought to be preferred to those of the opposing expert(s) in each of the areas of dispute. Most of these arguments related to the substance of the specific issues, and I will address them as needed in addressing those issues below. However, McCain also raised criticisms of Dr. Sastry and Dr. Vorobiev at a general level. It is convenient to address these arguments at the outset. For the following reasons, I conclude that McCain's general criticisms have no merit.

[55] First, McCain notes that Dr. Sastry admitted that "claim language was not [his] area of expertise": Transcript, p 595. This is an odd criticism. When the Court hears expert evidence in patent cases, it is generally to assist the Court with respect to the field of endeavour of the patent, not with the intricacies of claim language or the rules of construction. Dr. Sastry is an expert in the area of food processing and food process engineering; he is not a lawyer or patent agent. The Court does not expect scientific experts to be experts in the area of "claim language." Notably, there is no evidence that Dr. Raghavan was an expert in the area of claim language, despite being an inventor on a number of patents (as are Drs. Sastry and Vorobiev). He certainly was not qualified as an expert in that area.

[56] Next, McCain contends that Dr. Sastry had "undisclosed discussions" with one of Simplot's employees and witnesses, James Englar, to understand Simplot's processes. However,

Dr. Sastry's Second Report, which addresses infringement and thus Simplot's processes, expressly states that he traveled to Caldwell, Idaho and toured one of Simplot's facilities that operates the PEF system at issue in this litigation: Sastry Second Report, para 65. The evidence indicates that his discussions with Mr. Englar arose in and around that visit: Transcript, pp 590–593. While Dr. Sastry did not name Mr. Englar in particular in his report, I see no basis to impugn his evidence based on this. Other than its insinuations about "undisclosed discussions," McCain raised no substantive argument as to Dr. Sastry's understanding of Simplot's PEF system, which was largely uncontested, or how it might have been improperly affected by his site visit or any discussions or calls with Mr. Englar.

[57] McCain also criticizes Dr. Sastry's evidence on construction because he was not given instructions on the role of preferred embodiments in claims construction: Sastry First Report, Exhibit M; Transcript, pp 595–596. As noted above in discussing Dr. Vorobiev's evidence, faulty or incomplete instructions on relevant principles may affect the Court's willingness to rely on expert evidence. However, while Dr. Sastry was not given specific instructions about preferred embodiments, he was appropriately instructed more broadly regarding the use of the patent disclosure, which is where an inventor will discuss preferred embodiments. In any event, regardless of whether specific principles regarding preferred embodiments were set out in the instructions he was given, Dr. Sastry did not limit his construction to the preferred embodiments described in the patent. He thus appears to have understood that claims are not limited to preferred embodiments.

[58] On a number of occasions during cross-examination of Dr. Sastry, counsel for McCain put to Dr. Sastry passages from a deposition he gave in parallel proceedings in the United States. McCain cites three of them as affecting the weight to be given to Dr. Sastry's evidence, contending that his evidence was inconsistent. I do not consider any of them material to Dr. Sastry's overall credibility or the extent to which I can rely on his evidence. The first relates to discussions with employees of Simplot, which I have addressed above: Transcript, pp 590–591. The second relates to Dr. Sastry's ability to understand the limitation on temperature increase in Claim 1, which I find to be of little relevance as his earlier deposition was given in the context of the US Court having rendered a decision on construction after a "Markman" hearing: Transcript, pp 631–632.

[59] The third has to do with Dr. Sastry's willingness to accept the proposition that "at some point the definitions of MEF [moderate electric fields] and PEF become arbitrary": Transcript, pp 649–650. I agree that Dr. Sastry's evidence on this point was somewhat inconsistent. He had said in the US deposition that "at some point these definitions become arbitrary because […] MEF and PEF kind of overlap in a certain region, it's hard to say." However, when that proposition was put to him in this proceeding, he was initially unwilling to accept it, because he considered there may be reasons to use one term or the other. When his US deposition was put to him, he accepted it as his evidence. Despite this inconsistency, I do not consider the extent to which the definitions are "arbitrary" to be a significant issue, particularly since there is general agreement that there are no fixed and definite boundaries on the terms MEF and PEF, as discussed below. Nor do I find Dr. Sastry's initial unwillingness to accept the proposition put to him, on the basis that there may be reasons to use one term or the other, to be a material or

significant inconsistency that would affect his credibility generally or the weight I am prepared to give his opinions.

[60] McCain also notes that neither Dr. Sastry nor Dr. Vorobiev has worked on the conventional preheating process for potatoes referred to in the ’841 Patent: Transcript, pp 592–593, 635–638, 829–832. This certainly appears to be the case. However, it also appears to be the case for Dr. Raghavan, who was similarly never employed by a potato processing company: Confidential Transcript, pp 751–752. None of the experts was qualified in particular with respect to their experience in conventional preheating of potatoes. Beyond referring to two prior patents, Dr. Raghavan did not explain the source of his own evidence regarding french fry processing, much of which seems to have come from the ’841 Patent itself: Raghavan First Report, paras 107–114. I therefore do not see this as a basis for preferring Dr. Raghavan’s evidence over that of Simplot’s experts.

[61] With respect to Dr. Vorobiev, in addition to the criticisms addressed above, McCain contends that he “appeared confused by basic questions” in certain areas, and “evaded questions” about why he did not discuss the conventional preheating process. I disagree with this assessment of Dr. Vorobiev’s evidence. There were certainly some language issues in Dr. Vorobiev’s evidence, which was given with the assistance of an interpreter. Dr. Vorobiev, a native Russian speaker who speaks both English and French, prepared his reports in English but reasonably chose to give his testimony in French, in which he is more comfortable. This led to the occasional need for clarification and some miscommunication, but did not in my assessment

affect the substance of his evidence. I did not find Dr. Vorobiev's evidence on relevant substantive issues either confused or evasive.

[62] As discussed above, Dr. Vorobiev was not given instructions regarding claims construction including, as McCain again underscores, preferred embodiments. While this leads to me rejecting his evidence on the meaning of the patent, it has no effect on the remainder of his evidence, which does not depend on principles of claims construction.

[63] As is to be expected, the experts presented different, and sometimes directly conflicting, opinions on various issues relevant to the questions the Court is called upon to determine. Having reviewed the experts' reports, heard their testimony, and considered the parties' arguments, I see no reason to prefer Dr. Raghavan's evidence over that of Simplot's experts as a general matter.

[64] Conversely, I also do not conclude that I should prefer the evidence of Simplot's experts over those of Dr. Raghavan as a general matter or on every issue. At the same time, I note that in my assessment, Dr. Raghavan's evidence contained a number of inconsistencies and overstatements on a number of central issues. These concerns are discussed in below as they arise and include statements regarding what can be understood from the prior art and inconsistent opinions when addressing different issues, including claims construction and different grounds of invalidity. These do not lead me to reject Dr. Raghavan's opinions as a whole or on every issue. However, given the importance of a consistent approach in addressing patent construction, infringement, and validity, these inconsistencies undermine Dr. Raghavan's opinions in these areas in particular.

D. *The Person of Ordinary Skill in the Art and their Common General Knowledge*

[65] The parties were essentially in agreement with respect to the skilled reader to whom the ’841 Patent is addressed. That person would have the equivalent of a Bachelor of Science degree in food process engineering, plus the equivalent of at least two years’ experience with food processing: Raghavan First Report, para 150; Sastry First Report, para 83; Vorobiev First Report, para 22. While the experts’ opinions on the academic or experiential qualifications of the POSITA varied slightly, nothing material turned on these differences: Raghavan First Report, para 150; Sastry Second Report, paras 32–33; Vorobiev First Report, para 22; Raghavan Third Report, para 8.

[66] I agree the POSITA would have academic training, such as a Bachelor of Science or equivalent, in food process engineering or another discipline that would give them knowledge and training both in food processing generally and in electric field technologies in food processing in particular, as well as several years of practical experience in the area of the industrial processing of vegetables and fruit.

[67] To this, I would add that the POSITA’s practical experience in food processing would include at least some experience in the manufacture and processing of french fries in particular. A patent is read as a whole, with a single POSITA for all claims: *Teva Canada Limited v Janssen Inc*, 2018 FC 754 at para 236. Claim 6 of the ’841 Patent claims a process for treating potatoes for the purpose of producing french fries, and the discussion in the disclosure focuses on french fries. The experts accepted that knowledge of french fry processing would be within the CGK of the POSITA. I conclude that the patent is directed at least in part to a worker in the field of

french fry manufacturing and that to fully understand the patent, the POSITA (who may be an individual or a team of individuals) would have skill and knowledge in that area.

[68] The common general knowledge of this person at the publication date (December 27, 2001) is relevant to the construction of the patent. As I have concluded that I need not address the issue of obviousness, I do not need to separately consider the CGK of the POSITA at the priority date (June 21, 2000). In any event, with the exception of a few academic papers published in late 2000 and 2001, the parties and experts agreed that the CGK of the POSITA would have been the same on these two dates: Raghavan First Report, para 154; Sastry First Report, paras 86–87; Vorobiev First Report, para 24; Transcript, p 585.

[69] The parties and experts agreed on many aspects of the knowledge the POSITA would have in December 2001, including in the areas of electricity and electric fields, their use in food processing, the evaluation of food processing steps, and the processing of french fries. However, they also disagreed on a number of points, particularly as they relate to terminology; what the POSITA would have known, understood, and/or considered with respect to the nature and effect of certain electric field treatments; and the relationship between various textural characteristics. Some of these issues become relevant in the context of claims construction, while others are more relevant to issues of validity.

[70] The CGK may include information the patent presents as background knowledge, although it is not limited to this information: *Valeant Canada LP/Valeant Canada SEC v Generic Partners Canada Inc*, 2019 FC 253 at para 47, citing *Newco Tank Corp v Canada (Attorney General)*, 2015 FCA 47 at para 10. In the ’841 Patent, the inventors discuss aspects of the relevant background in the disclosure, and the parties generally agreed that this information

would be within the CGK of the POSITA. Discussion of the patent's disclosure therefore necessarily overlaps with discussion of the CGK.

[71] As a result, rather than attempting to set out the entirety of the CGK before turning to the disclosure and the claims of the '841 Patent, I will address the aspects of both the CGK and the disclosure that are particularly relevant to each claims construction issue as it arises, while recognizing that the patent construction exercise is undertaken having regard to the CGK as a whole: *Medexus Pharmaceuticals Inc v Accord Healthcare Inc*, 2024 FC 424 at para 86. In other words, the POSITA would read the claims of the '841 Patent in light of their CGK as a whole which, as explained above in discussing Dr. Vorobiev's evidence, represents their knowledge before reading the '841 Patent and its claims. However, since different aspects of the CGK come to bear to a greater or lesser degree in respect of different elements of the claim, it is convenient for purposes of explaining my conclusions to address those aspects in the context of each issue in sequence, rather than attempting to present the entirety of the CGK at the outset and then having to repeat it when analyzing claims construction.

[72] In the interests of readability, I will use abbreviated citations to patents and scientific literature in the following discussion, with full citations set out in Appendix A to these reasons.

E. *Construction of the Disputed Terms*

[73] I reproduce Claim 1 again here for ease of reference:

> 1. A process for treating <u>vegetables and fruit</u> before cooking in order to <u>reduce their resistance to cutting</u>, characterized by the application of a <u>high electric field</u> directly to the vegetables and/or fruit <u>under conditions such that the resulting increase in the temperature</u> of the vegetables and/or fruit is <u>almost zero</u> or <u>at least sufficiently low as to not amount to a preheating step</u>.

[74] The parties principally disagree on the construction of three aspects of Claim 1: (1) the measurement and amount of reduction claimed in the term *reduce their resistance to cutting*; (2) the scope of the term *high electric field*; and (3) the point at which the *resulting increase in temperature* remains *almost zero* or *at least sufficiently low as to not amount to a preheating step*. Their arguments with respect to the first and third of these three elements also engage the construction of the term *vegetables and fruit*.

[75] For ease, I will refer to these three disputed elements in the claim as, respectively, the *resistance to cutting* element, the *high electric field* element, and the *temperature* element. The construction of these three elements defines the scope of Claim 1. The *high electric field* element is of particular importance as it is effectively determinative of the question of infringement. However, that element cannot be considered in isolation and the construction of the other elements interacts with and provides context for the *high electric field* element, as well as being relevant to certain validity arguments. I will therefore address the three elements in the order they appear in Claim 1, recognizing that the dispute over the *high electric field* element is the most central.

(1) The *resistance to cutting* element

[76] The stated goal of applying the claimed process to the uncooked *vegetables and fruit* is to *reduce their resistance to cutting*. The parties agree that a reduction in *resistance to cutting* is an essential element of the claim, and that it is the existence of this reduction—rather than the intent or purpose of the individual implementing the process—that is required for a process to fall within the scope of the claim. The primary dispute on this element lies in whether the *resistance*

to cutting element would be understood to include any limitation on how much reduction must be achieved before the claim element is met, either functionally in terms of the quality of the subsequent cut or by way of comparison to the reduction caused by traditional preheating. Two additional disputes lie in whether the element would be read to mean that the process of Claim 1 only applies to whole *vegetables and fruit* and whether the word *cutting* would be understood to mean only cutting with a blade or would encompass cutting with other tools such as a wire.

[77] The POSITA would construe the *resistance to cutting* element in light of the disclosure and their knowledge of, in particular, the areas of preheating of potatoes and other vegetables and fruit, sensory evaluation, and textural analysis in food processing. I will set out the relevant CGK in these areas, including that set out in the ’841 Patent, and the additional relevant discussion in the disclosure, before addressing the parties’ competing constructions of the term *reduce their resistance to cutting*.

(a) *The CGK regarding preheating*

[78] As the inventors of the ’841 Patent state, and as the POSITA would know, processing of fruits and vegetables into final food products typically involves a number of steps, depending on the nature of the food and the product. The disclosure focuses on the processing of potato tubers intended to make french fries, which the inventors describe as a “preferred application” of the invention: ’841 Patent, p 1.

(i) Preheating potatoes before making french fries

[79] Different french fry manufacturers may use somewhat different approaches or manufacturing steps, but a series of processing steps were typically used to turn raw potatoes into french fries in industrial applications at the relevant dates (and to this day). These include (i) a number of steps prior to cutting; (ii) the cutting itself, which may use a water gun to propel potatoes toward a grid of blades at speeds of 80 to 100 km/h; and (iii) various post-cutting steps, including cooking and freezing: Raghavan First Report, paras 107–109.

[80] The pre-cutting steps include initial steps such as grading and cleaning of the potatoes, as well as peeling if the french fry product is a peeled product. As the inventors of the ’841 Patent discuss, it can also include a preheating step, in which the potatoes are immersed in water heated to about 40 to 60ºC for a period of about 20 to 40 minutes: ’841 Patent, p 1.

[81] This preheating step was long known. A 1978 US patent to Hodges refers to preconditioning raw potatoes by holding them in water at 130 to 145ºF (about 54 to 63ºC) for 30 to 60 minutes to “avoid ragged and fractured cuts on the one hand and undue toughness and resistance to slicing on the other” [emphasis added]. Another US patent from 1995 to Hannah refers to a preheating step in 140ºF (60ºC) water for about 10 minutes, which results in less breakage during handling and facilitates cutting without “additional slivers and/or feathered ends of the cut potatoes” [emphasis added]. Thus, while the disclosure of the ’841 Patent refers to leaving the potatoes in hot water for a period of 20 to 40 minutes, the POSITA would know that this period might range from about 10 minutes to an hour.

[82] The inventors state that this “traditional preheating” is performed to reduce the potato’s resistance to cutting, which is necessary to (i) ease the action of cutting tools; (ii) avoid twisting of the cut strips or a poor cut; and (iii) avoid damage to the cutting knives. The inventors expand on the second of these, noting that inappropriate pretreatment may result in a non-shear cut, and a “shattering” or crushing effect, which can lead to breakage of french fry strips, and to undesirable results for the quality of the cut and oil absorption: ’841 Patent, p 2.

[83] If french fry strips break in the cutting or subsequent handling steps, the resulting shorter pieces may cook differently or may not meet product specifications. Removal of these pieces results in product loss and thus lowers processing efficiency. Even if a strip does not break, the cut edge of a french fry may have small cuts or cracks along its length, *i.e.*, the “shattering” referred to by the inventors of the ’841 Patent, the “ragged and fractured cuts” referred to by Hodges, or the “feathering” referred to by Hannah. This shattering or feathering is considered undesirable, as it can affect oil absorption, the cooking process, and the ultimate quality of the product. The preheating step is designed to help avoid this effect, improving the quality of the cut.

[84] While preheating potatoes can improve the cutting step, care is taken to avoid heating the potatoes to the point at which the starches in the tuber are gelatinized. The Hodges patent describes this as occurring at 145ºF (63ºC). Starch gelatinization is observable as translucent and sticky areas of the potato. As potatoes in hot water will heat from the outside in, overtreatment resulting in starch gelatinization may be observed in an unwanted “cook ring” or “cooking ring” at the outer surface of the tuber. Removal of the unwanted cooking ring from the preheated

potatoes in further processing means that material is lost. Some of this partially cooked potato can also dissolve into the hot water, which both causes material loss and requires the water to be renewed.

[85] The inventors refer to these known drawbacks of the traditional preheating method: ’841 Patent, pp 1–2. As the POSITA would also know, factors such as the variety of the potato, the size of the tubers, and how long they have been stored before treatment affect how long they need to be pretreated, and at what temperature, in order to obtain the desired results for the subsequent cutting step while avoiding gelatinization.

[86] As can be seen from the foregoing, the CGK and the disclosure of the ’841 Patent identify two concepts, namely (i) resistance to cutting; and (ii) the quality of the resulting cut. The disclosure draws a connection between them, in that the purpose of the traditional pretreatment (and the invention) is said to be to reduce resistance to cutting, which in turn has the effect of improving the quality of the cut, *i.e.*, obtaining a shear cut and avoiding shattering: ’841 Patent, pp 2, 5. However, they remain different concepts, and it is important to recognize the distinction between them. This is particularly so since Claim 1 refers to *resistance to cutting* but does not expressly refer to the quality of the resulting cut.

[87] In his discussion of the CGK, Dr. Raghavan referred to both the quality of the cut and the reduced wear on cutting blades as being benefits of reduced resistance to cutting from the preheating step: Raghavan First Report, para 112. As Dr. Sastry notes, the focus in the industry appears to be primarily on the quality of the cut, rather than any particular concern about blade

wear: Sastry First Report, para 296. Nonetheless, he recognized that reducing cutting resistance also had at least some benefit in saving energy and reducing wear on cutting blades, contributing to a more efficient process: Transcript, pp 701–702.

[88] I pause to note that the disclosure of the ’841 Patent states that the traditional preheating step is performed to “reduce” resistance to cutting: ’841 Patent, pp 1–2. The term “reduce” is necessarily a relative one. In the context of the discussion of traditional preheating, the POSITA would readily understand the inventors to mean that the potato has a lower resistance to cutting after the preheating step than it had before the treatment. Equally, potatoes that have been preheated will have a lower cutting resistance than those that have not (*e.g.*, raw potatoes or potatoes that have been steam-peeled but not subsequently pre-heated).

(ii) Preheating other vegetables and fruit

[89] Given that the focus of this litigation was on french fries, the evidence presented by the parties focused on potatoes and french fry processing in particular, as the ’841 Patent does. However, since Claim 1 is not limited to potatoes, it is worth addressing the CGK in respect of preheating of other vegetables or fruit. By way of overview, the experts and parties presented very little evidence on the extent to which other vegetables or fruit are usually or traditionally preheated before cutting or further processing, whether in a hot water bath or otherwise.

[90] Dr. Raghavan’s discussion of preheating was mostly limited to potatoes and the descriptions of traditional preheating in the ’841 Patent: Raghavan First Report, paras 46, 49, 107–114, 159–161. Dr. Raghavan does state, in his discussion of french fry processing, that “[l]ikewise, beets, carrots, turnips, and salsify similarly benefit from preheating during their

processing”: Raghavan First Report, paras 110, 178; Raghavan Second Report, para 505. However, he provides no details regarding either the basis for this opinion or the nature, purpose, or effect of the preheating said to be performed on these other root vegetables.

[91] Similarly, in responding to Dr. Sastry’s opinion on overbreadth, Dr. Raghavan states that the POSITA “would start with a knowledge of preheating as used to treat other fruit and vegetables to reduce their resistance to cutting,” without providing any information as to what that knowledge is: Raghavan Second Report, para 436. At the same time, Dr. Raghavan agreed with Dr. Sastry that the description in the ’841 Patent of preheating for potatoes “is not necessarily applicable to all vegetables or fruits”: Sastry First Report, paras 446–447; Raghavan Second Report, para 511.

[92] Dr. Sastry’s reports similarly provide little information about the CGK regarding preheating of other vegetables or fruits, other than noting that they are “commonly subject to heat processing steps in order to assist with processing methods such as dehydration, extraction (e.g. juicing), sterilization, peeling, and cutting, among others,” before moving on to preheating of potatoes in particular: Sastry First Report, para 30. Dr. Sastry also mentions that the POSITA would have understood that for some products, it would be desirable to soften vegetables or fruit before cutting them, and that pretreatments such as preheating could be used for that purpose: Sastry First Report, para 226. However, his opinion was that the terms “preheating,” “preheating step,” or “preheating stage” did not have a well-defined and understood meaning for the treatment of fruits and vegetables other than for potatoes: Sastry First Report, paras 125, 445.

[93] Dr. Sastry does refer to one of his own papers (Palaniappan, 1991) that includes a comparison of electrical conductivity in carrots subjected to ohmic heating (heating through application of electric fields, discussed further below) and those subjected to “conventional heating using hot water in the jacket.” The paper also refers to similar curves having been observed in other papers for “conventionally heated beet tissue.” However, the paper does not speak to how or whether water heating of carrots or beets is commonly used in food processing as a preheating step before cooking or cutting them. “Conventional” in the context appears to simply refer to water heating rather than ohmic heating, rather than indicating that carrots are conventionally preheated before slicing in food processing.

(b) *The CGK regarding sensory evaluation*

[94] Since the primary goal of food processing is the production of food for consumption, food processors test the characteristics of food products, and the effects of processing steps, through evaluations using the human senses of smell, taste, touch, sight, and hearing. These sensory or sensorial evaluations allow for the assessment of food characteristics such as aroma, taste, texture, appearance, and overall quality, both during the production process and at the end of processing.

[95] There are subjective aspects to sensory evaluations, which might include descriptions or assessments of overall quality or desirability, and/or comparisons between products. However, efforts are made to improve objectivity, precision, and reproducibility of sensory evaluation panels through training and standardization.

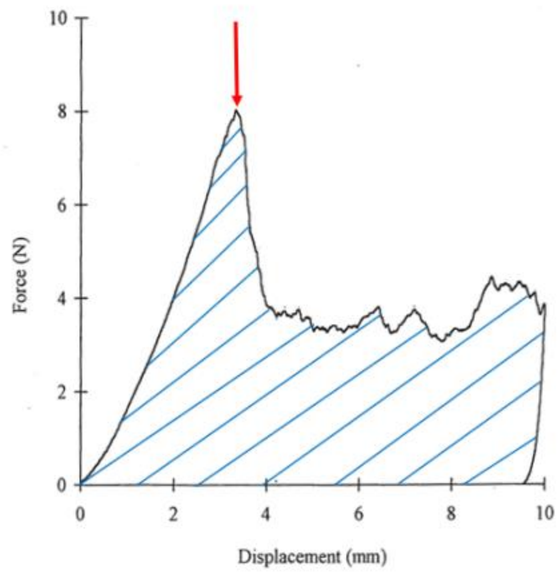
[96] Aspects of french fry manufacturing discussed above are amenable to such sensory evaluation, both in terms of how they affect the final quality of the french fry product and at various steps in the manufacturing process. For example, the presence of a cooking ring of gelatinized starch can be observed physically through the presence of translucent or sticky areas. Similarly, the concern about shattering or feathering in potato strips with poor cut quality presents both in broken strips and in small cuts or cracks on the surface of the strip. The POSITA would be aware that the quality of the cut achieved in processing can be assessed by physically viewing and touching sample potato strips to determine whether they suffer from such defects.

(c) *The CGK regarding texturometers*

[97] Objective testing of products is also important in food processing, allowing for the more precise measurement of particular characteristics. Of significance in this proceeding is the use of "texturometers" or texture analyzers, machines designed to measure various physical and mechanical properties of food, such as firmness, elasticity, compression, extension, bending, shearing, and cutting. Texturometers are well known, having been a standard part of food process engineering testing for decades.

[98] A food sample can be placed on a platform on the texturometer, and an arm fitted with a probe of varying types (*e.g.*, a cylindrical probe, a cone, a needle, a ball, a blade, or a wire) can be moved down into the sample. The force it takes for the probe to enter and continue into the food sample can be measured and recorded. The measurements can be plotted on a graph showing the force in newtons (N) at a recorded distance. The following example graph was presented by Dr. Sastry for reference, based on an academic paper published by, among others,

Drs. Goullieux and Pain, studying the effects of blanching and ohmic heating on the texture of potato cubes (Eliot, 1999a):



[Description: A line graph has an x-axis labeled "Displacement (mm)," with axis ticks at 0, 2, 4, 6, 8, and 10; and a y-axis labeled "Force (N)," also with axis ticks at 0, 2, 4, 8, and 10. A curve beginning at the origin rises to a peak of around 8N on the y-axis at around 4mm on the x-axis before dropping to an irregular curve between around 4 and 5N through to the 10mm point on the x-axis. The area under the curve is shaded with diagonal blue lines.]

[99] In the above sample texturometry curve, Dr. Sastry identified the peak showing the initial penetration force of cutting with a red arrow. The total amount of work (or energy) required to cut the sample to a particular depth is calculated as the total area under the force curve, as identified by the blue line shading. The total work can be measured or expressed in newton millimeters (N mm) or in joules (J), one joule being equal to one newton metre. A texturometry curve may be affected by the speed at which the probe is advanced into the food product.

[100] As noted above, the arm of a texturometer can be fitted with a variety of probes for the purpose of testing. The experts agreed that using a blade on a texturometer allows for the direct measurement of cutting resistance: Raghavan First Report, para 106; Sastry First Report,

para 66; Transcript, pp 696–697. However, they differed on whether a blade was *required* in order to measure cutting resistance. In Dr. Raghavan's view, only a texturometer fitted with a blade could measure resistance to cutting, with other probes measuring other mechanical properties that have no simple relationship with cutting resistance: Raghavan First Report, para 106; Raghavan Second Report, paras 45–49. Dr. Sastry opined that the POSITA would understand that cutting resistance could be measured with other cutting implements, such as a wire, and that cutting resistance is related to other properties, as a food that is softer than another will generally be simultaneously easier to compress, penetrate, bend, and cut: Sastry First Report, paras 66–79; Sastry Second Report, paras 24–28.

[101] The evidence regarding texturometers and the studies that use them show that various probes can be used, and that each directly measures only what the probe is doing to the sample. Thus, a texturometer fitted with a blade directly measures the energy required to cut with a blade, including matters such as the maximum cutting force, other peaks, and the total work performed to cut the sample (Hiller, 1996; Eliot, 1999a; Eliot, 2000). A texturometer fitted with a wire would similarly directly measure the energy required to cut the sample with a wire (Kamyab, 1998), while one fitted with a wedge would directly measure the energy required to cut or penetrate the sample with a wedge (Hiller, 1996). Similarly, a texturometer fitted with a cylinder or a cone would directly measure the energy required to compress the sample with the cylinder or cone respectively (Hiller, 1996; Rastogi, 1999; Eliot, 1999b).

[102] The dispute between the experts ultimately relates less to what is directly measured by the texturometer, and more to what can be understood indirectly from such measurements.

Would the POSITA understand as part of their CGK, for example, that a sample that is more easily compressed than another will also generally be easier to cut? The answer to this question does not affect the POSITA's construction of the '841 Patent. It is relevant only to Simplot's allegations of obviousness, which I have found I do not need to address. I therefore do not need to address the question further.

[103] The same is true with respect to the related subject of "turgor pressure," which is the pressure exerted by the fluids within a cell, which push the cell membrane against the cell wall. The experts disagreed about what the POSITA would know about turgor pressure and its relationship with softness and/or resistance to cutting. This led to significant disputes in their reports and testimony regarding the issue, and about what could be drawn from three academic papers in particular (Alvarez, 2000; Hiller, 1996; Rastogi, 1999): Raghavan Second Report, paras 23–33; Raghavan Third Report, paras 21–24; Raghavan Fourth Report, paras 23–36; Raghavan Fifth Report, paras 44–57; Sastry Third Report, paras 21–30, 37–41; Vorobiev Second Report, paras 29–33; Transcript, pp 484–491, 703–713, 737–749, 834–841.

[104] Again, these questions are primarily relevant to the question of obviousness, which I need not address. Only one aspect becomes relevant to the issue of claims construction, namely the relationship between the "softness" of a fruit or vegetable and its resistance to cutting. As noted above, in Dr. Sastry's opinion, the POSITA would understand that when a vegetable or fruit is softer, it is easier to cut, *i.e.*, can be cut with less force or energy: Sastry First Report, paras 69–73, 92; Sastry Second Report, para 26. In Dr. Raghavan's view, softening is a distinct property from resistance to cutting and cannot be correlated to it: Raghavan Second Report, para 55;

Transcript, pp 465–466. I address this difference of opinion further below at paragraphs [118] to [126] and [232] to [236] in the contexts it arises.

(d) *The inventors' discussion of the invention*

[105] The inventors of the '841 Patent describe drawbacks of traditional preheating using a hot water tank, including the cooking ring of gelatinized starch described above, loss of tuber material into the water, and the different increases in temperature in smaller tubers and larger ones: '841 Patent, pp 1–2. They say "[i]t would be desirable to submit tubers to treatment that will prepare them for cutting, and is efficient; in other words, a kind of treatment which avoids the 'shattering' effect, while minimizing or even eliminating the drawbacks that were mentioned about traditional preheating": '841 Patent, p 2. They indicate that they investigated solutions involving electrical process to overcome the limitations of the conventional methods of pretreatment.

[106] After a discussion of certain prior art, addressed further below, the inventors state that their invention focuses on treatment before cutting, to reduce the tuber's resistance to cutting. Under the heading "Summary of the Invention," they say the invention provides a process to treat vegetables and fruit in order to reduce their resistance to cutting "and thus reduce any loss of material during subsequent stages of the manufacturing process": '841 Patent, p 3. The application of a high electric field is said to translate to vegetables and fruit, particularly potatoes, "with the effect of softening which is favourable to shear cutting during subsequent stages for transforming the tubers into fry strips": '841 Patent, p 3.

[107] The inventors discuss testing they performed, including comparative testing on the quality of the cut, based on a sensorial score that assessed the “tactile appreciation of the roughness of the strip edge”: ’841 Patent, p 5. The POSITA reviewing this statement in light of their CGK would understand that the inventors conducted a sensory evaluation (by touching) of the shattering or feathering of the potato strips after cutting.

[108] The inventors also refer to quantitative texture measurements performed with a texturometer, which they describe as a “device that allows quantification of the tuber resistance to slicing”: ’841 Patent, p 5. They say they obtained results that show that “the energy that is necessary to slice tubers which have been electrically processed is similar to the energy necessary to slice heat processed tubers,” and that the energy at slicing decreased with an increase in the electric field: ’841 Patent, p 5. The POSITA reviewing these statements in light of their CGK would understand that the inventors found that the total energy required to cut the potato, *i.e.*, the area under the texturometry curve, was similar between the electrically treated potatoes and the heat processed potatoes. Since the inventors state that preheated potatoes have lower resistance to cutting than raw potatoes, the POSITA would understand that the purpose of comparing electrically treated potatoes to heat processed potatoes was to show that a similar resistance to cutting (and thus a similar, but unquantified, reduction compared to raw potatoes) was achieved with the electrical treatment.

[109] Having discussed these results, the inventors state that “[i]n addition to guaranteeing a shear cut,” [emphasis added] electrical processing had other advantages, including reduced water

consumption, short processing periods of 3 to 5 seconds instead of 20 to 40 minutes, homogenous processing regardless of tuber size, and energy savings: ’841 Patent, pp 5–6.

(e) *The parties’ constructions*

(i) McCain/Dr. Raghavan

[110] In Dr. Raghavan’s opinion, the POSITA would understand *cutting* to mean the step of slicing or dividing the fruit or vegetable into pieces with a blade. He concluded the POSITA would consider that the process must take place on whole, uncut vegetables or fruit since it is designed to reduce resistance to cutting and therefore implicitly occurs before the cutting of the vegetable or fruit: Raghavan First Report, para 180; Raghavan Second Report, para 62.

[111] In Dr. Raghavan’s view, *reduce their resistance to cutting* would be understood to mean that the vegetable or fruit is easier to cut, *i.e.*, that the energy required to cut it (in N mm) is lower than the raw vegetable or fruit: Transcript, pp 518–519; Raghavan First Report, paras 174–179, 182. In his opinion, the term would not include the resulting benefits of the reduction described in the disclosure, namely shear cutting or avoiding shattering: Raghavan First Report, para 179; Raghavan Second Report, para 55; Transcript, pp 464–466. Dr. Raghavan did not agree with Dr. Sastry’s contention that *reduce their resistance to cutting* included or was equivalent to “softening” the vegetable or fruit, as Dr. Raghavan viewed this as an additional claim limitation: Raghavan Second Report, para 55; Transcript, pp 465–466.

[112] In his initial construction, Dr. Raghavan did not address how much *resistance to cutting* was needed to fall within the claim. However, when faced with the question, Dr. Raghavan said

the POSITA would understand that *resistance to cutting* was "sufficiently" reduced if it achieved results comparable to traditional preheating, as assessed through quantitative (texturometer) and qualitative (sensory) methods: Raghavan Second Report, para 59; Raghavan Fourth Report, paras 38–39. For the sensory assessment, the POSITA would know the qualitative signs of sufficiently treated material, namely by assessing if it was soft to touch and appeared smooth, without the gelatinization that might show over-treatment: Raghavan First Report, paras 160–161; Raghavan Second Report, paras 61, 482; Transcript, pp 515–516. At the same time, he agreed in cross-examination that a sensory evaluation (or a good "sensorial score") would not tell the skilled person whether the work, in N mm, required to cut a potato was less than that of a raw potato: Transcript, pp 520–521.

(ii) Simplot/Dr. Sastry

[113] Dr. Sastry concluded that the POSITA would understand the *resistance to cutting* element to mean the process is applied such that it "softens vegetables and/or fruit thereby making them easier to cut": Sastry First Report, paras 90, 93. In his view, the POSITA would understand that when a vegetable or fruit is softer or has less *resistance to cutting*, it can be cut with less force (in newtons) or energy (in newton meters or joules), which can be measured by a texturometer: Sastry First Report, paras 92, 295; Sastry Second Report, paras 26–28.

[114] Significantly, Dr. Sastry also considered that the POSITA would understand from the inventors' statements about the objectives of reducing resistance to cutting that the process had to be applied so as to obtain a suitable cut quality, *i.e.*, a smooth or shear cut with minimal shattering or gelatinization: Sastry First Report, paras 17, 91, 93; Sastry Second Report, para 37. He also considered that Dr. Raghavan's discussion of sensory evaluation effectively incorporated

these cut quality factors into Claim 1: Sastry Third Report, paras 44–46; Raghavan Fourth Report, para 39.

[115] Dr. Sastry agreed with Dr. Raghavan that *cutting* meant slicing or dividing something into pieces, but disagreed that this could only be done with a blade, as opposed to other tools such as a wire: Sastry Second Report, paras 25, 42. He also disagreed that the process must be applied to whole vegetables or fruit. Rather, he considered that there must be at least one cutting step after the claimed process, such that the process would be applied to vegetables or fruit before they are cut into their final shape: Sastry First Report, para 93; Sastry Second Report, para 43.

[116] The experts thus effectively agree that *reduce their resistance to cutting* means making the vegetable or fruit easier to cut by lowering the energy required to cut it, but disagree as to (i) whether this equates to or requires a softening of the vegetable or fruit; (ii) whether the reduction must result in improved or suitable cut quality; (iii) whether the reduction must be equivalent to that obtained by preheating; (iv) whether the process must be applied to whole vegetables or fruit; and (iv) whether it is limited to *resistance to cutting* by a blade.

(f) *Construction of the term*

[117] For the following reasons, I conclude the POSITA reading the term *reduce their resistance to cutting* in the context of the ’841 Patent would understand it to mean that the process results in a non-zero (*i.e.*, significant or non-trivial) reduction in the energy required to cut the vegetable or fruit. They would not understand the term to incorporate any limitations

regarding softening (to the extent that it is an additional parameter rather than a synonym), the resulting quality of the cut, the amount of reduction being equivalent to that obtained by traditional preheating, or the cutting being done by a blade. Nor would the POSITA understand the process, or the reduction in cutting resistance, to be limited to its application to whole vegetables or fruit. In my view, each party and expert is seeking to read into the *resistance to cutting* element matters that are not found in the term as the POSITA would purposively construe it in light of their CGK in the context of the whole of the ’841 Patent.

(i) Softening

[118] I agree with Dr. Raghavan that Claim 1 does not include an additional element pertaining to softening. However, Dr. Sastry appears to use the term more as a synonym or explanation for a reduction *resistance to cutting*, rather than as an additional element of the claim. He states that the term *resistance to cutting* element would be understood to mean that the process “softens vegetables and/or fruit thereby making them easier to cut”: Sastry First Report, para 90; Transcript, pp 565–566. Since he also says that the POSITA would understand that when a vegetable or fruit is softer, it can be cut with less force or energy, Dr. Sastry appears to consider the two terms effectively equal or synonymous: Sastry First Report, para 92; Transcript, pp 565–566, 575–576, 583.

[119] In this, Dr. Sastry is consistent with the inventors, who use the term “softening” to describe the impact of applying an electric field in their “Summary of the Invention”:

> According to the invention, said stage consists in the application of a high electric field directly to vegetables and fruit, under such conditions that the resulting temperature increase for the vegetables and fruit is almost zero or at least sufficiently low as not to amount to a preheating stage. The application of a high electric

> field, such as is used for extracting sugar from beet and precooking fries, translates to vegetables and fruit, and particularly to potato tubers, <u>with the effect of softening</u> which is favourable to shear cutting during subsequent stages for transforming the tubers into fry strips.
>
> [Emphasis added; '841 Patent, p 3.]

[120] I will return to this passage below in addressing other aspects of Claim 1. For present purposes, however, it can be seen that in the first sentence of the passage, the inventors are referring to the *high electric field* element and the *temperature* element of the invention. In the second sentence, the inventors indicate that the application of the field softens the potato or other vegetable and fruit, which is favourable to shear cutting (*i.e.*, improving the quality of the cut). There would be no doubt in the POSITA's mind that this sentence is directed to the *resistance to cutting* element, and that by referring to "softening" the vegetable or fruit, the inventors were referring to *reducing their resistance to cutting*.

[121] I therefore reject Dr. Raghavan's opinion that the "softening" the inventors are referring to in this passage is distinct from *reducing resistance to cutting*: Raghavan Second Report, para 55; Transcript, pp 465–466. Dr. Raghavan does not explain why the inventors, in describing their invention, would be introducing a distinct parameter, different from both *resistance to cutting* and cut quality, that they never refer to again. The inventors are clearly using "softening" as a shorthand or synonym for *reducing resistance to cutting* in this passage.

[122] I also note that Dr. Raghavan initially appeared to understand that "softening" does mean that a potato has reduced resistance to cutting, or at least relates to it. In his First Report, Dr. Raghavan described conventional hot-water preheating as being applied until potatoes are

"heated and softened," with the aim of reducing resistance to cutting: Raghavan First Report, paras 110–111. Similarly, in addressing the CGK in respect of the "[c]onventional preheating step used to reduce resistance to cutting," he stated that the qualitative signs a potato had been sufficiently treated included "observing how hard or soft to touch the treated potato was," with texturometry being a means for quantitative assessment of a reduction in resistance to cutting: Raghavan First Report, paras 160–161.

[123] Similarly, in addressing claims construction, Dr. Raghavan quoted the passage reproduced above in the context of *resistance to cutting* and the language of Claim 1, without suggesting that the inventors were referring to a distinct parameter unrelated to the claim: Raghavan First Report, paras 188–189. He also relied on the relationship between softness and *resistance to cutting* in addressing infringement, concluding that a statement in an operating manual that potatoes are "made softer" by PEF treatments was evidence that Simplot's process was intended to reduce *resistance to cutting*: Raghavan First Report, paras 226–227; Exhibit 84, p 13; see also Confidential Transcript, pp 455–456.

[124] It was not until responding to the reports of Drs. Sastry and Vorobiev that Dr. Raghavan opined that softening—including as referred to by the inventors in the above passage that he relied on, and continued to rely on—is distinct from, and could not even be correlated to, a reduction in resistance to cutting: Raghavan Second Report, paras 55, 67, 140(b), 144, 213, 221(c), 235, 241–243; Raghavan Third Report, paras 18–24, 35, 41, 56; Raghavan Fourth Report, paras 24, 32, 36; Raghavan Fifth Report, paras 18, 36, 45, 52, 57; Transcript, pp 464–466; see also McCain Closing Submissions, paras 24–25, 34. I will return to this question in

addressing the *high electric field* element, as the sentence in question is an aspect of one of McCain's central arguments on the construction of that term.

[125] I conclude that by referring to the electric field having the effect of "softening" the potato, they were referring to reducing its resistance to cutting. As noted, I also read Dr. Sastry's evidence as effectively equating softening and resistance to cutting or at least saying that the one is directly tied to the other. At the same time, this means there is a redundancy in Dr. Sastry's construction that the process "softens vegetables and/or fruit thereby making them easier to cut." To the extent that "softening" is synonymous or equal to "easier to cut," then Dr. Sastry's construction could simply read that the process "makes vegetables and/or fruit easier to cut." Such a construction effectively accords with both Dr. Raghavan's construction and the Court's, as lowering the energy to cut a vegetable or fruit means it is easier to cut: Sastry First Report, para 295.

[126] Both Dr. Raghavan's insistence on the distinction between softening and *reducing resistance to cutting* and Dr. Sastry's insistence on the use of the term appear mostly directed to issues of validity, since some of the prior art refers to softness. As noted above, construction is to be undertaken before assessing infringement and invalidity and not as a results-oriented exercise, even if central issues on construction (where the "shoe pinches") tend to be driven by issues determinative to the outcome, and thus either an infringement or an invalidity issue: *Whirlpool* at paras 43, 49(a)–(b); *dTechs EPM* at para 70. In my view, for the purposes of construction, it is sufficient to note that *reducing resistance to cutting* means, as the experts effectively agree, lowering the total energy required to cut the vegetable or fruit.

(ii) Quality of the cut

[127] Dr. Sastry is quite right that the disclosure of the ’841 Patent contains a number of indications that the inventors were seeking to convey to the reader that the invention they disclosed and claimed would improve the quality of the cut of vegetables and fruit. In language that often introduces an invention in a patent, they assert it would be “desirable” to submit tubers to a treatment that avoids the shattering effect. They describe their invention as not only reducing resistance to cutting, but consequently reducing loss of material in subsequent stages of the manufacturing process, and go so far as to state that the invention has the effect of “guaranteeing” a shear cut.

[128] Nonetheless, I agree with Dr. Raghavan and McCain that the language of Claim 1 does not reasonably allow a construction that includes cut quality as an essential element of the claim, either in the term *reduce their resistance to cutting* or elsewhere. As noted above, the claims of a patent define the scope of the monopoly, and the Court must adhere to the language of the claims, purposively construed, giving that claim language primacy: *Free World Trust* at paras 31(a)–(d), 33, 39–40; *Tearlab* at para 31. In my view, the POSITA would understand that resistance to cutting refers to the energy required to cut a fruit or vegetable, while cut quality refers to the characteristics of the resulting cut. The POSITA would know that the two are related, in that reducing resistance to cutting was understood to have effects in improving cut quality. However, they would understand them as different concepts.

[129] Although the inventors tested and clearly wanted to convey the advantages of their invention in terms of cut quality, they did not claim those advantages. Claim 1, as drafted, is

limited to a process that will *reduce resistance to cutting* of vegetables and fruit. Reading this term to include elements of cut quality would go beyond construing the language of the claims purposively to improperly import an advantage or promise found in the disclosure into the claims: *Whirlpool* at para 52; *Biogen* at paras 72–74; *Tearlab* at para 33. This is particularly so since, as Dr. Sastry ultimately recognized and as the inventors express, a reduction in *resistance to cutting* may have other advantages in addition to reducing shattering or feathering, including limiting blade wear and reducing energy consumption: Transcript, pp 701–702.

[130] It is also relevant that Claim 1 is not limited to the treatment of potatoes. There was no evidence that shattering or feathering is an issue—or even occurs—in all *vegetables and fruit* or, indeed, in any vegetables or fruit other than potatoes. To incorporate a limitation into Claim 1 that is specific to potatoes would be inconsistent with its broader use of *vegetables and fruit* (a term discussed further below). There was also no evidence that even in potatoes, shattering or feathering invariably occurs in raw potatoes, such that its absence would necessarily demonstrate to the POSITA the existence of a reduction in cutting resistance. To the contrary, the ’841 Patent itself only goes so far as to say that "[i]nappropriate pre-treatment <u>may</u> result in a non-shear cut, and a 'shattering' or crushing effect" [emphasis added]. The patent therefore does not purport to identify a direct relationship between reducing resistance to cutting and improving the quality of the resulting cut.

(iii) Equivalent to preheating

[131] For the same reasons of adherence to the claim language, I reject Dr. Raghavan's contention that Claim 1 requires a reduction in *resistance to cutting* equivalent to that achieved by traditional preheating. Again, Claim 1 includes no such limitation. It is clear that the inventors

view the claimed process as an alternative to traditional preheating of vegetables. But there is no requirement in Claim 1 that it be used as a replacement of preheating in hot water. The process of Claim 1 can thus be performed even if a party or company never used such preheating, or if the industry as a whole never preheated a particular fruit or vegetable in hot water. Claim 1 does not refer to a comparison between the claimed reduction in *resistance to cutting* and the reduction caused by preheating in a water bath. As discussed further below, Claim 1 does make an express comparison to preheating in respect of the claimed temperature increase: it must be *at least sufficiently low as to not amount to a preheating step*. They make no similar comparison to preheating in the reduction in *resistance to cutting*, and it is not for McCain or the Court to read in such a comparison.

[132] Contrary to both Dr. Raghavan and Dr. Sastry's constructions, Claim 1 contains no requirement that the *resistance to cutting* be "sufficiently" reduced to achieve a particular end. Rather, what it claims is a process that results in reduced *resistance to cutting* in the *vegetables and fruit* through the application of a *high electric field*. The degree of reduction in *resistance to cutting* to be achieved through the process is left to the skilled reader applying and working the invention. It may well depend on the application they choose to use the process for. If they wish to use it before cutting and cooking avocados, they may consider a particular amount of reduction of *resistance to cutting* beneficial; if before cutting and cooking cauliflower, salsify, or potatoes, the demands of the product may be different. Claim 1 does not limit these applications or the amount of reduction in *resistance to cutting*. There must be a reduction in the *resistance to cutting*, but the POSITA reading the term would understand it to include any non-zero (*i.e.*, significant or non-trivial) amount of reduction.

(iv) Whole vegetables and fruit

[133] Adherence to the claim language, construed purposively, also leads me to reject Dr. Raghavan's contention that Claim 1 is limited to a process applied to whole, uncut vegetables or fruit. This limitation is not found in Claim 1, and it would not be understood by the POSITA to be part of a purposive construction of the term *vegetables and fruit*, the *resistance to cutting* element, or any other element of the claim. While I agree that reducing resistance to cutting implies there will be a cutting step after the claimed processing treatment, I cannot agree that a prior cutting step is excluded either expressly or implicitly.

[134] Claim 1 does not claim a process for treating whole *vegetables and fruit*, and the disclosure makes no mention of the importance of the vegetable or fruit being whole. Indeed, Dr. Raghavan misstates the patent when he says that "the 841 Patent states that the invention provides a new way of conducting a well-known pretreatment stage, reducing resistance to cutting, when starting from <u>whole</u>, raw vegetables and fruit" [emphasis added]: Raghavan First Report, para 128. The '841 Patent says nothing about starting from "whole, raw vegetables and fruit." It says that the claimed process reduces resistance to cutting of vegetables and fruit.

[135] Nor is there any element of the CGK that would lead the POSITA to conclude that the language of Claim 1 was intended to refer exclusively to whole *vegetables and fruit*. It would read Claim 1 too narrowly to exclude from its ambit a process in which, for example, a potato or beet is cut in half before treatment, had a small piece cut off it, or was trimmed to remove rot or other defects (see Transcript, pp 1004–1006, where both contrary positions were expressed by McCain). Yet this would be the effect of Dr. Raghavan's construction, which again appears to be

directed at avoiding certain prior art for validity reasons rather than at attempting to purposively construe the language of Claim 1 in the context of the ’841 Patent.

[136] In support of their argument regarding whole *vegetables and fruit*, Dr. Raghavan and McCain point to the list of traditional processing steps given in the background section disclosure, noting that the list does not include a cutting step prior to preheating: Raghavan First Report, para 175(a); Raghavan Second Report, para 54; McCain Closing Argument, para 32. This argument is unpersuasive. Notably, the list in question also does not refer to preheating, listing the steps as ones in which vegetables are “washed, peeled, size-sorted, cut, blanched, dried, possibly immersed in frying oils, frozen and packed”: ’841 Patent, p 1. Asserting that the list does not include a cutting step prior to preheating is therefore nonsensical.

[137] In any case, even if the list had referred to preheating, attempting to read the word “whole” into Claim 1 on the basis of the inventors’ general listing of traditional steps in vegetable processing falls squarely into the description of “borrowing this or that gloss from other parts of the specification”: *Whirlpool* at para 52, citing *Metalliflex Ltd v Rodi & Wienenberger Aktiengesellschaft*, 1960 CanLII 83 (SCC), [1961] SCR 117 at p 122. Indeed, this argument lies in stark contrast to McCain and Dr. Raghavan’s strong insistence that other aspects of the disclosure—including aspects expressed more clearly and with greater connection to the claimed process, like the “guarantee” of a shear cut—not be read into the claims. The POSITA reviewing this aspect of the disclosure would not read it as any sign that the inventors were limiting their claim to whole *vegetables and fruit*.

[138] McCain's reliance on the fact that McCain and Simplot use steam peeling, rather than peeling by cutting with knives, reaches even further afield in an attempt to justify including a limitation that simply does not appear in the claim: McCain Closing Argument, para 32, fn 136. Claim 1 is not limited to french fry manufacturing, is not limited to vegetables that have been steam peeled rather than peeled with knives, and is certainly not limited to the processes that McCain or Simplot happen to use. Further, McCain's argument ignores the fact that the very evidence it cites indicates that McCain's process involved manual trimming of the tubers prior to preheating and cutting: Transcript, pp 102–103; 187; see also Exhibit 59, p 155.

(v) Cutting with a blade

[139] I also conclude the POSITA would not understand the *resistance to cutting* element to be limited to reducing resistance to cutting with a blade as opposed to any other cutting tool, as Dr. Raghavan contends: Raghavan First Report, para 180; Raghavan Second Report, para 37. It is important to note that while the process of Claim 1 implies that it occurs prior to cutting, since its goal is to *reduce resistance to cutting*, there is no cutting step in the process of Claim 1 itself.

[140] Dr. Raghavan presented little explanation for his assertion that the POSITA reading Claim 1 in light of their CGK and in the context of the '841 Patent would understand *cutting* to mean slicing or dividing something into pieces with a blade in particular: Raghavan First Report, para 180; Transcript, pp 467, 490–491. Dr. Raghavan does state in his Second Report that "[f]ruit and vegetables are cut using blades, not wires," but he provides no support or explanation for this statement: Raghavan Second Report, paras 47, 236. The literature indicates that most references to cutting tests involve the use of a blade, and in particular a razor blade (Hiller, 1996; Alvarez, 1999; Eliot, 1999a; Eliot, 2000), although one paper (Hiller, 1996) also refers to the

"cutting edge" of a wedge probe, and one paper (Kamyab, 1998) refers to cutting tests with a wire. None of these articles refer to the extent to which vegetables or fruit are cut with blades or other implements in industrial applications. There was thus little evidence that the term "cutting" when used in the field of food processing in respect of fruits and vegetables would be understood to mean only cutting with a blade.

[141] Conversely, Dr. Sastry's only reference in support of his statement that the POSITA would understand that cutting of certain food products can be performed with other implements, such as a wire, was to the Kamyab (1998) article, which is about cutting cheese with wire: Sastry Second Report, paras 25, 42. He contended that the POSITA would know that both wire cutting and blade cutting involve similar properties, although this evidence mostly came out in facing cross-examination on his discussion of the Kamyab (1998) article: Transcript, pp 750–754. Dr. Raghavan raised issues about the differences in the types of cutting, noting that tissue-level effects are important for cutting resistance because cutting requires movement of a blade through tissue, and blades and wires have "radically different tool geometry": Raghavan Second Report, paras 20, 37, 46.

[142] On this latter point, Dr. Raghavan was right to criticize Dr. Sastry for simply presenting Kamyab (1998), including its formula for constant force per unit width in steady-state cutting, as pertaining to a blade, without explanation as to how the discussion regarding wire cutting in the paper would be understood to apply to blade cutting: Sastry First Report, paras 70–73, 230–233; Raghavan Second Report, paras 46–49, 235–237. However, in doing so, Dr. Raghavan himself quoted a paper (Hiller, 1996) out of context.

[143] Dr. Raghavan stated that the authors of Hiller (1996) noted that for blades, “the cutting tak[es] place very close to the edge of the blade and involv[es] the surrounding tissue only minimally”: Raghavan Second Report, para 46. However, in the article, this statement refers to a hypothetical “infinitely thin blade”: Hiller, 1996. Dr. Raghavan does not cite the authors’ statements comparing cutting with a blade and cutting with a wedge and comparing the results of their wedge-fracture and blade-cutting tests. In any case, to the extent that the passage quoted by Dr. Raghavan does apply to real-world blade cutting, it appears to contradict Dr. Raghavan’s own opinion that tissue-level effects are important in cutting with a blade because it requires movement of the blade through the tissue: Raghavan Second Report, paras 20, 37, 46.

[144] The disclosure of the ’841 Patent gives some indication that the inventors did not mean to limit their invention to a process that precedes cutting with a blade. In discussing the importance of pre-treatment in the background section of their discussion, the inventors say that “[p]re-treatment to reduce the tubers’ resistance to cutting is necessary to ease the action of cutting tools, avoid twisting of the cut strips or a poor cut, as well as damage to the cutting knives” [emphasis added]: ’841 Patent, p 2. The inventors’ reference to “cutting tools” in addition to “cutting knives” suggests the possibility of use of cutting tools that are not knives or blades.

[145] It is important to recall that the process of Claim 1 relates to treatment of potatoes before cutting, rather than requiring the cutting itself. The question raised by Dr. Raghavan’s proposed limit to cutting with a blade is therefore only whether the process is limited to reducing *resistance to cutting* with a blade, or whether it also encompasses reducing *resistance to cutting* with another cutting tool. The evidence was equivocal at best regarding whether a process that

reduces resistance to cutting with a blade would also reduce resistance to cutting with a wire, or vice versa, or whether it is even possible to reduce resistance to cutting with a blade without also reducing resistance to cutting with any other tool.

[146] In this regard, Dr. Raghavan's evidence regarding the differences between texturometry tests in which the texturometer is fitted with a blade and those in which it is fitted with another probe does not assist, for two reasons: Raghavan First Report, para 106; Raghavan Second Report, paras 45, 59–60. First, while the inventors refer to texturometry testing, they do not refer to the probe used for those tests: '841 Patent, p 5. Second, a texturometer is simply a device for measuring resistance to slicing. The inventors did not, in Claim 1, limit the reduction in *resistance to cutting* to a particular method of measuring either the reduction or the cutting resistance. They simply claimed a process in which the *resistance to cutting* of the vegetable or fruit, as a physical property of that vegetable or fruit, is reduced.

[147] In the absence of clear evidence that the POSITA would understand that cutting of fruits and vegetables is invariably done with blades instead of other cutting tools, or that treating a fruit or vegetable with an electric field might somehow reduce its *resistance to cutting* with a blade but not reduce its *resistance to cutting* with a wire or other tool, I am not satisfied that the POSITA would read the *resistance to cutting* in Claim 1 as being limited to reducing *resistance to cutting* with a blade alone.

[148] I note again that this issue appears to be driven by concerns about invalidity in light of the prior art, and in particular articles that study the effects of electric fields on fruits or

vegetables using tests that did not involve blades: Raghavan Second Report, paras 168–169, 180(e), 186(d), 246–249. As noted, while there is no inherent difficulty in addressing relevant issues that affect infringement or invalidity when undertaking claims construction, the construction itself should not be undertaken with the goal of distinguishing prior art: *Whirlpool* at paras 43, 49(a)–(b); *dTechs EPM* at para 70. Construing the *resistance to cutting* element purposively, but without considering the impact of the construction on infringement or validity, I conclude the POSITA would not understand it to limit the claimed invention to a process that reduces *resistance to cutting* with a blade specifically as opposed to reducing *resistance to cutting* with any other cutting tools.

(vi) Conclusion

[149] I therefore conclude that the POSITA reading the *resistance to cutting* element in the context of the ’841 Patent would understand it to simply mean that the process results in a reduction in the energy required to cut the vegetable or fruit. No other limitation on the term proposed by the parties and experts is justified by a purposive reading of the language of the claim in the context of the patent as a whole.

(2) The *high electric field* element

[150] The process of Claim 1 requires the application of a *high electric field* directly to the vegetables and/or fruit. As a central point of contention between the parties, McCain argues that the POSITA would read a *high electric field* as used in Claim 1 to cover any electric field that results in a reduced cutting resistance, while Simplot argues it would be read to refer to electric fields in the range of about 20 to 100 V/cm and would certainly not cover electric fields in the

range of 1 kV/cm or above. The construction of the *high electric field* element requires a careful consideration of the POSITA's general knowledge in the areas of electricity and electric fields, including their impact on plant tissues and the terminology that was used to describe them at the date of the publication of the '841 Patent, as well as the discussion contained in the '841 Patent itself.

(a) *The CGK regarding electricity and electric fields*

[151] As the parties agree, the POSITA would be familiar with the nature of electricity and the relationships between current (I), voltage (V), conductivity (σ), resistance (R), and power (P). They would understand Ohm's law, by which voltage varies with current and resistance according to the formula V=IR. They would similarly understand that resistance and conductivity are reciprocal quantities, with resistance being measured in ohms (Ω) and conductivity being measured in siemens per meter (S/m).

[152] An electric field or electrical field refers to the electrical forces exerted on other charged particles within a physical area, such as between two electrodes. The strength or magnitude of an electric field (E) is a function of the potential difference between the electrodes and the distance between them. It is measured in volts per meter (V/m).

[153] Electrical energy can be converted into other forms of energy such as thermal energy (heat). When current passes through a conductor, the amount of heat generated will depend on the current, the resistance of the conductor, and the time for which the current flows. This heating is known by a number of names, including ohmic heating, Joule heating, and resistance

heating. Heat is generated in accordance with Joule’s law, which provides that the amount of heat created equals the square of the current, multiplied by the resistance and the time, *i.e.*, the formula $Q=I^2Rt$, with Q being the amount of heat generated, expressed in joules (J). Expressed differently to reflect the field strength (E) and conductivity of the material (σ) instead of the current and resistance, this formula can be stated as $Q=E^2\sigma t$.

[154] As discussed further below, in addition to generating heat, electric fields can also cause other, non-thermal effects as a result of the effect of the electric field on ions within the field.

(b) *The CGK regarding thermal processing*

[155] Heat processing is frequently used in the food processing industry. Processing steps such as boiling, blanching, sterilization, or drying are used for various reasons, including food preservation, improving food safety and processing efficiency, and obtaining a desired final food product in terms of colour, flavour, or texture. Heating foods can change the physical properties of food at the cellular level. Cellular membranes can become permeable, allowing material to cross the cell membrane between the interior and exterior of cells. This is referred to as “thermal permeabilization.” Heating can also soften foods and can cause molecular transformation such as the gelatinization of starch molecules or the denaturation of proteins. For example, as discussed above and in the ’841 Patent, thermal treatment of potatoes in hot water can reduce the potato’s resistance to cutting, and may also create a gelatinized starch cooking ring around the outside of the tuber.

[156] As noted, passing current through a resistant material can heat the material through ohmic heating, in which the electrical energy is converted into thermal energy. Ohmic heating has been known as a method for heating foods for over a century. Ohmic heating causes heat to be generated within the food, rather than from external sources such as hot water, allowing for more uniform heating. Typical ohmic heating equipment has a treatment chamber fitted with electrodes connected to a power supply. The electrodes apply an electric field to the food via the electrodes, either by being connected directly to the food or by being connected to a medium, like a water bath, in which the food is immersed. Applying an electric field can cause the same thermal effects as conventional heating, including softening, gelatinization, and denaturation.

(c) *The CGK regarding non-thermal processing and effects*

[157] Electric fields were also known in food processing for non-thermal effects, *i.e.*, effects independent of the increase of the temperature of the food caused by ohmic heating. These effects are not entirely isolated from each other, as the application of any electric field will cause at least some degree of thermal effect, in accordance with Joule's law. However, food processing engineers recognize the existence of electric effects that are not caused by heat, and research often seeks to focus on these effects.

[158] These known effects include those caused by the impact of the electric field on the different ionic charges within the phospholipid bilayer of a cell membrane and on the different ionic charges inside and outside a cell membrane, known as the "transmembrane potential." This is illustrated in the following diagrams from Dr. Sastry's First Report, which I found helpful in understanding the concept:

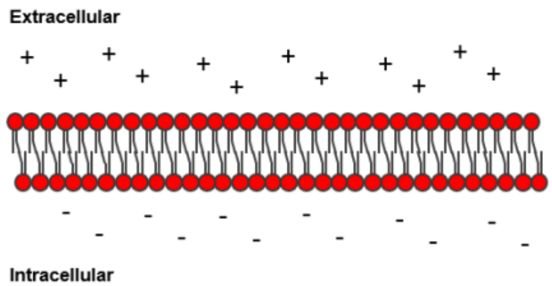


Figure 3. Transmembrane potential diagram.

[Description: A figure labelled "Figure 3. Transmembrane potential diagram" pictures a phospholipid bilayer extending laterally. A collection of plus signs appears above the bilayer, labelled "Extracellular"; a collection of minus signs appears below the bilayer, labelled "Intracellular".]

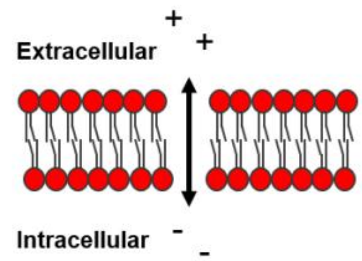


Figure 4. Electropermeabilization diagram.

[Description: A figure labelled "Figure 4. Electropermeabilization diagram" pictures the phospholipid bilayer extending laterally, with a gap in the middle in which a vertical double-headed arrow appears. Two plus signs appear above above the bilayer, labelled "Extracellular"; two minus signs appear below the bilayer, labelled "Intracellular".]

[159] In these diagrams, a cross-section of the phospholipid bilayer of a cell is shown with the phosphate head of the phospholipids in red and the lipid tails in black. The application of an electric field exerts forces on the charged molecules inside and outside the cell. If the field is strong enough, this can cause pores to be formed in the cell membrane, creating a permeability in the membrane allowing material to flow through the pores. This is termed "electroporation" or "electropermeabilization." It has the effect of partially disintegrating the cell membrane, which can affect the texture and other properties of food tissue. It can also have similar effects on the cells of micro-organisms in the food product, inactivating the microbes and improving food safety.

[160] Electroporation will occur when the electric field strength exceeds a critical value, which will vary depending on factors such as cell size, transmembrane potential, and membrane capacitance. Even at field strengths below this critical value, however, cell membrane damage and partial permeabilization can occur through mechanisms other than electroporation.

Electroporation/electropermeabilization effects can be reversible or irreversible, depending on the parameters of the electric field being applied.

[161] Both Dr. Sastry and Dr. Vorobiev addressed electroporation as being part of the CGK in their respective First Reports: Sastry First Report, paras 37–44, 49–50; Vorobiev First Report, paras 32–42. Dr. Raghavan addressed non-thermal food processing generally, and referred to microbial inactivation, extraction, and pasteurization, but did not discuss what was known about the mechanisms of non-thermal effects beyond a brief reference to “preserving the product tissue”: Raghavan First Report, paras 83–86, 93. In response to Drs. Sastry and Vorobiev, Dr. Raghavan agreed the POSITA would be familiar with the literature regarding electroporation, but criticized Drs. Sastry and Vorobiev’s evidence on a number of grounds, including on the basis that the POSITA would not apply their knowledge of electroporation in the context of the ’841 Patent: Raghavan Second Report, paras 34–37; Raghavan Third Report, paras 13–17, 37–38; Raghavan Fourth Report, para 7.

[162] Having reviewed Dr. Raghavan’s criticisms carefully, I find them unpersuasive and some of them unduly argumentative. For example, Dr. Raghavan criticizes his colleagues’ focus on electroporation, rather than other effects or mechanisms. However, other than referring to the uncertainty of the mechanics of electroporation, he presents no substantive discussion of other effects or mechanisms he thought should have been discussed in greater detail: Raghavan Second Report, paras 34–35; see also Raghavan Third Report, paras 13, 17. In any event, both Dr. Sastry and Dr. Vorobiev did address other related non-thermal electric effects and mechanisms, including partial and reversible permeabilization, and electro-osmotic effects, albeit not to the

same extent as their discussion of electroporation: Sastry First Report, paras 37, 43, 49–50; Vorobiev First Report, paras 37, 40–41.

[163] The same is true of Dr. Raghavan's criticism of Dr. Sastry for discussing only cell-level effects and not tissue-level effects: Raghavan Second Report, para 37. While Dr. Raghavan asserts generally that tissue-level effects are important and that the POSITA would consider them when using electric fields to reduce resistance to cutting, his own initial discussion of the CGK presented no discussion of tissue-level effects. Even his response provides little detail beyond saying that cutting affects fruits and vegetable at the tissue level and that it may be affected by "factors like intercellular adhesion": Raghavan Second Report, paras 20, 37. Dr. Raghavan does not explain these concepts further.

[164] In my view, the POSITA's knowledge of electroporation would be relevant to their reading and understanding of the '841 Patent given its connection to non-thermal electric field effects and to PEF in particular. As the experts agree, PEF technologies were known by those in the field. The '841 Patent refers to them. As discussed further below, the evidence indicates that at the time of publication of the patent, PEF was being studied primarily in connection with its electroporation effects. The POSITA's understanding of these electric field technologies and their effects would inform their reading of the patent, and the *high electric field* element in particular.

(d) *The CGK regarding pulsed electric field treatment*

(i) PEF treatments in food processing

[165] As discussed, stronger electric fields impart a greater amount of thermal energy to food products, with the energy imparted increasing in proportion to the square of the field strength. To control the amount of heat generated at higher field strengths when focusing on non-thermal electric effects, researchers developed techniques beginning in around the mid-20th century of applying electric fields in very short pulses. This became known as pulsed electric field or PEF. In the latter half of the 20th century, improvements in electrical engineering technology increased researchers' ability to control parameters in PEF applications, such as pulse time and field intensity. By 2001, PEF food processing research included the use of PEF for microbial inactivation and for applications such as drying or extracting juice or sugar.

[166] The experts agree that the use of PEF in food processing formed part of the CGK of the POSITA at the date of publication of the '841 Patent. As reflective of this CGK, the experts referred to a number of academic publications from the 1990s and early 2000s speaking to the application of PEF technologies in food processing (Knorr, 1994; Ho, 1995; Grahl, 1996; Ho, 1997; Angersbach, 1997; Sensoy, 1997; Knorr, 1998; Rastogi, 1999; Angersbach, 1999a; Angersbach, 1999b; Barsotti, 1999; Bazhal, 2000; Ruhlman, 2001; Lebovka, 2001) as well as patents in the area (a 1999 PCT patent to Eshtiaghi and a 2000 US patent to Mittal).

[167] As can be seen in these sources, the electric fields used in PEF treatments are typically measured in kV/cm and range from many hundreds of V/cm to tens of kV/cm, while the very short pulses are typically measured in microseconds (μs), *i.e.*, millionths of a second. The papers

the experts put forward as illustrative mostly studied pulses ranging from 1 to 800 μs, with some studying slightly longer pulse of 1 ms/1,000 μs (Lebovka, 2001) or 1.5 ms/1,500 μs (Angersbach, 1999a). The effects of a different number of pulses, and thus a different total amount of applied energy, was also frequently studied, with the number of pulses ranging from a single pulse to as many as 1,000.

[168] As the experts agree, the high voltages and short pulse durations of pulses mean that special equipment is typically needed to implement a PEF treatment: Sastry First Report, paras 57, 60; Vorobiev First Report, paras 46, 69–90; Raghavan Second Report, para 44.

(ii) PEF treatments and electroporation

[169] Dr. Sastry described PEF as being a technique based on the electroporation of cell membranes: Sastry First Report, para 56. Similarly, Dr. Vorobiev noted that by the 1990s, cell membrane permeability due to electroporation was identified as the primary underlying mechanism for the cellular changes caused by PEF: Vorobiev First Report, para 65. Dr. Raghavan took issue with these statements, asserting that the defining aspect of PEF was its use in a non-thermal process, rather than the electroporation of tissues: Raghavan Second Report, para 42; Raghavan Third Report, para 37. At the same time, Dr. Raghavan agreed in cross-examination that the POSITA would know that PEF treatments caused electroporation: Transcript, pp 507–508, 516–517.

[170] Having reviewed the literature cited by the parties, I find it supports Drs. Sastry and Vorobiev's view that in December 2001, the common knowledge in the art was that the primary

mechanism by which PEF treatments were understood to impact plant tissue and microbial cells was through electroporation.

[171] A 1994 review paper (Knorr, 1994) considered the application of PEF in food processing (terming it “high electric field pulses” or HEFP). In discussing the underlying theory of the treatment, the authors note that the transmembrane potential induced when an external electric field is applied to a cell “is believed to be the primary event that leads to pore formation.” In the years that followed, authors publishing in the area of PEF treatments frequently referred to electropermeabilization/electroporation as the relevant mechanism (*e.g.*, Ho, 1995; Grahl, 1996; Angersbach, 1997; Sensoy, 1997; Knorr, 1998; Angersbach, 1999a; Angersbach, 1999b; Barsotti, 1999; Eshtiaghi; Rastogi, 1999; Bazhal, 2000; Lebovka, 2001).

[172] Dr. Raghavan stressed that the Knorr (1994) review paper indicated that the particular mechanisms of pore formation and membrane destabilization by PEF were not entirely understood: Raghavan Second Report, para 35. A similar statement is seen in Grahl (1996). However, these statements relate to the particular mechanism of <u>how</u> pores are formed, not <u>whether</u> they are formed. Dr. Raghavan did not explain why he thought the particular mechanism of how pores are formed would be important to the POSITA’s understanding of the ’841 Patent. In any event, Grahl (1996) indicates that while not entirely understood, electromechanical compression of the cell membrane owing to the attraction of opposite charges inside and outside the cell membrane was the “most widely accepted model” (see also Sensoy, 1997).

[173] Indeed, many of the papers in the late 1990s were directed to studying how the permeabilization of plant cells known to be caused by PEF affects other food processes such as dehydration (Angersbach, 1997; Rastogi, 1999); the particular PEF parameters to obtain permeabilization (Sensoy, 1997; Bazhal, 2000); or how to quantify the extent of permeabilization (Knorr, 1998; Angersbach, 1999a; Angersbach, 1999b).

[174] Dr. Vorobiev co-authored a paper published in early 2001 studying the breakage of cellular tissues in PEF treatments (Lebovka, 2001). The authors noted that there had been a "significant advance" in understanding the nature and mechanisms of PEF, stating that the "strong electric field causes electroporation of cells, an increase in their permeability, and, in some cases, disruption of their structural integrity. […] This phenomenon is sometimes referred to as electropermeabilization." Thus, while the particular "nature of electropermeabilization of complex cellular materials [was] not yet fully understood" (Lebovka, 2001), there was clearly a general understanding of electroporation caused by PEF.

[175] I conclude that the POSITA would have understood at the date of publication of the '841 Patent that PEF treatments were being applied and studied in food processing primarily because of the electroporation/electropermeabilization effect. As the experts appear to agree, this was understood to be a non-thermal effect, and many of the foregoing papers state that PEF involves very low temperature increases and can therefore be considered a non-thermal method (Knorr, 1994; Ho, 1995; Grahl, 1996; Angersbach, 1997; Knorr, 1998; Angersbach, 1999a; Angersbach, 1999b; Rastogi, 1999; Bazhal, 2000; Lebovka, 2001).

[176] Dr. Raghavan's evidence seeking to downplay the role of electroporation as important to the POSITA's knowledge of the effects of PEF treatment on food products appears contrary to his own stated views at around the time of the publication of the patent. In a paper on PEF treatment published shortly after the publication date (Bazhal, 2003), Dr. Raghavan and his co-authors introduced their topic with the following statements:

> The major interest in pulsed electric field (PEF) treatment of cellular materials <u>is derived from its non thermal applications in inducing increased permeability</u> […]. Dielectric breakdown […] or electroplasmolysis […] of biological cells during PEF treatment <u>is generally due to electroporation. This is the formation and growth of pores in biological membranes resulting from their polarization under external electric field</u>.
>
> [Emphasis added; citations omitted.]

[177] This article was published after December 2001, so it is not itself part of the CGK. However, it was initially submitted in May 2002, it cites earlier papers for the foregoing statements, and Dr. Raghavan presented it as reflecting the CGK: Raghavan First Report, para 85 (fn 21). Dr. Raghavan also accepted in cross-examination that it reflected his understanding "back in that time frame," and there was no evidence that his knowledge, understanding, or view of PEF had materially changed in the few months between the publication date of the '841 Patent and the submission of this article: Transcript, pp 509–510, 677–679; see also Ngadi (2003). I find that this reference, as well as the broader body of literature relating to PEF treatments referred to above, undermines Dr. Raghavan's efforts to limit the extent to which the POSITA would associate PEF treatment with the mechanisms of electroporation/electropermeabilization at the date of publication of the '841 Patent.

[178] Drs. Sastry and Vorobiev observed that the different cellular effects, different electric field and treatment parameters, and different equipment used in PEF applications are such that the technique is considered distinct from other electric field applications such as ohmic heating, and the use of PEF in food processing was generally a distinct research area from ohmic heating: Sastry First Report, paras 56–64; Vorobiev First Report, paras 43–47. The articles cited above support these conclusions, with which Dr. Raghavan did not disagree: Raghavan Second Report, paras 42–44; Raghavan Third Report, para 26. In other words, the treatment of fruits and vegetables with electric fields of much higher strengths in microsecond or millisecond pulses is not simply a question of the degree of treatment, but a difference in the kind of treatment.

[179] I conclude that at the date of publication, the POSITA would be aware of PEF treatments in the field of food processing, and would understand that (a) PEF was a comparatively new technology compared to ohmic heating, and was being studied on an ongoing basis as a generally distinct research area; (b) it was considered an effectively non-thermal treatment, with electric effects not related to the heat generated by the electric field; (c) these effects, including increased permeability, were generally due to electroporation caused by the electric field creating pores in the cell membrane; and (d) PEF typically required specialized equipment permitting the application of sufficiently high electric field intensities and very short pulse durations, typically in the range of microseconds.

(e) *The CGK regarding terminology used to describe electric field treatments*

[180] Reviewing the claims through the eyes of the POSITA in light of their CGK involves a consideration of whether words, terms, or language used in the patent had a particular technical

meaning or common understanding in the field of art at the date of publication: *Whirlpool* at para 53; *Free World Trust* at para 51; *Tetra Tech* at para 88. An important area of disagreement between the parties and their experts relates to the terminology used in the CGK to describe electric field strengths and treatments.

[181] In Dr. Raghavan's opinion, the term "high electric field" was known to the POSITA (i) to refer to non-thermal food processing methods, in contrast to ohmic heating; (ii) as an "umbrella term" covering a wide range of field strengths, with terms including "high intensity electrical field pulse (HELP)," "high voltage electric pulses," and "high field electric pulses" being used "under" that umbrella; and (iii) to include "pulsed electric field" and "moderate electric field" treatments as "subsets" of high electric field treatment: Raghavan First Report, paras 56, 83–86, 90–96, 99; Raghavan Second Report, paras 40–41, 373, 494–496; Transcript, pp 448–454. Dr. Raghavan pointed to a number of publications using these various terms to support his opinion.

[182] Dr. Sastry disagreed with Dr. Raghavan's assertion that the POSITA would understand the term "high electric field" to refer only to non-thermal processing techniques, and also with his assertion that it was an "umbrella term" that covered various types of treatments, field strengths, and applications, including PEF: Sastry Second Report, paras 12–23; Transcript, pp 570–571. In his view, the term "high electric field" was neither a term of art either with a single meaning nor a broad term covering all non-thermal electrical processing methods. Rather, the POSITA would understand the term based on its context and what a given author stated they

were using the term to mean. Dr. Sastry, too, pointed to a number of publications to support his position.

[183] Having reviewed the experts' reports and the various publications they cite, and having heard their testimony, I find little support for Dr. Raghavan's claim that the term "high electric field" was understood by the POSITA in December 2001 as an "umbrella" term to refer generally to non-thermal treatments and to include other terms such as "moderate electric field" and PEF. Given the importance of the term "high electric field" to the parties' construction arguments, and the importance of reviewing the '841 Patent in light of the CGK, I will provide my reasons for this conclusion in some detail, including reviewing the various publications cited by the experts.

[184] For his assertion that researchers used the term "high electric field" as an umbrella term for non-thermal electric processing, Dr. Raghavan cited one 1967 paper (Sale, 1967); six papers between 1995 and 2001 (Hashinaga, 1995; Kharel, 1996; Bajgai, 2001a; Bajgai, 2001b; Hashinaga, 1999; and Isobe, 1999); and three later papers on which he was an author (Singh, 2016; Vanga, 2016; and Singh, 2013): Raghavan First Report, para 83 (fn 19).The three papers that Dr. Raghavan co-authored all date from the mid-2010s. They therefore cannot have been part of the CGK of the POSITA in December 2001. Nor do they give any indication of the POSITA's general knowledge of terminology 12 to 15 years earlier. I will therefore consider the other papers Dr. Raghavan cites for this assertion, before turning to the other prior art cited by the experts.

[185] Sale, 1967. The Sale (1967) paper was recognized as an early seminal work on pulsed electric fields: Transcript, p 654. It is cited frequently in the literature on PEF: Knorr, 1994; Grahl, 1996; Sensoy, 1997; Knorr, 1998; Angersbach, 1999a; Barsotti, 1999; Ruhlman, 2001. It deals with bactericidal effects and uses the term “high electric fields” once in its title and once in its summary, using the terms “electric fields” and “very high electric fields” in the body of the article. The authors provide the electric field strengths being used, ranging between 5 and 25 kV/cm.

[186] The six 1995-2001 papers. As Dr. Sastry points out, the six papers that Dr. Raghavan cited from the most relevant time period (1995–2001) all come from the same laboratories or groups of researchers in Japan and at McGill, with many authors in common: Sastry Second Report, paras 21–23. With one exception (Kharel, 1996), these papers were directed to drying using electric fields as a result of a phenomenon known as “electric wind,” “ionic wind,” and/or “electrohydrodynamic drying (EHD).” Electric wind is created by application of an electric field to an air gap for a long period of time, a different technology than direct application of a current to food in a water bath: Transcript, pp 526–529. The Kharel (1996) paper from the same lab addresses the effect of a similar treatment with high electric fields on the postharvest life (respiration and ripening) of fruits and vegetables. In each case, the authors indicate the electric field strengths being used, which range from about 2.8 kV/cm to about 6.7 kV/cm in the six papers, and the time periods for which they were applied, which range from 4.5 to 10 hours in the electric wind papers and between 5 minutes and 3 hours in the case of Kharel (1996).

[187] My reading of the foregoing papers accords with Dr. Sastry's opinion that they use the term "high electric field" to refer to the specific type of field and application being studied in the publication, rather than as an umbrella term referring broadly to a wide range of electric fields in various treatments: Sastry Second Report, paras 19–22. The six papers from the 1995-2001 period in particular appear to reflect the preferred terminology of the group of authors to refer to fields studied to generate electric wind (or, in one case, assess impact on ripening), and do not in themselves provide much evidence that the term was in general usage to describe any non-thermal electric treatment, regardless of field strength.

[188] This view is not affected by the fact that later publications from Dr. Vorobiev's laboratory (Lebovka, 2004a; Lebovka, 2004b; Lebovka, 2005; Vorobiev, 2006) contain introductions that cite one of the electric wind papers (Bajgai, 2001a) as part of a list of references in respect of PEF applications: Transcript, pp 860–868. On its face, the Bajgai (2001a) paper, which studies constant application of an electric field for 7 hours, does not relate or refer to PEF treatments. Neither Dr. Raghavan nor McCain contend that it does: Raghavan First Report, para 83. As Dr. Vorobiev noted, the citation of this paper in the later publications was likely simply an error, albeit a repeated one, given that the paper clearly does not pertain to PEF: Transcript, p 865. In any case, the fact that Dr. Vorobiev cited Bajgai (2001a) in this context in no way supports the contention that the term "high electric field" used in the paper was recognized or used as an "umbrella term" to describe any non-thermal electric treatment.

[189] Pulsed electric field publications. Dr. Raghavan cites a number of publications dealing with PEF for the assertion that various terms describing PEF technologies were "used under the

umbrella term ‘high electric field’” at the relevant time (Rastogi, 1999; Ho, 1995; Ho, 1997; and the 2000 US patent to Mittal). Having reviewed these publications, as well as the other publications dealing with PEF prior to 2001 that appear in the evidence, I again find that they do not support Dr. Raghavan’s assertion.

[190] As set out in paragraph [166] above, the experts referred to 14 papers and two patents dealing with PEF applications in food processing in the period from 1994 to 2001. None of these papers uses the term “high electric field,” by itself, to refer to either the electric field or to the treatment being applied. This includes those cited by Dr. Raghavan: Transcript, pp 523–524.

[191] Rather, these publications use a variety of different terms, including “pulsed electric field(s)” or “electric field pulse” (Grahl, 1996; Sensoy, 1997; Angersbach, 1999b; Barsotti, 1999; Bazhal, 2000; Ruhlman, 2001; Lebovka, 2001); “high electric field pulses” (HEFP) and/or “high field electric pulses” (Knorr, 1994; Grahl, 1996; Ho, 1997; Sensoy, 1997; Angersbach, 1999b; Bazhal, 2000; Lebovka, 2001); “high intensity electric field pulses” (HELP) (Angersbach, 1997; Knorr, 1998; Rastogi, 1999; Angersbach, 1999a); “high voltage electric pulses” (Ho, 1995; Mittal); “*champ électrique à haute pulsation (CEHP)*” [“highly pulsed electric field (HPEF)”] (Eshtiaghi); and “high field, very short time electric pulses” (Barsotti, 1999).

[192] I note that the same is true of two other US patents McCain refers to, namely a 1984 patent to Geren and a 2001 patent to Robbins, issued 11 days before the ’841 Patent was published. Geren uses “short-duration high-current-density pulses” or “successive high-density current pulses” to describe alternating current pulses of between 200 μs and 5 ms, while Robbins

refers to “high voltage electric field […] in short pulses” to describe aspects of the prior art and “low voltage pulsed electrical energy” to refer to the claimed treatment.

[193] With two exceptions, all of these publications, including those using the term “pulsed electric field,” refer to the voltage or intensity of at least some of the fields being studied or cited as “high” [Ruhlman (2001) refers to treatment zones with a high voltage electrode and a low voltage electrode; Eshtiaghi uses the term “highly” to refer to the pulses rather than the electric field]. However, all of them use a term that specifies that the treatment being studied is a pulsed treatment. None of them simply uses the term “high electric field” to describe PEF treatment, or gives any indication that the PEF treatment being studied could or would simply be referred to using the term “high electric field” as an umbrella term.

[194] McCain points to the use of the term “high electric field” in the seminal Sale (1967) paper as indicative of the use of the term to cover PEF. However, this paper was one of the first addressing pulsed electric field technologies and was published some 34 years prior to the publication of the ’841 Patent. Neither McCain nor Dr. Raghavan identified a subsequent paper that used the term “high electric field” to refer to PEF treatment without the simultaneous use of the word “pulse” or “pulsed.” Rather, each of the academic papers and patents in the period from 1994 to 2001 uses terms such as “high intensity electrical field pulse,” “high voltage electric pulses,” “high electric field pulses,” or “high-voltage pulsed electrical field treatment.”

[195] This includes a paper co-authored by Dr. Sastry that was put to him in cross-examination (Sensoy, 1997). That paper refers to “high voltage pulsed electric field (PEF)” treatment, to

"[s]hort duration of high electric field pulses, i.e., pulsed electric field (PEF)" and later to "high electric field pulses." While some of these terms include the words "high electric field," the paper is consistent with other papers from this period, which invariably refer to PEF treatments by a term that includes the word "pulse." In my view, the numerous publications from the eight years preceding the publication date better reflect the terminology as the POSITA would understand it being used in the art at that time, rather than a single paper from 34 years earlier, even a seminal one.

[196] It is clear that terms like "high voltage electric pulse" contain an element referring to the strength of the electric field ("high") and an element referring to the nature or duration of the treatment ("pulse"). However, reviewing the papers shows that the terminology used in the art at the time of the publication of the '841 Patent always referred to PEF treatments with the inclusion of the word "pulse." In other words, none of the publications referred to a PEF treatment as being a "high electric field" treatment without also specifying that it was pulsed treatment.

[197] I therefore agree with Dr. Sastry that the POSITA in 2001 with knowledge of these papers would not understand the term "high electric field," used by itself, to be an umbrella term in common usage to mean any non-thermal electrical treatment covering a broad range of electric field strengths and applications. Indeed, if the term were being used as a common umbrella term in or prior to 2001, as Dr. Raghavan contends, one would expect him to be able to demonstrate its broader or more common use in this time frame, beyond one group of researchers dealing primarily with a particular phenomenon (electric wind).

[198] Moderate electric field. With respect to the term "moderate electric field," Dr. Raghavan contended that it was known to be a "subset" of non-thermal high electric field treatment with comparatively lower field strengths, but without being associated with any exact field strength or range: Raghavan First Report, paras 90–92; Transcript, pp 453–454. Dr. Sastry asserted that it was generally understood to encompass the use of electric fields less than 1000 V/cm to induce electric effects (including field strengths typically used in ohmic heating), but agreed there was no hard and fast rule: Sastry First Report, para 55; Transcript, pp 561–562, 647, 653. Neither expert cited publications from before December 2001 that used the term in accordance with their proposed understanding that might show it was shared by the POSITA based on their CGK at that time.

[199] In responding to Dr. Sastry, Dr. Raghavan cited a number of papers that use the term "moderate" in connection with field strengths ranging from 0.2 to 7.5 kV/cm: Raghavan Second Report, paras 40–41; Transcript, pp 491–493. All of those papers related to PEF applications (in which pulses of 2 to 100 µs were applied), and only one of them predates the December 2001 publication date (Bazhal, 2000). That paper was co-authored by Dr. Vorobiev, and refers to "moderate electric field pulses" with a voltage between 0.3 and 1.5 kV/cm, compared to "high electric field pulses" of 20 to 50 kV/cm and "low electric field pulses" of 100 to 300 V/cm.

[200] Similarly, in another paper from Dr. Vorobiev's lab at UTC that Dr. Raghavan does not cite (Lebovka, 2001), the summary of earlier studies in the paper's introduction refers to "moderate PEF treatment" using a field strength in the range of 0.5–2kV/cm, compared to "high PEF treatment" of 10–50 kV/cm. The authors also discuss short pulses of "low strength electric

fields" of <200 V/cm causing damage to the cell that is spontaneously reversible when the field is switched off. In discussing their own study, however, the authors do not use the terms "low," "moderate," or "high." Rather, they refer to the particular treatments studied, namely 1 ms pulses at 200 and 500 V/cm, with different pulse repetition times.

[201] Asked about the Lebovka (2001) paper, Dr. Vorobiev explained that in his view, there were no accepted limits for the terms "low," "moderate," or "high," which are relative terms that might have different meanings in different contexts, papers, or treatments: Transcript, pp 883–888. This explanation accords with the use of the terms both in Dr. Vorobiev's papers and in the other literature.

[202] These references do not support Dr. Raghavan's contention that "high electric field" was understood as an umbrella term that included, among other things, moderate electric fields. To the contrary, where the terms were used, they were set up in contradistinction, *i.e.*, that a moderate electric field pulse was of a different (lower) strength than a high electric field pulse, with each term again being defined by the author for the purposes of their publication.

[203] The result is that the same electric field (say, 500 V/cm) used in PEF treatment might fall within the range described in some papers with authors from one lab as "moderate PEF treatment" in distinction to "high PEF treatment" (Bazhal, 2000; Lebovka, 2001; each by authors at UTC), and in other papers with authors from a different lab as "high intensity electric field pulses" (Angersbach, 1997; Knorr, 1998; Rastogi, 1999; each by authors at the Berlin University of Technology [Berlin University]). This does not indicate that the term "high electric field" was

a general term covering the various field strengths. Rather, as the POSITA would recognize, it indicates that different authors used different terms to describe field strengths and applications, defining their own terminology for the purpose of each paper. The POSITA would therefore know that they would have to look beyond the particular term used to understand what it was describing in a given publication.

[204] At the same time, the POSITA aware of all of the publications discussed above, including those related to PEF and those related to electric wind or ripening, would know that they generally used the term "high" to refer to electric fields in the range of thousands of V/cm, and never lower than 100 V/cm (the lowest voltage in the 0.1–15 kV/cm range seen in Knorr, 1994). No expert or party pointed to any publication prior to 2001 in which an electric field below 100 V/cm was referred to as "high," either in the term "high electric field" or otherwise. This does not support Dr. Raghavan's contention that the POSITA would understand any electric field to be a "high electric field," provided it was being used for non-thermal treatment.

[205] On my review of the various references cited by the experts as being part of the CGK of the POSITA, and having considered the experts' reports and testimony, I conclude that the CGK of the POSITA in December 2001 included the knowledge that terms such as "low," "moderate," and "high" were used as relative terms to describe various electric fields used in various applications in food processing and food processing research. The terms did not have commonly accepted or defined parameters, and different authors may have used them to describe different field strengths, with the authors invariably defining how they were using the terms by giving the field strengths in V/m or equivalent.

[206] The POSITA would therefore understand that they would have to look beyond the particular term used to understand what it was describing in a given publication. The term “high electric field” was used on occasion in the prior art, but the evidence does not show that it was a term of art with a particular, well-understood technical meaning, or that it was used as an umbrella term to mean any non-thermal electric field treatment. I also conclude that the POSITA would understand in 2001 that when referring to treatments involving the application of electric fields in very short pulses, measurable in microseconds or milliseconds, authors would and could use a number of terms, but these terms would invariably include the term “pulse” or “pulsed.”

(f) *The inventors’ discussion of the invention*

[207] As set out above, after discussing the need for pretreatment and the disadvantages of traditional preheating, the inventors state that to overcome the limitations of conventional methods of pretreating tubers, solutions involving electrical processes were investigated. The inventors then discuss and distinguish the prior art in three paragraphs. Given their importance and brevity, they are worth reproducing in full:

> The application of pulsed electric fields is known in various areas of food product processing, for example food industry, specifically for sugar extraction from beets, or sterilization of food products.
>
> U.S. Patent No. 3,997,678 (Vigerstrom) discloses a process for processing potato tubers that are intended to be made into French fries. The process includes a blanching stage between the cutting and the immersion into frying oil, during which the strips are immersed in a bath of water and heated until sterilization is achieved by application of an electric field through electrodes immersed in the water. Traditionally, a blanching or precooking stage is included in processes for making tubers into fries. It is meant to reduce the temperature or the frying time, and consists in a preheating stage, in order to extract reducing sugars and inactivate enzymes. It is seen as a gelatinization of starch.

> In contrast to the process that is disclosed in U.S. Patent No. 3,997,678, in which the application of an electric field occurs following cutting to heat and sterilize the product, the present invention focuses on treatment before cutting, to reduce the tuber resistance to cutting.
>
> [Emphasis added; ’841 Patent, pp 2–3.]

[208] The inventors go on, under the heading “Summary of the Invention” to say that their invention consists of a treatment stage for vegetables and fruit to reduce their resistance to cutting, consisting in the application of a high electric field: ’814 Patent, p 3. I have reproduced a portion of this passage above at paragraph [119] in addressing the *resistance to cutting* element. Given the importance of the passage to the parties’ arguments on the *high electric field* element, it is worth reproducing again:

> The invention provides a process that includes, as well known, a treatment stage for tubers or roots, and more generally, of vegetables and fruit in order to reduce their resistance to cutting, and thus reduce any loss of material during subsequent stages of the manufacturing process.
>
> According to the invention, said stage consists in the application of a high electric field directly to vegetables and fruit, under such conditions that the resulting temperature increase for the vegetables and fruit is almost zero or at least sufficiently low as not to amount to a preheating stage. The application of a high electric field, such as is used for extracting sugar from beet and precooking fries, translates to vegetables and fruit, and particularly to potato tubers, with the effect of softening which is favourable to shear cutting during subsequent stages for transforming the tubers into fry strips. The process is found to be insensitive to tuber volume, whatever the size of the tuber, with the absence of any noticeable elevation of the tuber temperature; as such no cooking ring is formed that would lead to loss of material as occurs in the case of heat processing.
>
> [Emphasis added; ’841 Patent, p 3.]

[209] The inventors then discuss tests showing that to obtain optimal cutting, tubers should be immersed in water and an electric field of 46 to 65 V/cm applied for a period of between 3 and 5 seconds: ’814 Patent, pp 3–4. In describing a preferred embodiment, the inventors again refer to an electric field between 45 and 65 V/cm applied during periods of 3 to 5 seconds, noting that at the high end of these ranges (65 V/cm for 5 seconds), the water/tuber mixture increased by 5.6ºC, while at the lower end of these ranges (45 V/cm for 3 seconds), the temperature increase is only 1.6ºC: ’814 Patent, p 4. The inventors state that “[p]recisely determining the voltage applied, and the application period, depends on the potato variety,” noting that the electrical processing has an impact on the colour, texture, and taste of the finished product: ’814 Patent, p 5. As an aside, I note that (a) the inventors refer to a range of “46 [*sic*] to 65 V/cm” in describing optimal cutting, but a range of 45 to 65 V/cm in the discussion of their test results, with no explanation for the difference given; and (b) in their discussion of temperature, the inventors refer to a field strength of “65 V/m,” which all parties appear to recognize as a typographical error for “65 V/cm”: ’841 Patent, pp 3, 4.

[210] In discussing the results of the sensorial and texturometry tests referred to above, the inventors note that the quality of cutting increased as the electric field increased; that the energy necessary to slice the electrically processed tubers is similar to that necessary to slice heat processed tubers; and that the energy at slicing decreased as the electric field increased: ’814 Patent, p 5.

[211] The inventors indicate that electrical processing according to the invention has several advantages (in addition to “guaranteeing a shear cut,” as discussed above), including reduced

water consumption, a "very short processing period (3 to 5 seconds, compared to the 20 to 40 minutes that are necessary for heat processing)," homogenous processing regardless of tuber size, energy saving, and reducing blanching time before frying: '814 Patent, p 6.

[212] The inventors conclude with the following discussion, which I will again set out in full:

> Obviously, the invention is not limited to the embodiment described, and many modifications may be made, while keeping within this invention.
>
> In particular, while the above example concerns the processing of potato tubers for French fry manufacturing, it would be easy for a skilled person to experimentally determine optimal operating conditions for processing other tubers or roots, or more generally, other vegetables or fruits, and specifically, to choose a processing period associated with an electric field of a given intensity.
>
> Preferably, the electric field should be between 30 and 75 V/cm approximately, and the processing period between 1 and 10 seconds approximately.
>
> [Emphasis added; '841 Patent at p 6.]

(g) *The parties' constructions*

(i) McCain/Dr. Raghavan

[213] Dr. Raghavan opined that the POSITA would understand a *high electric field* to be "an electric field that is strong enough to make the vegetable or fruit easier to cut." In his view, this reflects the "general, ground-breaking, and conceptual nature of the invention, i.e., that high electric fields can reduce resistance to cutting and replace the conventional preheating step": Raghavan First Report, para 182; Raghavan Second Report, para 65. He felt the POSITA would not consider *high electric field* to include any parameter restrictions, since they would know that

the exact field strength to be used could vary depending on different factors, including the mass and qualities of the vegetable or fruit being treated: Raghavan First Report, para 183.

[214] In Dr. Raghavan's view, the introduction of particular parameters in Claim 3, which limits the process to an electric field of 45 to 65 V/cm applied during a period of between 3 and 5 seconds, supports his reading as a matter of claim differentiation, as does the reference in the specification to pulsed electric fields, the extraction of sugar from beets, the Vigerstrom patent, and "non-limiting" examples: Raghavan First Report, paras 184–191; Raghavan Second Report, para 67. He also cited his discussion of the articles in the CGK, opining that the POSITA's understanding that "high electric fields" can vary in field strength by several orders of magnitude and can be applied in pulses (including one pulse) would lead them to conclude that any such variations would be captured by the term *high electric field*: Raghavan Second Report, paras 68–69.

[215] Based on Dr. Raghavan's opinion and his discussion of the use of the term "high electric field" in the prior art, McCain adopts his construction that high electric field means an electric field strong enough to achieve the purpose of reducing resistance to cutting. It argues the POSITA would understand that electric fields, and in particular "high electric fields," could be applied in a variety of field strengths, with the prior art showing field strengths varying by orders of magnitude, and that pulsed electric field treatments could be modified by changing the field strength, pulse length, and pulse number, as seen in publications such as Sale (1967). It notes that the prior art included field strengths as low as 2 V/cm (referred to in the Vigerstrom patent cited in the '841 Patent, which claims a preferable field of 2 to 200 V/cm) and as high as 120 kV/cm

(referred to in the Mittal patent, which refers to field strengths in a range from 15 to 120 kV/cm), and notes the inventors' reference to the examples given in the patent as "non-limiting."

(ii) Simplot/Dr. Sastry

[216] Dr. Sastry considered that the POSITA would consider the term *high electric field* to be ambiguous in the context of the patent, as it does not provide enough information to ascertain the scope of the term with any degree of certainty. However, if "forced" to define it in the context of the patent, his opinion was that the POSITA would conclude that *high electric field* referred to a continuous (*i.e.*, not pulsed) electric field with a strength no lower than about 20 V/cm, and no greater than about 100 V/cm: Sastry First Report, para 95. This range is based on (i) the inventors' reference to a preferred range of 30 to 75 V/cm; (ii) the recognition of potential variance to this range; (iii) the POSITA's knowledge that strengths below 20 V/cm would not be strong enough to permeabilize the cell wall or cause any cellular disintegration that would lead to softening; and (iv) strengths above 100 V/cm applied for the durations given would result in significant ohmic heating and the vegetables or fruit becoming too soft or even mushy: Sastry First Report, paras 98–103.

[217] Dr. Sastry did not consider that the two references to the term "high electric field" in the disclosure, reproduced at paragraph [208] above, would assist the POSITA in understanding the meaning of the term, particularly as they would have known that ohmic heating was a well-known method to extract sugar from vegetables and fruit including beets: Sastry First Report, paras 96–97. He expressly excluded the possibility that the POSITA would consider the term *high electric field* to encompass PEF applications, which they would view as a specific and distinct technology from the continuous electric field taught in the patent: Sastry First Report,

paras 104–105. In his view, the reference to PEF in the background discussion would not lead the POSITA to conclude that the inventors were claiming PEF applications through the use of the term *high electric field*, particularly since the inventors do not make any reference to pulses or pulsed electric fields in describing their invention or its embodiments: Sastry First Report, paras 105–106.

[218] Simplot adopts and relies on the construction Dr. Sastry said he would take if “forced” to do so. It argues that since the term *high electric field* had no generally understood meaning in the art at the date of publication, the POSITA would give it meaning based on the context of the ’841 Patent. Given the discussion and testing set out in the disclosure and the knowledge of the POSITA regarding ohmic heating and electroporation, Simplot argues the POSITA would understand the term in context to mean a field in the range of 20 to 100 V/cm and to exclude PEF treatments in the range of hundreds or thousands of V/cm applied in microsecond pulses.

(h) *Construction of the term*

[219] I have considered the ’841 Patent, the expert evidence, the parties’ arguments, and the publications they cite. For the reasons that follow, I conclude that, while there are sound arguments on both sides, on balance the POSITA reading the ’841 Patent at the date of publication would understand the term *high electric field* as used in Claim 1 to mean a field in the range of about 2 to about 200 V/cm. This is a construction closer, but not identical, to that proposed by Simplot and Dr. Sastry.

(i) Experts' approach to construction

[220] I begin by noting some concerns with the approaches Dr. Raghavan and Dr. Sastry each took to the issue of construction. Dr. Raghavan appeared to reach his construction based on the "general, ground-breaking, and conceptual nature of the invention": Raghavan First Report, para 182; Raghavan Second Report, para 65. However, a patent is not to be read or construed based on an expert's, or the Court's, assessment of whether it is "ground-breaking." Construction is to be undertaken before considering issues of validity, based on a purposive reading of the claims read as the POSITA would understand them on their date of publication: *Whirlpool* at paras 43, 48–49, 52–55. The fact that an expert considers a patent novel, or even ground-breaking, does not merit an expansion or different reading of its claims.

[221] Conversely, Dr. Sastry's approach in which he apparently felt "forced" to construe the claims is inconsistent with the principle that claims are to be read by the POSITA looking to understand it and not to misunderstand it: *Whirlpool* at para 49(c). Dr. Sastry was clearly concerned about ambiguity of the term *high electric field*, a position that Simplot ultimately did not pursue in closing argument. However, he was able to reach a construction based on his view of how the POSITA looking to understand the patent and make it work would read it. This is the approach that ought to have been undertaken at the outset, rather than being something forced on Dr. Sastry.

[222] The foregoing being said, the experts each provided relevant evidence regarding the CGK of the POSITA and how they would understand the language of the claims, read in the context of the patent. I do not dismiss either expert's evidence simply on the basis of these concerns. At the

same time, as discussed below, I agree with Simplot that Dr. Raghavan's opinions include inconsistencies that undermine his opinion on the construction of the *high electric field* element.

(ii) Language of the claims and meaning of the term in the art

[223] Claim 1 refers to a process characterized by the application of a *high electric field*. As McCain notes, the claim does not set out a particular field strength or range of field strengths that the process is to use. Nor did the inventors provide a definition of *high electric field* in the disclosure of their patent to tell the skilled reader what is meant by the term. However, the POSITA would understand that the inventors were intending to refer to a particular type of electric field, and not just any electric field, through the use of the term "high." The inventors did not claim, for example, a process "[…] characterized by the application of an electric field directly to the vegetables and/or fruit […]."

[224] As set out in the discussion of the CGK above, the term "high electric field" was not a term of art that would have a particular identifiable meaning to the skilled person in the field of food process engineering. It would not mean to the POSITA, as Dr. Raghavan effectively suggests, "an electric field of any strength that achieves the desired result." The POSITA would know that the word "high" to describe a field strength was a relative term used in various contexts by various authors to mean various things, and that they would have to review how the term was used in the context of a publication to understand its meaning.

[225] At the same time, the POSITA would note that the term *high electric field* used by the inventors does not refer to "pulses." The POSITA would know that those in the art at the time of publication of the patent invariably used a term incorporating reference to pulses when referring

to PEF treatments. Not seeing any reference to pulses in the inventors’ use of the term *high electric field* (or in the discussion of the invention, as discussed below), would suggest to the POSITA that the claimed process did not include pulsed electric field processes, and that the *high electric field* did not include the field strengths typically used in such processes.

[226] Claim 3 of the ’841 Patent depends from Claim 1 and limits the process to an electric field of 45 to 65 V/cm applied for between 3 and 5 seconds. The POSITA familiar with the principles of patent drafting would understand that that the term *high electric field* in Claim 1 must necessarily include fields of those strengths: *Patent Rules*, SOR/2019-251, Rule 63; *Halford v Seed Hawk Inc*, 2004 FC 88 at paras 90–91, 95, varied on other grounds 2006 FCA 275. Similarly, the POSITA would understand from their review of the disclosure of the ’841 Patent that the inventors intended the term *high electric field* to include electric fields of 30 to 75 V/cm, which the inventors describe as preferable.

[227] Given their knowledge of the CGK, in which the term “high” was never used to describe fields below 100 V/cm, the POSITA would know that the inventors were using the term *high* or *high electric field* in a manner different from the various ways in which authors used the term in the prior art. Indeed, even Dr. Raghavan admitted (after the question was posed several times) that he would call the electric fields of 30 to 75 V/cm “moderate electric fields” (MEF), while reiterating that the categories are not well-established: Confidential Transcript, pp 755–756. This would reinforce the POSITA’s view that they would have to consider how the term was used in the context of the ’841 Patent in particular to understand its meaning.

(iii) The summary of the invention

[228] The POSITA reading the term *high electric field* in Claim 1 in the context of the ’841 Patent would see several passages in the disclosure and the claims that would inform their understanding. Some of them speak in favour of McCain’s construction, while others speak in favour of Simplot’s construction.

[229] I begin with the inventors’ summary of their invention, as it is the only place in the disclosure that the inventors use the words “high electric field.” As set out at paragraph [208] above, the inventors state that the invention provides a process that includes, as “well known,” a treatment stage for vegetables and fruit in order to reduce their resistance to cutting, and thus reduce any loss of material during subsequent stages of the manufacturing process: ’814 Patent, p 3. They then state that according to the invention, the treatment stage “consists in the application of a <u>high electric field</u> directly to vegetables and fruit, under such conditions that the resulting temperature increase for the vegetables and fruit is almost zero or at least sufficiently low as not to amount to a preheating stage” [emphasis added; no party suggested that “preheating stage” meant anything different than “preheating step”]. This sentence provides no interpretive assistance to the POSITA as it effectively just reiterates the language of the *high electric field* element and the *temperature* element of Claim 1, without guidance as to the meaning of *high electric field*.

[230] The inventors then say, in the sentence that includes the only other use of the term “high electric field” in the disclosure, discussed above at paragraphs [119] to [121], that the “application of a <u>high electric field, such as is used for extracting sugar from beet and</u>

precooking fries, translates to vegetables and fruit, and particularly to potato tubers, with the effect of softening which is favourable to shear cutting […]" [emphasis added]: '814 Patent, p 3.

[231] The experts agree the POSITA would understand the reference to "precooking fries" in this passage to be a reference to the Vigerstrom patent referred to and discussed by the inventors: Sastry First Report, para 97; Raghavan First Report, para 185(c); Raghavan Second Report, paras 400–401; Transcript, p 630. I will return to this reference below. The parties disagree on two aspects of the foregoing passage, namely the reference to extracting sugar from beets and, as discussed above, the reference to "softening."

[232] I will return to the question of softening first, which highlights an area of inconsistency in McCain and Dr. Raghavan's position. McCain and Dr. Raghavan rely on the above passage as drawing a connection between the *high electric field* used in the process of Claim 1 to reduce *resistance to cutting* and PEF methods known to extract sugar from beets: McCain Closing Submissions, para 46; Raghavan First Report, paras 128–129, 185(a)–(b), 189; Raghavan Second Report, paras 67, 86(b). However, the cited passage does not directly refer to reducing resistance to cutting. It refers to the application of electric fields "with the effect of softening," which is favourable to shear cutting (*i.e.*, cut quality).

[233] If the POSITA understands this passage as relevant to Claim 1, *i.e.*, as a statement by the inventors that the application of a *high electric field* such as those used for extracting sugar from beet and precooking fries reduces *resistance to cutting*, as McCain contends, it is because they understand that when the inventors refer to "softening" they mean that the potato has a reduced

resistance to cutting. Dr. Sastry understood it in this way and opined that the POSITA would also understand that when a vegetable or fruit is softer, it can be cut with less force or energy: Sastry First Report, paras 91–93. Indeed, in his Second Report, Dr. Raghavan reiterated his view that the inventors in this sentence were referring to the *high electric field* of the invention and of Claim 1, *i.e.*, the very field that *reduces resistance to cutting*: Raghavan Second Report, para 67. As I have concluded above, there seems no other way to understand this sentence.

[234] At the same time, and inconsistently in my view, Dr. Raghavan opined that the same sentence refers not to *resistance to cutting* but to softening as a distinct and indeed uncorrelated parameter: Raghavan Second Report, para 55; Raghavan Second Report, paras 55, 67, 140(b), 144, 213, 221(c), 235, 241–243; Raghavan Third Report, paras 18–24, 35, 41, 56; Raghavan Fourth Report, paras 24, 32, 36; Raghavan Fifth Report, paras 18, 36, 45, 52, 57; Transcript, pp 464–466.

[235] It appears that Dr. Raghavan and McCain are trying to have it both ways. They argue that a sentence that refers to high electric fields causing "softening which is favourable to shear cutting" supports their construction in respect of the *high electric field* that causes reduced *resistance to cutting* Claim 1, while at the same time suggesting that the reference to softening has nothing to do with *resistance to cutting*.

[236] As indicated above at paragraphs [122] to [126], the latter position seems inconsistent with Dr. Raghavan's own approach to softening in his first report. It appears to be directed at Dr. Sastry's opinion that it was known in the prior art that PEF caused softening of fruits and

vegetables, and that the POSITA would therefore understand that they were easier to cut. However, if Dr. Raghavan's opinion that softening and reduced resistance to cutting are distinct and not correlated is accepted, it is difficult to see how the sentence above advises the POSITA readers that applying a high electric field will reduce resistance to cutting. This underscores the importance of applying a consistent approach to patent construction, infringement, and validity, rather than adopting one reading for purposes of construction and another for purposes of validity.

[237] As noted above, I see no other way of reading the sentence in question than as referring to reducing resistance to cutting. Understood in this way, it states that the application of a "high electric field, such as is used for extracting sugar from beet and precooking fries" has the effect of reducing resistance to cutting, which is favourable to shear cutting. As McCain notes, this sentence might be read as echoing the inventors' discussion of the prior art, in which they refer to the application of pulsed electric fields in various areas, "specifically for sugar extraction from beets, or sterilization of food products," and to Vigerstrom, which refers to pretreatment of potatoes. On this reading, the POSITA would understand the *high electric field* of Claim 1 to cover both electric fields of the strengths referred to for extracting sugar from beets by PEF (including field strengths in the range of hundreds or thousands of V/cm) and those used for precooking fries (notably, the 2–200 V/cm used in Vigerstrom).

[238] I agree with McCain that this reading provides some support for their proposed construction. However, I do not consider it determinative, for three reasons. First, the inventors' reference is oblique. They do not directly tell the POSITA what range of field strengths they

mean to cover through the use of the term *high electric field*, and do not refer directly to PEF or pulses, but simply refer generally to a field "such as is used for extracting sugar from beet and precooking fries." The POSITA reviewing the '841 Patent would have to "connect the dots" back to the reference to the use of PEF, despite the absence of reference to pulses, if they were to understand the inventors to mean that *high electric field* included field strengths used in PEF.

[239] Second, the POSITA would know that electric fields of varying strengths were used for extracting sugar from beets, including those in the ranges discussed in Vigerstrom, and not only the higher strength fields typically used in PEF applications, which themselves can vary: Sastry First Report, paras 55, 97, Exhibit CC (Halden, 1990); Vorobiev First Report, paras 53–54.

[240] Dr. Raghavan did not disagree that this was part of the CGK, but opined that the POSITA would not apply such "literature regarding thermal processes like ohmic heating" in the context of the '841 Patent: Raghavan Second Report, para 38. I disagree. While the POSITA would understand the inventors to be claiming a process that was non-thermal (or at least low-thermal), this does not mean that when considering the meaning of *high electric field* and the inventors' reference to an electric field "such as is used for extracting sugar from beet," they would forget or ignore their knowledge of extracting sugar from beets using electric fields of lower strengths similar to those discussed in Vigerstrom. Indeed, Vigerstrom also relates to a thermal process, as the inventors of the '841 Patent themselves point out, so Dr. Raghavan's opinion that the POSITA would not apply literature relating to thermal processes is inconsistent with both the inventors' citation of Vigerstrom and his own opinion that the POSITA would consider

Vigerstrom in connection with the reference to “precooking fries”: Raghavan First Report, paras 126, 185–186; Raghavan Second Report, paras 400–401.

[241] An even more material inconsistency is raised by McCain and Dr. Raghavan’s reference to and reliance on the Eshtiaghi patent, as well as their broader position that the POSITA would understand *high electric field* to include PEF applications using electric fields in the range of 1 kV/cm or more. The Eshtiaghi patent issued in 1999 to Drs. Eshtiaghi and Knorr from Berlin University. All experts cite it as forming part of the CGK of the POSITA: Transcript, pp 598–599; Raghavan Second Report, para 68; Raghavan Third Report, paras 81–82; Vorobiev First Report, paras 52, 68. It relates to a method for extracting sugar from sugar beets using “electric field pulses,” and claims, in a dependent claim, the use of “strong electric field pulses” of between 0.5 and 40 kV/cm and from 1 to 2000 pulses. The disclosure refers to the treatment as [TRANSLATION] “Highly Pulsed Electric Field (HPEF)” and notes that it is done to electropermeabilize cells or their agglomerates.

[242] Dr. Raghavan did not refer to Eshtiaghi in first addressing construction of the term *high electric field*. However, in response to Dr. Sastry, he referred to the above passage in the disclosure referring to extracting sugar from beets, and opined that the Eshtiaghi patent “provides guidance to the skilled person with an example of what may constitute a ‘high electric field’ as that term is used in the ’841 Patent,” namely the range in Eshtiaghi of between 0.5 and 40 kV/cm: Raghavan Second Report, paras 67–68.

[243] In addressing the CGK and validity in the same report, however, Dr. Raghavan insists that "[t]he skilled person would be familiar with the literature regarding electroporation but would not apply it in the context of cutting resistance because they would not want to remove the contents of the cells (e.g., starch in the case of treating potatoes to produce French fries) or modify cells in that way for a food product to be consumed": Raghavan Second Report, paras 34, 282; Transcript, pp 490–491, 516–518, 531. Dealing with the Eshtiaghi patent in particular, he opined that it relates to treatment that is explicitly trying to permeabilize cells, and that the POSITA would understand that the '841 Patent relates to a process in which vegetables and fruit would be negatively affected by permeabilizing their cells: Raghavan Second Report, paras 157(b), 165; Transcript, p 495.

[244] Thus, Dr. Raghavan is simultaneously asserting that the POSITA (a) <u>would not</u> apply literature regarding electroporation, such as Eshtiaghi, in the context of the '841 Patent because they would know that electroporation would be undesirable; and (b) <u>would</u> apply that same literature in the context of the '841 Patent to conclude that the term *high electric field* includes field strengths known to cause electroporation: Transcript, pp 507–508, 516–518, 531; Sastry Third Report, para 16. This inconsistency considerably weakens Dr. Raghavan's opinion on the construction of this term and in particular his contention that the POSITA would be guided by the reference in the disclosure to extracting sugar from beets and their knowledge of Eshtiaghi to conclude that the term *high electric field* in Claim 1 covers fields as high as 500 V/cm to 40 kV/cm.

[245] I note that this is not an issue of the POSITA's knowledge before and after reading the '841 Patent. If the POSITA would not consider applying field strengths of 500 V/cm to 40 kV/cm prior to reviewing the '841 Patent because of the adverse effects of electroporation on food quality, but would consider such field strengths after reviewing the '841 Patent notwithstanding those effects, then there might be no inconsistency. However, as Dr. Raghavan conceded, the knowledge of the POSITA with respect to such field strengths would remain unchanged by reviewing the '841 Patent, which provides no new information or discussion regarding them: Transcript, pp 529–531.

[246] I thus do not accept Dr. Raghavan's opinion that in considering the inventors' reference to applying a "high electric field, such as is used for extracting sugar from beet and precooking fries," the POSITA would not apply their knowledge of extracting sugar from beet using electrical fields similar to those used in Vigerstrom for precooking fries, but would instead consider literature regarding PEF despite their knowledge of the adverse effects of electroporation, which led Dr. Raghavan to state generally that the POSITA would not apply such literature. Rather, the POSITA would view the reference to high electric fields such as those used for extracting sugar from beet and precooking fries would be more likely to understand that the inventors were referring to the type of electric fields used for both of these applications, and not those that were understood to adversely affect foods designed for consumption.

[247] This leads to the third reason I conclude that the inventors' reference to "such as is used for extracting sugar from beet" is not determinative of the construction issue, namely that the POSITA would not read that reference in isolation from the rest of the disclosure. Rather, they

would read the patent as whole, including the other indicators and clues to construction, in construing the term *high electric field*. Even if connected to the earlier reference to PEF being used for sugar extraction, the statement is not so clear or definitional that the POSITA would ignore the remainder of the disclosure or their CGK.

[248] In this regard, I agree with Simplot that Dr. Raghavan's own evidence that the POSITA would not consider electroporation of the type caused by PEF treatment to be desirable in the context of the '841 Patent again speaks strongly against McCain's construction. As set out above, the CGK of the POSITA in December 2001 included the knowledge that PEF treatments were being applied and studied in food processing primarily because of the effect of electroporation/electropermeabilization. The POSITA reading the initial reference to pulsed electric fields for sugar extraction from beets and sterilization of food products in the background section of the disclosure would understand this to relate to the electroporation caused by PEF treatment.

[249] As Dr. Raghavan insists, the POSITA would understand that electroporation was undesirable in the treatment of, for example, potatoes being used for french fries. In the absence of a contrary teaching in the patent, the POSITA with this knowledge would not read the single reference to PEF in the background discussion as indicating that the inventors intended to claim, through the words *high electric field*, a process using field strengths such as those used in PEF and thereby causing such undesirable electroporation. The '841 Patent contains no such teaching.

[250] Significantly, when cross-examined on the issue of electroporation and *high electric field*, Dr. Raghavan agreed that the POSITA would consider a field strength of 1,000 V/cm or more, which would cause electroporation and thus adverse effects on the taste and texture of the food, to be above the maximum for a *high electric field* as set out in the patent:

> Q. Okay. And I believe we discussed before, but I think you agreed with me that as of 2001, the skilled person understood that a field strength in the range of 1,000 volts per centimetre or more would cause electroporation?
>
> A. Uhm-hmm [positive].
>
> Q. And they would have believed that it would have affected the taste or texture of the food; correct?
>
> A. Yes. During that period, yes. That was the main research activities that was going on, yes.
>
> Q. Right. <u>So the skilled person would have believed that those field strengths would be above the maximum for a high electric field as set out in the patent; correct?</u>
>
> <u>A. Above the maximum in comparison to what?</u>
>
> <u>Q. Well, above the maximum, as we just talked about, in the context of --</u>
>
> <u>A. Yes.</u>
>
> <u>Q. -- the document, right?</u>
>
> <u>A. Yes.</u>
>
> [Emphasis and characterization of non-verbal response added; Transcript, p 531.]

[251] This concession is consistent with Dr. Raghavan's evidence regarding the POSITA's understanding of the impact of electroporation, and his statement that the POSITA would know that if preserving product tissue is important, using a relatively lower field strength may be appropriate: Raghavan Second Report, para 34; Raghavan Third Report, para 17; Transcript,

pp 454, 490, 507–510. However, it is contrary to, and undermines, his overall opinion as set out in his reports that the POSITA would understand electric fields of 1 kV/cm or more to fall within the meaning of *high electric field* as used in Claim 1.

[252] It is worth noting in this context that the POSITA would understand, both from the passage referred to above and the *temperature* element discussed below, that the process of Claim 1 to be one that applies a largely, if not entirely, non-thermal electrical effect to the potatoes. However, this would not lead the POSITA to conclude that it would entail electroporation. As the experts agree, the POSITA would know that non-thermal electric effects were not limited to electroporation: Sastry First Report, paras 37, 43, 49–50; Vorobiev First Report, paras 37, 40–41; Raghavan First Report, paras 83, 93; Raghavan Second Report, para 34; Raghavan Third Report, para 17.

[253] Before concluding this section, I will respond briefly to McCain's reliance on the cover page of the US equivalent to the '841 Patent, namely US Patent No. 6,821,540 [the US '540 Patent]: Exhibit 70. McCain notes that the US '540 Patent cites the 1976 patent to Vigerstrom, the 2000 patent to Mittal, and the Rastogi (1999) paper, which present various ranges of electric fields: McCain Closing Submissions, para 46, fn 163. In my view, this reliance is misplaced. The issue before the Court is the construction of the Canadian '841 Patent and not the US '540 Patent. That the examiner of the US '540 Patent cited the Mittal patent and Rastogi (1999), for unknown reasons, is of no moment. It also would not have been known to the POSITA at the date of publication of the '841 Patent. Nor is it relevant that the US '540 Patent has the same

reference to the Vigerstrom patent as the ’841 Patent. It is the reference to Vigerstrom in the ’841 Patent itself that is relevant.

(iv) The preferred embodiments and testing

[254] At the conclusion of the summary of their invention, the inventors state that “to obtain optimal cutting, tubers should be immersed in water and an electric field of 46 to 65 V/cm applied between electrodes in the water, during a period of between 3 and 5 seconds”: ’841 Patent, pp 3–4. This statement reflects the inventors’ discussion of their preferred embodiment and the testing they performed, set out on the following pages of the disclosure: ’841 Patent, pp 4–6.

[255] As noted above, the inventors describe having applied an electric field between 45 and 65 V/cm to potato tubers for periods from 3 to 5 seconds, noting the temperature increases in the water of the application. They note the advantages of the process, including a “very short processing period” of 3 to 5 seconds compared to the 20 to 40 minutes necessary for heat processing: ’841 Patent, pp 4–5. Without indicating why, the inventors state that the electric field should preferably be between 30 and 75 V/cm approximately and the processing period between 1 and 10 seconds approximately: ’841 Patent, p 6.

[256] As McCain and Dr. Raghavan rightly point out, a patent claim is not limited to the experiments performed by the inventors, or to the preferred embodiments described in the disclosure: *Bombardier* at para 54; *Valence Technology, Inc v Phostech Lithium Inc,* 2011 FC 174 at paras 64, 119, aff’d 2011 FCA 237 at paras 2, 32–36. However, this does not mean that the inventors’ discussion of their testing or their preferred embodiments is irrelevant or

uninformative. Indeed, resolving uncertainty in the scope of a claim through reference to what is discussed in the disclosure, including in the described embodiments, is part of purposive construction: *MediaTube Corp v Bell Canada*, 2017 FC 6 [*MediaTube (FC)*] at paras 22–25, 50–53, aff'd 2019 FCA 176 [*MediaTube (FCA)*] at paras 10–11, lv to appeal ref'd 2020 CanLII 22066 (SCC).

[257] The POSITA reviewing the inventors' detailed discussion of their invention would see that the inventors discussed experiments using electric fields between 45 and 65 V/cm and a processing period of 3 to 5 seconds. When moving beyond these tests to a preferred range of electric fields, the inventors suggest a slight expansion of these parameters, from 30 to 75 V/cm and from 1 to 10 seconds. The POSITA would see no indication whatsoever that the inventors were proposing, teaching, or claiming, electric fields 10 or 100 times stronger than the highest field strength they discuss, or that such fields be applied for periods 1,000 to 1,000,000 times shorter than the shortest period they refer to.

[258] To the contrary, the POSITA would understand that the inventors were expressly teaching the application of electric fields at strengths that would have a different effect on plant tissues than those 10 or 100 times stronger. The POSITA would certainly be aware that applications of much higher electric fields were used in food processing through PEF treatments. Yet the inventors in describing their invention put forward no discussion of using either the voltages or pulse durations used in PEF, no proposed parameters for a PEF treatment, nor even any suggestion that PEF treatment might have the same effect in reducing resistance to cutting as the electric fields discussed. Even when suggesting that the POSITA could "choose a processing

period associated with an electric field of a given intensity," the inventors refer to a "processing period" and make no reference to the use of pulsed electric fields. To the contrary, they go on to provide the slightly broader range of 30 to 75 V/cm and a processing period between 1 and 10 seconds.

[259] The analysis of Justice Locke, then of this Court, in *MediaTube (FC)* is apposite. There, the question was whether the term *audio/video signals* in a claim covered only analog signals or both digital and analog signals, as it related to the demodulated input signal and the output of the redistributor: *MediaTube (FC)* at paras 41, 44–45. The Court found that the absence of discussion of digital signals in the disclosure, in circumstances where the POSITA would know of such signals, indicated that the inventors only meant analog signals when they referred to *audio/video signals*:

> Upon review of the disclosure, the skilled person sees only reference to analog audio/video signals after demodulation. The disclosure even provides for the demodulators that are receiving digital input signals to decode them into analog form. There is no suggestion that any audio/video signals could be in digital form after demodulation.
>
> With regard to the plaintiffs' argument that the skilled person was well aware of the existence of digital signals, this appears in fact to be an additional reason to read claim 1 narrowly. The focus uniquely on analog signals, and the failure to make even the slightest suggestion of digital signals being output from the demodulators or the processors and sent downstream from the redistributor to the communications interface, suggest that the inventor contemplated only analog signals at this stage. This is in stark contrast with the input signals which are shown in digital and analog formats and repeatedly described as being in "any format". In fact, a main thrust of the invention is the gathering in one place of a plurality of input signals having different formats and putting them into a common format.
>
> [Emphasis added; *MediaTube (FC)* at paras 50–51.]

[260] The Federal Court of Appeal rejected an argument that this analysis amounted to improperly adding words to the claim or improperly limiting the claims to preferred embodiments described in the disclosure, recognizing it as an appropriate approach to purposive construction: *MediaTube (FCA)* at paras 10–11.

[261] In the present case, the inventors' unique focus on electric fields in the range of tens of V/cm, applied for periods in the range of seconds, when the inventors and the skilled person were well aware of the existence of PEF treatments applying electric fields in the range of hundreds and thousands of V/cm for microseconds, similarly suggests that the inventors were only claiming the former. This is particularly so given the POSITA's knowledge of the difference between the two types of treatments in terms of their impacts on fruits and vegetables at the cellular level, even leaving aside the different equipment typically used for the techniques.

[262] In this regard, McCain's argument that the '841 Patent does not refer to electroporation, and that the POSITA would therefore not construe *high electric field* based on whether it achieved electroporation, misses the point. As the experts agree, the CGK of the POSITA would include knowledge of electroporation, including the fact that the application of electric fields of hundreds and thousands of V/cm would cause this damage to plant cells. The POSITA would know the literature that studied (or patented) the application of such fields, done in very short pulses to control temperature increases, was directed to this electroporation effect. The fact that the '841 Patent does not discuss applying any such fields, or causing any such effects, would lead the POSITA to conclude that they were not what the inventors meant or claimed in using the

term *high electric field*. Again, this is simply strengthened by the POSITA's knowledge that these effects were in fact undesirable.

[263] As a related argument, McCain's relies on the inventors' statements regarding modifications, set out at paragraph [212] above. As McCain notes, the inventors state that the invention is not limited to the embodiment described, and that many modifications can be made. While this reiterates and underscores the general rule that the claims of a patent are not limited to the disclosed or preferred embodiments, it does not in my view mean that the POSITA would understand the claim to be unlimited in nature. Nor would it lead the POSITA to ignore the discussion in the disclosure, including the inventors' discussion of the experiments they performed and the specific embodiments they teach.

[264] Further, the inventors state that it would be easy for the skilled person to experimentally determine optimal conditions for processing other tubers, roots, fruits, or vegetables, *i.e.*, not potatoes, for which the processing conditions were studied by the inventors and are provided in the patent. The POSITA would not read this passage and understand it to mean that they could or should experiment to determine parameters for treating potatoes with electric fields one or two orders of magnitude stronger than those discussed, while still falling within the definition of *high electric field*.

(v) Claim differentiation

[265] As noted above, Claim 3 limits the process of Claim 1 to the application of an electric field of 45 to 65 V/cm for a period between 3 and 5 seconds. Although McCain did not rely on Claim 3 in closing argument, Dr. Raghavan suggested that the POSITA seeing this limitation and

understanding the principle of claim differentiation would understand that the *high electric field* of Claim 1 has no limitations at all in terms of field strength: Raghavan First Report, para 184. I agree that claim differentiation can be a relevant interpretative tool, creating a rebuttable presumption that two claims are not identical and that the limitations of a dependent claim are therefore not part of the claim from which it depends: *Whirlpool* at para 79; *Tetra Tech* at paras 113–115.

[266] In the present case, the presumption is of little assistance. Notably, neither party proposed a construction of Claim 1 that was limited to electric fields of 45 to 65 V/cm, such that no claim redundancy with Claim 3 arises: Transcript, pp 536–537. If anything, the POSITA would note that the inventors chose to include in their claims only one claim that limited the field strength and application time. They did so at the parameters of their disclosed experiments, rather than including a dependent claim at the strength of even their preferred parameters of 30 to 75 V/cm and 1 to 10 seconds. The POSITA familiar with the common patent drafting practice of cascading claims might be led to conclude that the *high electric field* of Claim 1 meant the preferred parameters, with Claim 3 being narrowed to the tested parameters: *Teva Sildenafil* at para 80.

[267] At the same time, however, no patentee is required to include every limitation or claim that might possibly be drafted. I conclude that the POSITA would be guided by other aspects of the specification, and would not draw anything from the limitation in Claim 3 other than that the *high electric field* of Claim 1 must, at least, include field strengths of 30 to 75 V/cm.

(vi) A "single pulse"

[268] McCain and Dr. Raghavan argue that PEF treatments were known to potentially use a single pulse, and that the POSITA would therefore not distinguish PEF treatments from the "single pulse" electric field treatments described in the '841 Patent: Raghavan First Report, para 85; Raghavan Second Report, paras 68–70; McCain Closing Submissions, paras 43–44, 51–52.

[269] This argument is wholly unpersuasive. It relies on describing the application of an electric field for a period of 1 to 10 seconds as a "pulse" in the sense of a pulsed electric field, a description found nowhere in the literature presented as the CGK of the POSITA. To the contrary, as discussed above, the literature in the art uses the term "pulse" to refer to pulses that are microseconds (or, at the outside, one or two milliseconds) in length. McCain points to no support for its contention that a POSITA would consider, for example, a 1 or 3-second electric field application to be a "pulse" and thus akin to PEF treatments: Transcript, pp 1017–1018. I draw nothing from Dr. Sastry's agreement that "3 to 5 seconds was an example of a pulse duration," given how the term is used in the CGK and Dr. Sastry's subsequent indication that he did not see pulses referenced in the patent: Transcript, pp 627–628.

[270] To support this argument, McCain relies on the fact that Knorr (1998), for example, "demonstrated that one pulse could be enough to cause maximum permeabilization." This reliance is misplaced. The single pulse in question had to have a specific energy input of around 10^4 J/kg, achieved by an electric field in the range of 0.6 to 26 kV/cm and a pulse of between 10 and 800μs: Knorr, 1998; Transcript, pp 499–500. The fact that such a pulse caused maximum

permeabilization would not, as McCain implies, lead the POSITA to consider a 3-second application of 45 V/cm as being in any way a similar electric field treatment. Indeed, McCain's argument on this point is again directly inconsistent with Dr. Raghavan's insistence that the POSITA would be looking to avoid electroporation (let alone "maximum permeabilization") as undesirable for fruits and vegetables that are subsequently cooked and eaten, and would not "apply" the prior art dealing with electroporation in the context of the '841 Patent.

[271] McCain and Dr. Raghavan attempt to paint a picture in which the POSITA considers the application of electric fields in food processing as a continuum that can range from field strengths of a few V/cm up to tens of thousands of V/cm, with application times from 1 µs up to 10 million µs (*i.e.*, 10 s), and everything in between, with no conceptual difference between them. The picture that the POSITA would see in the CGK and the '841 Patent is very different. While various field strengths and application times could certainly be applied, the POSITA would see a clear distinction between PEF treatments as described and studied in the CGK and the electric fields described in the '841 Patent, in terms of the nature of the treatments, their mechanisms of action, and the fields of research.

[272] I therefore do not accept McCain and Dr. Raghavan's construction of the term *high electric field*, namely to mean any electric field strong enough to make vegetables or fruit easier to cut.

(vii) The inventors' reference to Vigerstrom

[273] At the same time, I do not fully accept Simplot and Dr. Sastry's construction, which would limit the construction of the term to electric field strengths between about 20 and

100 V/cm. As noted, Dr. Sastry opined that the POSITA would understand that field strengths below 20 V/cm were unlikely to have any effect on resistance to cutting, while field strengths over 100 V/cm were likely to result in significant ohmic heating.

[274] In my view, the POSITA would consider such knowledge in reading the ’841 Patent, but they would do so together with their understanding of the teachings of the specification. This includes the reference to “a high electric field, such as is used for extracting sugar from beet and precooking fries” set out at paragraph [208] above.

[275] I have discussed above at some length the reference to extracting sugar from beets. With respect to precooking fries, the experts agreed that in the context of the ’841 Patent, the skilled person would understand this to be a reference to the Vigerstrom patent: Sastry First Report, para 97; Raghavan First Report, para 185; Raghavan Second Report, paras 400–401; Transcript, p 630. I agree. The POSITA would note that, unlike the reference to extracting sugar from beets, the inventors directly tie the “high electric field” of the invention to the french fry manufacturing process of Vigerstrom. As seen in the passage reproduced at paragraph [207] above, the inventors use the term “precooking” to refer to the blanching stage described in Vigerstrom, and then use the term “precooking fries” in describing the “high electric field” of the invention.

[276] The inventors distinguish their invention from what is disclosed in Vigerstrom on the basis of the timing and purpose of the electric field application. The POSITA would note that they do not distinguish Vigerstrom on the basis of the strength of the electric field applied.

[277] The Vigerstrom patent discusses the application of electric fields of 2 to 200 V/cm to precook fries: Raghavan First Report, para 185(c); Transcript, pp 622–623. In light of the inventors' foregoing references to Vigerstrom, the POSITA would not limit the term *high electric field* to a considerably smaller range of electric fields than those discussed in Vigerstrom. Rather, the specific references to Vigerstrom would lead the POSITA to conclude that the inventors considered the "high electric field" to be in the range of 2 to 200 V/cm. While this range is broader than that proposed by Dr. Sastry, I consider it to be how the POSITA would read the language of Claim 1 of the '841 Patent in its entire context, in consideration of the purpose of the invention, the discussion of the inventors, and their common general knowledge of the use of electric fields in food processing, including the effects of electroporation and permeabilization more broadly.

[278] I say this despite the POSITA's knowledge that applying an electric field in the range of 200 V/cm for as long as 3, 5, or 10 seconds is likely to result in considerable ohmic heating, and potentially both thermal permeabilization and electropermeabilization. As discussed below, the POSITA would recognize that Claim 1 refers to the *conditions* under which the *high electric field* is applied (including the length of the application), and that some heating was considered to fall within the scope of Claim 1, provided it remained below the level that would amount to a *preheating step*. They would also recognize that the patent teaches shorter applications of the electric field such as 1 second, even though it does not contemplate microsecond or millisecond pulses. While the POSITA might have concerns about the application of a field as strong as 200 V/cm, these concerns would not be as strong as for the application of a field of 500 or 1,000 V/cm or more, known to cause irreversible electroporation even in an extremely short

time. These concerns would therefore not lead them to ignore the teaching of the patent that links the term *high electric field* to the field strengths in Vigerstrom. Conversely, the POSITA would have concerns that a field strength as low as 2 V/cm might have limited effect, but would have known that Vigerstrom teaches the use of such voltages as having a beneficial effect at the blanching stage of french fry processing.

(viii) Conclusion

[279] I therefore conclude that the POSITA, reading the term *high electric field* in Claim 1 purposively, with a mind willing to understand the inventors' invention, in the context of the '841 Patent and their knowledge of the art of food process engineering, would understand it to refer to an electric field in the range of about 2 to 200 V/cm. I note that whether the POSITA would read the *high electric field* to mean this range or the range from about 20 to 100 V/cm proposed by Dr. Sastry and Simplot does not materially affect any of the parties' infringement or validity arguments.

(3) The *temperature* element

[280] Claim 1 requires the claimed process to be conducted *under conditions* such that the *resulting increase in the temperature* of the treated vegetables or fruit be *almost zero* or *at least sufficiently low as to not amount to a preheating step*. Two aspects of this element are not in dispute.

[281] First, the POSITA would understand the *conditions* referred to relate to the treatment conditions in which the *high electric field* is applied to any given vegetable or fruit, and

particularly those that might affect the temperature. These would include the particular strength of the *high electric field* applied, the treatment duration, the conductivity of the treatment media, and the starting temperature of the vegetable or fruit: Sastry First Report, para 114; Raghavan Second Report, para 76. While Dr. Sastry opined that the term *under conditions such that* was ambiguous, this was not pressed by Simplot: Sastry First Report, para 114.

[282] Second, the POSITA would understand the reference to the *resulting increase in the temperature* to refer to the temperature increase (a) of the vegetable or fruit, rather than, for example, the water in which they are treated; and (b) caused by the application of the electric field. They also agree the POSITA would know that in accordance with Joule's law, the application of any electric field to a material with non-zero resistance will have some thermal effect, *i.e.*, will result in some non-zero increase in temperature.

[283] The dispute between the parties lies principally in the term *at least sufficiently low as to not amount to a preheating step*. McCain contends it would be understood to (a) relate to the preheating step of whichever vegetable or fruit was being treated, which would be limited to those traditionally preheated in a water bath; and (b) have an upper bound at which the vegetable or fruit shows the disadvantages of traditional preheating, notably loss of material into water or a cooking ring or other gelatinization. Simplot argues the expression cannot be reasonably understood at all, *i.e.*, that it is ambiguous, because the variability of preheating steps is such that the term creates no knowable limits.

(a) *The CGK regarding preheating*

[284] I have discussed above knowledge that the POSITA would have regarding preheating. As particularly relevant to the construction of the heating element of Claim 1, I highlight the following aspects of the evidence regarding the CGK:

- Preheating potatoes in a hot water bath before cutting them to reduce their resistance to cutting was well known and practiced in the food processing industry. Particular parameters of temperature and time used by different food processors would vary, although treatment in hot water between 40 and 63ºC for 10 to 60 minutes was typical. These parameters would be adjusted by the POSITA to obtain the desired results of the process in terms of cut quality and to avoid or limit the undesirable starch gelatinization seen in a cooking ring around the outside of the potato. These parameters would also depend on potato variety, tuber size, and time of season.

- Neither Dr. Raghavan nor Dr. Sastry presented evidence regarding the POSITA's knowledge of how much the temperature of a potato usually increased in the course of such preheating. The prior art included the Hodges patent, which states that for the process it claimed, the final temperature of the potato should be no less than 130ºF (54ºC) but less than about 145ºF (63ºC) to avoid gelatinization.

- With respect to vegetables and fruit other than potatoes, Drs. Raghavan and Sastry agreed the POSITA would know that for at least some products, other vegetables and fruit would benefit from a reduction in cutting resistance before cutting, and that preheating could be used for this purpose, but that the parameters applicable for potato preheating were not necessarily appropriate for other vegetables and fruits.

- Beyond Dr. Raghavan's statement that preheating has been used in the processing of "other vegetables and fruit, such as beets, carrots, turnips, and salsify," no expert (or lay witness) presented evidence about whether, or the extent to which, any fruits or vegetables other than potatoes were in fact usually preheated to reduce their resistance to cutting, whether to improve the quality of the cut, reduce wear, or any other purpose, or the parameters of such preheating. There was evidence of some heating steps for other purposes, such as heating beets for sugar extraction or apples for juice extraction.

(b) *The inventors' discussion of the invention*

[285] As noted, in their discussion of french fry production, the inventors state that in order to reduce the resistance to cutting of potato tubers, they are traditionally submitted to heat processing. They describe a typical process, in which tubers are left in water heated to 40 to 60ºC for a period of 20 to 40 minutes. Among the disadvantages of this process raised by the inventors are the cooking ring, the loss of material due to dissolution of the tuber in the water, and the heterogenous nature of the process, since smaller tubers reach a desired inside temperature faster than medium or larger ones: '841 Patent, pp 1–2.

[286] In the passage reproduced at paragraph [208] and discussed at length above, the inventors use the phrase "almost zero or at least sufficiently low as not to amount to a preheating [step]" found in Claim 1: '841 Patent, p 3. They then say the following on the subject of temperature:

> The process is found to be insensitive to tuber volume, whatever the size of the tuber, with the absence of any noticeable elevation of the tuber temperature; as such no cooking ring is formed that would lead to loss of material as occurs in the case of heat processing.
>
> [Emphasis added; '841 Patent, p 3.]

[287] Later, in their discussion of the preferred embodiment, the inventors discuss their experimental results. They note that for an electric field of 65 V/cm applied for 5 seconds, the increase in temperature of the water/tuber mixture was 5.6ºC, while for 45 V/cm for 3 seconds, the temperature increase was 1.6ºC. They conclude that "in other words, the temperature increase is still sufficiently low that it produces neither any loss of material into the water, nor any cooking ring": '841 Patent, p 4.

(c) *The parties' constructions*

(i) McCain/Dr. Raghavan

[288] Dr. Raghavan concluded the POSITA would understand the *preheating step* to mean the heat processing described in the '841 Patent, and the *temperature* element as a whole to mean that the resulting increase in the temperature of the vegetable or fruit being treated would not cause significant cooking rings or loss of material: Raghavan First Report, paras 193–198; Transcript, pp 470–472. This view was based principally on the inventors' discussion of the disadvantages of the traditional preheating process, said to be avoided with the claimed process, and the inventors' discussion of the test results, which show temperature increases that produce no loss of material or cooking ring.

[289] McCain added to this that the *preheating step* meant the preheating step used for any particular vegetable or fruit: Transcript, pp 931–939, 1024. On this approach, McCain argued that vegetables or fruits that were not treated with a conventional preheating step would be excluded from the *vegetables and fruit* of Claim 1: Transcript, pp 932–936. It also argued that the POSITA would understand a "cooking ring" as gelatinization caused by heat regardless of its

position within the vegetable or fruit, such that the upper temperature bound would be the temperature at which the vegetable or fruit showed any gelatinization: McCain Closing Submissions, paras 57–58; Transcript, pp 1025–1028.

(ii) Simplot/Dr. Sastry

[290] Dr. Sastry was unable to construe this element of Claim 1. In his view, the term *preheating step* (like “preheating” and “preheating stage”) had no well-defined or understood meaning as to the treatment of fruits and vegetables other than perhaps for potatoes: Sastry First Report, paras 124–129, 443–450. While the POSITA would understand the discussion in the ’841 Patent of preheating potatoes, they would not know how much of a temperature increase within the vegetable or fruit would be low enough not to amount to a preheating step, or whether the step is dependent on the type of vegetable or fruit. In Dr. Sastry’s opinion, the reported experimental results regarding temperature would not assist the POSITA, since the temperature of the water/tuber could not be used as a proxy for the temperature of the potato without information about the conductivity of the treatment water and the potato.

[291] Simplot adopted Dr. Sastry’s opinion, arguing that the term was ambiguous: Simplot Closing Argument, paras 75, 79–91.

(d) *Construction of the term*

[292] For the following reasons, I conclude the POSITA would understand the *temperature* element to mean that the increase in temperature of the treated vegetable or fruit caused by the electric field treatment is low enough that it would not be similar to a temperature increase

caused by preheating the vegetable or fruit in hot water for an extended period. The POSITA would not consider that there was a specific numerical rise in temperature that would *amount to a preheating step* and thus act as a precise delimitation on the scope of the claim. Nor would they conclude that the *vegetables and fruit* of Claim 1 are limited to those vegetables and fruits that had previously or typically been treated with preheating.

[293] I agree with Simplot that this construction leaves no small uncertainty as to the border between what *amounts to a preheating step* and what does not. However, I conclude that the POSITA approaching the patent with a mind willing to understand it and with their general knowledge of food processing, including thermal and non-thermal treatments, would be able to assess whether any given real-world process caused a temperature rise amounting to a *preheating step*. In any event, any concern regarding uncertainty of the term in Claim 1 is materially mitigated in Claim 6. Since that claim relates specifically to the treatment of potatoes prior to cutting them into strips for the purpose of making french fries, the POSITA would be able to assess the temperature rise of a *preheating step* given their knowledge of conventional thermal pretreatment of potatoes even though, again, there is no precise number of degrees that would divide a process that amounts to a *preheating step* from one that does not.

(i) Vegetables and fruit

[294] I begin this section by observing that while McCain submitted that the Court should adopt Dr. Raghavan's construction of the *temperature* element, it in fact argued for a construction that differed from Dr. Raghavan's, in two material respects. The first relates to how the element affects the meaning of the term *vegetables and fruit*; the second to when a temperature increase would *amount to a preheating step*.

[295] With respect to the former, McCain argues that in light of the *temperature* element, the POSITA would understand Claim 1 to be limited to vegetables and fruit that are “subjected to a conventional preheating step,” *i.e.*, are preheated to reduce their resistance to cutting: Transcript, pp 932–936. It claims that this was also Dr. Raghavan’s construction, referring to and relying on a statement in Dr. Raghavan’s First Report that “[i]n general, vegetables and fruit that would undergo conventional preheating are those that would alternatively undergo the claimed process”: Raghavan First Report, paras 177–178.

[296] This statement is far from a clear opinion that the POSITA reading Claim 1 would limit the term *vegetables and fruit* to those that undergo conventional preheating. To the contrary, in responding to Dr. Sastry on the subject of overbreadth, Dr. Raghavan opined that “the 841 Patent repeatedly refers to processing <u>fruit and vegetables generally</u>” [emphasis added], citing a number of passages in the disclosure: Raghavan Second Report, para 434. He concluded the POSITA would understand the claimed process “could be used on <u>any fruit or vegetable</u> based on the description of the patented process in the 841 Patent, which makes express reference to fruit and vegetables” [emphasis added]: Raghavan Second Report, para 436. If Dr. Raghavan’s view was that *vegetables and fruit* was limited to those vegetables and fruit known to the skilled reader to be subjected to a pretreatment process before cutting, no doubt he would have said so.

[297] In any case, I agree with Simplot that the language of Claim 1 cannot reasonably bear the interpretation McCain now seeks to put on it.

[298] It is clear from the context of Claim 1 that the *vegetables and fruit* referred to are intended to subsequently be cut. Beyond this, the term does not have any limitation on its face.

Construing the term purposively in the context of the disclosure, including the passages Dr. Raghavan himself cites, confirms the broader reading that is apparent from the face of the claim.

[299] The inventors begin the disclosure with the statement that the invention concerns "a process for treating tubers or roots, and more generally, vegetables and fruit such as potato, beet, turnip, carrot, salsify, etc., before cooking." In addition to adding the word "fruit" to the listed root vegetables, the inventors add two qualifiers ("such as" and "etc.") to indicate they did not intend to limit the *vegetables and fruit* of their invention to this list. Similar references are found throughout the disclosure: Raghavan Second Report, paras 434–435. The inventors state that the invention applies "particularly, but not exclusively," to the processing of potatoes to make french fries. In summarizing the invention, they refer to "tubers or roots, and more generally, […] vegetables and fruit." They say that the application of a high electric field "translates to vegetables and fruit, and particularly to potato tubers." Most directly, they say that "it should be understood that all that follows <u>may be generally applied to vegetables and fruit intended to be cut</u>" [emphasis added]. They also say it would be easy for the skilled person to determine operating conditions "for processing other tubers or roots, or more generally, other vegetables or fruits."

[300] All of these indicators would confirm the POSITA's understanding that the unlimited term *vegetables and fruit* appearing in Claim 1 was not intended to be limited to those vegetables and fruit that were conventionally preheated before cutting. Conversely, there is not a single passage in the disclosure or the claims to suggest that the inventors meant a limited subset of *vegetables and fruit*.

[301] While the inventors indicate that their solution overcomes the limitations of conventional methods of pretreating tubers, this would not lead the POSITA to limit the *vegetables and fruit* of Claim 1 either to tubers in particular or to other vegetables that were known in the prior art to be preheated. Claims must be read purposively, but there is no indication that the purpose of the invention or the claimed process is exclusively to replace a preheating step for potatoes or other vegetables or fruit that were previously preheated. To the contrary, as the inventors state and the POSITA would understand, its purpose is to reduce resistance to cutting of vegetables and fruit intended to be cut.

[302] As with its construction of *vegetables and fruit* as being limited to whole vegetables and fruit, McCain's proposed construction restricting the *vegetables and fruit* appears designed to counter validity concerns rather than reading and understanding the language of the claim as it would be understood by the POSITA. Again, this is not the correct approach to claims construction.

(ii) Cooking rings and gelatinization

[303] The main issue with respect to the *temperature* element is when the POSITA would understand an *increase in the temperature* of the vegetable or fruit to *amount to a preheating step*.

[304] On this issue, McCain again argued for a construction that differed from Dr. Raghavan's. As set out above, Dr. Raghavan's view was that the POSITA would understand the element to mean that the increase in the temperature of the vegetable or fruit "would not cause significant cooking rings or loss of material": Raghavan First Report, paras 193–198; Transcript, pp 470–

472. McCain's closing submission was that the element meant that the temperature increase was low enough that there would be no starch gelatinization anywhere in the potato, and that "[a]voiding a cook ring isn't part of the claim": Transcript, pp 1026–1033.

[305] For the following reasons, I conclude that the POSITA would not construe the *temperature* element as either Dr. Raghavan or McCain propose.

[306] Dr. Raghavan's construction, focused on cooking rings or loss of material, cannot be accepted, for four reasons. First, it is a construction that relies not on the *resulting increase in the temperature* of the treated vegetable or fruit, as set out in the claim language, but on resulting advantages of the claimed process. The inventors did not draft their claim in this way. Despite being well aware of the disadvantages of cooking rings and resulting material loss, the inventors did not define the *temperature* element with reference to avoiding those disadvantages.

[307] Dr. Raghavan refers to the inventors' discussion of test results, where they note that "the temperature increase is still sufficiently low that it produces neither any loss of material into the water, nor any cooking ring," suggesting that this would lead the POSITA to consider this the upper limit of the temperature increase: Raghavan First Report, paras 196–197. However, this passage relates to the temperature of the water/tuber mixture, and not the temperature of the vegetables or fruit and, in any case, the inventors did not use such language in their claim. Similarly, while the inventors note that the process of the invention creates no "noticeable elevation of the tuber temperature" such that "no cooking ring is formed," the inventors chose not to include the absence of a cooking ring in the claim. Dr. Raghavan's construction thus

effectively introduces into the *temperature* element the asserted advantages of the invention as set out in the disclosure.

[308] A comparison can be made to the *resistance to cutting* element. While the inventors state that reducing resistance to cutting can have advantages in improving the quality of the cut, this is not what they claim, as Dr. Raghavan insists. The same is true of the *temperature* element. The inventors note in the disclosure that the low temperature increase of the process means that no material is lost into the water and no cooking ring is formed, but they do not claim this advantage as the limitation on the claim.

[309] Second, Dr. Raghavan's construction effectively equates *a preheating step*, the language in the claim, with the formation of a cooking ring and the resulting loss of material. However, Dr. Raghavan agreed that a cooking ring is not always formed in conventional preheating: Transcript, pp 538–539. Indeed, the POSITA would know, as referred to in the Hodges patent, that a goal of the preheating steps is to avoid gelatinization. The creation of a cooking ring is therefore not synonymous with or a proxy for the temperature of a preheating step.

[310] Third, Dr. Raghavan's construction would not have meaning for all *vegetables and fruit* to which Claim 1 might apply. Cooking rings are formed through the gelatinization of starch at the surface of the potato: Sastry First Report, para 300 (fn 185); Transcript, pp 538–539. There was no evidence that cooking rings occur or could occur when other vegetables or fruit are heated, and no evidence regarding the starch content of such other vegetables or fruit. To the contrary, Dr. Sastry stated, without contradiction, that many fruits and vegetables contain little to no starch and thus would not form a cooking ring following a preheating step: Sastry Second

Report, para 54. There was therefore no evidence that the POSITA would understand reference to a "cooking ring" to make any sense in the treatment of, say, a carrot, a beet, or an avocado. This being so, a temperature limit that is defined by the existence or non-existence of a cooking ring and the resulting loss of material would have no meaning.

[311] Fourth, even with respect to potatoes, Dr. Raghavan's reliance on cooking rings and loss of material is unworkable given the POSITA's general knowledge. The POSITA would know from their knowledge of electric fields that foods treated with such fields do not heat from the outside in as they do in a hot water bath. Rather, the heating occurs within the food and evenly throughout it, although differences in conductivity within the product could potentially lead to differential heating: Sastry First Report, paras 35, 51; Transcript, pp 560, 663–665; Barsotti, 1999; Vigerstrom.

[312] As a result, applying an electric field will not result in a cooking ring around the outside of a potato, even if there is a significant increase in temperature: Transcript, pp 539–541. The inventors of the '841 Patent make this very point in the disclosure, noting that the claimed process yields "[h]omogenous processing in volume, whatever the tuber size," in contrast to traditional preheating, "which is not homogenous, since it operates through diffusion toward the inside of the tubers": Raghavan First Report, paras 124(e), 143(c).

[313] In its closing submissions, McCain apparently sought to address this latter concern by arguing that the limitation would not be the presence of a cooking ring, but gelatinization generally. They asserted the POSITA would "understand a cook ring as gelatinization caused by heat, <u>regardless of its position within the fruit/vegetable</u> (i.e., at the surface as observed with

preheating or elsewhere)" [emphasis added]: McCain Closing Submissions, para 58. I reject this assertion. There was no evidence whatsoever that a POSITA would understand a cooking ring to mean anything but gelatinization of starch at the surface of a treated vegetable or fruit (and in particular a potato). While McCain cites passages in both Dr. Sastry's cross-examination and Dr. Raghavan's examination in chief, these passages in no way support McCain's assertion: Transcript, pp 456–457, 636.

[314] McCain went so far as to suggest that this is what Dr. Raghavan meant by his construction: Transcript, p 1029. I again reject this contention. Dr. Raghavan's evidence was clear and repeated. He construed the element to mean that the resulting increase in temperature "would not cause significant cooking rings or loss of material": Raghavan First Report, paras 193, 197; Raghavan Second Report, paras 293, 503; Transcript, p 471. He did not refer to gelatinization generally, nor suggest that the POSITA would understand the references to cooking rings to mean gelatinization wherever it occurs. McCain is trying to recast Dr. Raghavan's opinion, to the extent of submitting that "[a]voiding a cook ring isn't part of the claim," when it was central to Dr. Raghavan's construction: Transcript, p 1026. In my view, this weakens both that opinion and McCain's proposed construction.

[315] McCain's construction that the *temperature* element relates to avoiding gelatinization generally is thus unsupported by any expert. It is unsupported by the disclosure, which refers to cooking rings at the surface of the tuber, but does not refer to avoiding gelatinization generally. Most importantly, it is unsupported by the claim language, which refers to *a preheating step* but makes no reference to avoiding gelatinization or maintaining a temperature below the temperature of starch gelatinization. Further, as Simplot points out, McCain's construction is

inconsistent with Dr. Raghavan's own evidence that a temperature increase amounting to a *preheating step* can occur even in the absence of gelatinization: Raghavan Second Report, para 363; Transcript, pp 790–793.

[316] I therefore conclude the POSITA would not construe the *temperature* element to mean that the increase in temperature is any temperature increase provided there is no cooking ring, other gelatinization, or loss of material.

[317] However, this does not mean that the *temperature* element cannot be construed. As discussed below, another formulation of the element put forward by Dr. Raghavan and McCain presents a workable construction that is consistent with the language of the claim and the CGK of the POSITA.

(iii) Preheating step and ambiguity

[318] Despite maintaining their approach based on cooking rings and gelatinization, both Dr. Raghavan and McCain set out a different standard when addressing ambiguity, namely that "the permissible increase in temperature is defined by reference to the temperature increase that takes place during a preheating step": Raghavan Second Report, para 504; McCain Closing Argument, para 110; Confidential Transcript, p 893. As Dr. Raghavan conceded in cross-examination, and despite McCain's contrary argument, this is a different construction than that based on cooking rings: Confidential Transcript, pp 795–796; Transcript, p 898.

[319] On this construction, the assessment of whether an increase in temperature is *sufficiently low* is not made by looking at physical changes to the vegetable or fruit, but by comparing the

temperature increase to the temperature increase that occurs during *a preheating step*. In my view, this is the comparison that Claim 1 calls for. However, the question then becomes whether the POSITA would be able to understand the term *a preheating step* in order to assess whether a given increase in temperature amounts to that.

[320] As noted, Simplot and Dr. Sastry argue that they could not, since *a preheating step* had no well-defined and understood meaning outside potatoes, potato processors use different conditions for their preheating steps, and the ’841 Patent provides no guidance on the temperature increases that would result or would be used as a standard: Sastry First Report, paras 124–129, 443–450; Confidential Transcript, pp 797–798. In particular, the test results showing temperature increases of 1.6ºC and 5.6ºC provide no guidance, since they refer to the water/tuber mixture, and the tubers may well heat up faster than the water when subjected to an electric field, depending on their conductivity compared to that of the water: Sastry First Report, paras 128–129, 448–449; Transcript, p 572. Dr. Raghavan’s assumption that the temperature increase for the tubers alone would not exceed the temperature increase for the mixture is therefore not justified: Raghavan First Report, para 198; Raghavan Second Report, para 79; Sastry Second Report, paras 56–57; Transcript, p 472; Confidential Transcript, pp 766–767.

[321] I agree with Simplot that the test results in the ’841 Patent are not definitive and do not set out the internal temperature of the potato tubers. I also agree that there is no evidence on the record to establish that there are standard preheating steps in the art for other fruits and vegetables and that even for potatoes, the internal temperature of a tuber after preheating may vary depending on the particular treatment used by a food processor and factors such as the potato variety.

[322] As a result, there is no possibility that a POSITA could determine a precise temperature increase, expressed in degrees or fractions of a degree, and say with confidence that treatments that increase the temperature below that number do not amount to a *preheating step* while those above it do amount to a *preheating step*. Neither McCain nor Dr. Raghavan purported to identify such a temperature increase, either for potatoes or for any other fruits or vegetables, including those said to be traditionally pretreated.

[323] There is therefore certainly some attraction to Simplot’s argument that the POSITA would be unable to know in advance whether or not something would be within Claim 1, and that the ’841 Patent does not define “distinctly and in explicit terms the subject-matter of the invention”: *Pharmascience Inc v Bristol-Myers Squibb Canada Co*, 2022 FCA 142 [*Pharmascience Apixaban*] at paras 60–61; *Patent Act*, s 27(4).

[324] However, while the Canadian law on ambiguity requires an inventor to give adequate notice to the public as to the scope of the claim, it also recognizes that a claim is not invalid simply because it is not a model of concision and lucidity: *Pharmascience Apixaban* at para 61, citing *Letourneau v Clearbrook Iron Works Ltd*, 2005 FC 1229 at para 37; *Western Oilfield Equipment Rentals v M-I LLC*, 2021 FCA 24 at para 121. The Court will attempt to give a patent claim meaning if it can, while recognizing that the onus to define the scope of their claim is statutorily placed on the inventor. At the same time, the *Patent Act* is not designed to allow inventors to obtain a patent using loose or uncertain claim language that can be twisted this way or that, only to later assert that the skilled reader would understand it in precisely the way that would avoid the prior art while covering the defendant’s conduct.

[325] The *temperature* element of the ’841 Patent certainly raises some of these concerns. If the POSITA cannot know, and even the patentee cannot define, what temperature increase amounts to a *preheating step*, how could the POSITA know whether a given process meets the *preheating step* or does not? Nonetheless, on the balance of the evidence I conclude the POSITA would generally be able to understand whether a temperature increase caused by an electric field treatment would be one that amounts to *a preheating step*. While there may be a degree of uncertainty at the boundary, I am not satisfied that it prevents the POSITA from understanding the claim. I reach this conclusion based on the evidence regarding the CGK of the POSITA regarding preheating steps and thermal vs non-thermal treatment of foods, as well as the admittedly limited indicators provided in the ’841 Patent.

[326] As discussed above at paragraphs [155] and following, the POSITA would be aware of differences between thermal and non-thermal processing, including as they relate to electric field applications. Thermal and non-thermal effects may overlap and, as explained above, no electric field application is ever fully non-thermal. However, researchers and others in the field studied and sought to isolate thermal and non-thermal effects of various treatments. Thus, despite the fact that any electric field treatment would cause some ohmic heating, the experts recognized a difference in quality between thermal treatments and non-thermal treatments: Sastry First Report, paras 29–30, 37–55; Vorobiev First Report, paras 43–47.

[327] The POSITA would combine this knowledge with their knowledge of conventional preheating of potatoes and other fruits and vegetables. With respect to the latter, the evidence was sparse, but Drs. Raghavan and Sastry appear to agree that preheating to ease slicing did

occur for at least some other vegetables and fruits: Raghavan First Report, paras 110, 178; Raghavan Second Report, paras 436, 505; Sastry First Report, para 226. While Dr. Sastry asserts there was no standard for *a preheating step*, I conclude that the POSITA would have a general understanding of conventional preheating of vegetables and fruits for this purpose. This would include an understanding of the impact of preheating on the internal temperature of the food or, at least, how to measure that temperature increase.

[328] The POSITA would also consider the term *a preheating step* in the context of the inventors' discussion of conventional preheating of potatoes in a hot water bath at 40 to 60ºC for 20 to 40 minutes. While being unable to say with precision exactly what temperature increase such a treatment would cause (which would presumably be at least somewhat different for 20 minutes at 40ºC than it would for 40 minutes at 60ºC, and different for different sizes or varieties of potatoes), the POSITA would have an understanding of the type of treatments and resulting temperature rises the inventors were contemplating in their use of the term *a preheating step*. This would be contrasted with the inventors' test results. Although only the temperature increase of the tuber/water mixture was reported, the POSITA would be readily able to apply the given electric field and time parameters and measure the resulting temperature of the vegetable or fruit if they wished to determine whether a given treatment caused a similar temperature increase.

[329] I conclude the POSITA looking to understand the '841 Patent would construe *a preheating step* to mean a thermal treatment that causes a material temperature rise, similar to that caused by conventional preheating for an extended period in a hot water bath. The *temperature* element requires the claimed process to cause a temperature increase of the

vegetable or fruit low enough that it would not be similar to a temperature increase caused by such *a preheating step*. While there may be some treatments where it is less clear whether the temperature increase amounts to *a preheating step*, I do not see this as necessarily creating an ambiguity.

[330] In this regard, it is important to consider the question of ambiguity in the context of the field or art of the patent, and in the context of the claims at issue, so as to avoid it becoming an overly hypothetical exercise. Simplot posits, for example, that the skilled reader would not know how many degrees a pineapple could increase in temperature during an electrical treatment before it would amount to *a preheating step*. However, it is to be recalled that the claim in question is addressed to a real-world field of endeavour, that of food processing, and in particular to a process involving the application of electrical equipment to reduce resistance to cutting of vegetables and fruit. Leaving aside McCain's own experimental results, discussed further below, Simplot was unable to point to any real-world scenario in which a food processor was or intended to treat vegetables or fruits with a *high electric field* to *reduce their resistance to cutting*, but was entirely unable to determine whether what they were doing amounted to a thermal treatment or *preheating step*.

(iv) Claim 6

[331] In any event, I conclude that any concern regarding ambiguity of the *temperature* element in Claim 1 is attenuated in Claim 6, which limits the process to one applied to potatoes before cutting them to make french fries.

[332] Dr. Sastry's evidence that there was no well-defined meaning for the term *preheating step* included an exception "perhaps for potatoes": Sastry First Report, paras 125, 445. His opinions on ambiguity were generally directed at the vegetables and fruit of Claim 1, rather than the french fry processing of Claim 6: Sastry First Report, paras 443–450.

[333] The POSITA had considerable knowledge of the preheating step applied to potatoes to reduce their resistance to cutting before cutting them into strips to produce french fries. Although there can be variation in the nature of the treatments used between companies, as well as variation based on time of year and variety, there was no evidence that the POSITA would understand that these variations resulted in changes in the potato temperature caused by the process large enough to make it impossible to distinguish between a temperature increase amounting to a *preheating step* and one that does not. Indeed, the POSITA would know that any french fry processor would be looking to achieve about the same results from their preheating step, such that the temperature differences resulting from the processes used by different companies would likely be modest.

[334] Using this knowledge, combined with the teachings of the '841 Patent above and their general knowledge of thermal and non-thermal processing in electric fields, I conclude the POSITA would be reasonably able to determine whether a given electric field treatment resulted in an increase in temperature amounting to *a preheating step*.

F. *Conclusion on construction*

[335] For the foregoing reasons, I conclude that the POSITA reviewing Claim 1 of the ’841 Patent on its date of publication, in light of the patent as a whole and their CGK, would understand it to claim the following:

> A process for treating *vegetables and fruit* [not necessarily whole or previously uncut, and not limited to those traditionally preheated in a water bath]
>
> before cooking [*i.e.*, that have not yet been cooked, but may have been subjected to other treatment such as steam peeling]
>
> in order to [*i.e.*, with the effect of]
>
> *reduce their resistance to cutting* [*i.e.*, making them easier to cut by lowering the total energy required to cut them than they were before the treatment, without any limitation on the resulting quality of the cut, the amount of reduction other than it be non-zero (non-trivial or significant), or that the cutting be with a blade],
>
> characterized by the application of a *high electric field* [an electric field in the range of 2 to 200 V/cm]
>
> directly to the vegetables and/or fruit [either through physical contact with electrodes or being placed in a medium such as water that has electrodes immersed in it]
>
> under conditions such that the *resulting increase in the temperature* of the vegetables and/or fruit [*i.e.*, the increase in the temperature of the vegetable or fruit itself, rather than the surrounding medium, caused by the application of the electric field]
>
> is *almost zero* or *at least sufficiently low as to not amount to a preheating step* [*i.e.*, low enough so as not to be similar to the temperature increase caused by preheating the vegetable or fruit in hot water for an extended period, without restriction based on the gelatinization of starch or material loss].

[336] The POSITA would understand Claim 6 to claim a process as described above, in which the term *vegetables and fruit* is replaced by *potatoes*, the term *a preheating step* refers to the preheating step traditionally applied to potatoes by immersing them in hot water, and the process is applied to potatoes prior to cutting them into strips for the purpose of producing french fries.

III. Infringement

[337] A patent claim is infringed if the defendant’s product, method, or process includes all of the essential elements of the claim as properly construed: *Free World Trust* at paras 31(f), 68, 75; *Western Oilfield* at paras 48–49.

[338] McCain’s allegations of infringement relate to Simplot’s introduction into its french fry processing of a pulsed electric field system manufactured by Elea Vertriebs-und-Vermarktungsgesellschaft mbH, a company that manufactures and sells PEF systems for the food industry. By way of background, Simplot had previously named Elea as a third party in this action, but the third party claim was struck upon determination that it was not within the jurisdiction of this Court: *McCain Foods Limited v JR Simplot Company*, 2021 FCA 4 at paras 82, 95–99, lv to appeal ref’d 2021 CanLII 58911 (SCC).

[339] Evidence regarding Simplot’s manufacturing process was presented in documents and through the evidence of **James Englar**, Senior Director of Technical Services for the JR Simplot Company, based in Idaho. Mr. Englar has held a number of positions over the course of 25 years with Simplot or a predecessor company, including acting as plant manager of potato manufacturing plants in Portage la Prairie and in Idaho. Some information regarding the system and its technical details was also provided by **Dr. Stefan Toepfl**, the Managing Director of Elea.

[340] None of the aspects of Simplot’s french fry manufacturing process relevant to the question of infringement are in material dispute. At the relevant time, Simplot’s system applied a

pulsed electric field to potatoes before cooking them and before cutting them into strips for the purpose of producing french fries.

[341] While the specific details of Simplot's process are confidential, the parties agree that the electric field applied in the course of this process is outside the scope of the term *high electric field* as I have construed it above, being well above 200 V/cm.

[342] As a result, Simplot's process does not include all of the essential elements of either Claim 1 or Claim 6. Simplot therefore did not infringe those claims during the life of the '841 Patent.

[343] Simplot also alleges that McCain has not met its burden to demonstrate that its process reduces the *resistance to cutting* of the potatoes, particularly in the context of the high-speed cutting systems it uses to cut the potatoes after treatment. While not determinative of the issue of infringement, I conclude that McCain has established that Simplot's system meets the *resistance to cutting* element.

[344] The primary evidence McCain relies on in respect of the *resistance to cutting* element is the results of internal texturometry testing at Simplot, performed at the time Simplot was reviewing the possibility of bringing the PEF system into its french fry manufacturing process: Exhibit 60; Exhibit 63.

[345] The texturometry testing data show the energy required to cut potato samples not treated with the PEF system and samples treated with the PEF system. Mr. Englar spoke to this testing in his evidence: Confidential Transcript, pp 286–287, 299–300, 353–355.

[346] Simplot argues that these texturometry results cannot be used to infer that there is a reduction in the energy required to cut its potatoes at the high speeds that it uses in its manufacturing. It relies on the common knowledge that measurements of cutting resistance may be affected by the speed at which a texturometry probe is advanced into the food product, and on Dr. Raghavan’s admission in cross-examination that similar texturometry testing by the inventors would not allow one to make conclusions about whether a reduced resistance to cutting would be achieved at the much faster speeds used in industrial french fry processing: Exhibits 11/12; Confidential Transcript, pp 773–775.

[347] In my view, and despite Dr. Raghavan’s admission, the evidence McCain relies on establishes on a balance of probabilities that the PEF process used by Simplot results in a reduction in the amount of energy needed to cut the potatoes. This seems to be precisely what the texturometry testing was intended to demonstrate, and what Simplot concluded from it.

[348] I leave aside for present purposes the underlying question of whether the *resistance to cutting* element of Claim 1 is dependent on the cutting speed of the subsequent cutting that is performed, which I need not determine. I note again, however, that a vegetable or fruit’s resistance to cutting is a physical property of the vegetable or fruit, and a texturometer is simply a device for measuring or quantifying that property. A different setting on a texturometer may

affect the measurement, but it does not affect the physical property of the vegetable or fruit. I also note that no expert proposed a construction in which the *resistance to cutting* element could only be measured at industrial cutting speeds. To the contrary, both experts opined that the POSITA would understand that the force and work required to cut the potato, and thereby its *resistance to cutting* within the meaning of Claim 1, could be measured by a texturometer with an appropriate attachment and methodology, although they disagreed on whether the attachment had to be a blade, as noted above: Sastry First Report, paras 92, 294–295; Sastry Second Report, para 26; Raghavan First Report, para 162; Raghavan Second Report, paras 59–60.

[349] In any event, it is clear that texturometry analysis is commonly used in the food processing industry, including by french fry manufacturers, to assess resistance to cutting, even though texturometry probes travel more slowly than industrial cutting blades. Indeed, if it were impossible to draw any reliable or material conclusions from texturometry analysis about whether a process reduced resistance to cutting at industrial speeds, one questions why Simplot would undertake such testing, why it would refer to the results of that testing in both internal commercial and internal training documents, and why the makers of PEF systems would highlight such results in presenting their systems to potential customers who manufacture french fries: Exhibit 60, pp 19, 21; Exhibit 63, pp 6–7; Confidential Transcript, pp 286–287, 299–300, 353–355.

[350] Simplot's arguments also do not have the support of their own expert evidence. Dr. Raghavan gave his opinion that the Simplot documents showed that Simplot's process met the *resistance to cutting* element: Raghavan First Report, paras 228–231. In responding to

Dr. Raghavan on infringement issues, Dr. Sastry did not opine that nothing could be drawn from the texturometry results or that they did not establish that the *resistance to cutting* element was met, despite his knowledge of the nature of texturometry and the testing performed: Sastry Second Report, paras 63–78.

[351] Given the foregoing, I conclude that the evidence presented by McCain, including Simplot's documents and Dr. Raghavan's opinion based on them, demonstrate on a balance of probabilities that the *resistance to cutting* element is met, despite Simplot's arguments and Dr. Raghavan's admission regarding the limitations of texturometry data.

[352] This said, I flag one aspect of Dr. Raghavan's infringement opinion that I have already referred to above, namely his conclusion that an Elea document acknowledges that the purpose of the PEF treatment used by Simplot is to reduce resistance to cutting because potatoes are "made softer by this method of treatment which facilitates further processing (e.g. slicing)": Raghavan First Report, para 227–228; Exhibit 84. I have identified above the inconsistency between this evidence and Dr. Raghavan's opinion that softening is a distinct and uncorrelated parameter than resistance to cutting. I will not repeat that discussion here, as McCain did not rely on this aspect of Dr. Raghavan opinion and it does not impact my conclusion that the *resistance to cutting* element is met. However, I will briefly return to this issue below in addressing the parties' invalidity arguments and the importance of consistency.

IV. Validity

A. *Introduction: Alternative Construction and Grounds of Invalidity Raised*

[353] Simplot originally advanced its invalidity arguments both in defence to McCain's claim and by way of a counterclaim seeking declarations of invalidity of all claims of the '841 Patent. However, at trial, Simplot advised that given the nature of the claim against it and the intervening expiry of the patent, it was only pursuing its invalidity grounds by way of defence to McCain's allegations of infringement of Claims 1 and 6, and only to the extent that McCain's construction is adopted: Transcript, pp 907–910; Confidential Transcript (Dec 19, 2024), pp 94–95.

[354] As set out above, the construction of Claim 1 I have adopted, particularly as it relates to the term *high electric field*, is dispositive of McCain's claim for infringement. I need not address whether the asserted claims are invalid based on this construction, given Simplot's withdrawal of its counterclaim and its invalidity arguments based on this construction. However, in case I have adopted an incorrect construction of the term *high electric field*, I will address Simplot's alternative validity arguments.

[355] The discussion below is therefore premised on the construction of *high electric field* proposed by McCain, namely any electric field strong enough to reduce the *resistance to cutting* of the vegetable or fruit, including PEF treatments using electric fields of 1 kV/cm or more. Other aspects of Claim 1 will bear the same construction reached above, including that (a) the *vegetables and fruit* are not limited to whole or previously uncut vegetables or fruit, nor to those

traditionally preheated in a water bath; (b) the *resistance to cutting* element means lowering the total energy required to cut the fruit or vegetable, with no limitation on the quality of the resulting cut or the amount of reduction; and (c) the *temperature* element involves a comparison of the temperature increase of the vegetable or fruit to the increase that would be caused by preheating in hot water for an extended period, without restriction based on starch gelatinization or material loss.

[356] As a result, on this construction, Claim 1 claims a process for treating vegetables and fruit before cooking, to reduce their resistance to cutting, characterized by the application of any electric field sufficient to cause that reduction (with no upper limitation), under conditions such that the temperature of the vegetable or fruit is not increased to the extent it would be in hot water preheating. On this construction, Claim 6 claims the same process, but limited to the treatment of potatoes before cutting them into strips to make french fries. For purposes of the discussion below, I will term this the "alternative construction."

[357] Simplot raises five grounds of invalidity, in addition to the ambiguity argument I have rejected above: insufficiency, overbreadth, lack of utility, anticipation, and obviousness. With respect to each ground of invalidity, Simplot bears the burden of establishing that Claims 1 and 6 of the '841 Patent are invalid: *Whirlpool* at para 75; *Patent Act*, s 45.

[358] There is a degree of overlap and interrelatedness to the asserted grounds of invalidity and the parties' arguments with respect to them. It is therefore important in considering them to maintain a consistent approach to the nature of the invention, the claims and disclosure of the '841 Patent, the knowledge and understanding of the POSITA, the work of the inventors, and the

prior art. One cannot, for example, adopt a different reading of either a patent claim or the prior art for purposes of construction and assessing a sound prediction of utility, or a different reading for purposes of utility than for obviousness or overbreadth: *Whirlpool* at para 49(b); *Shire Biochem Inc v Canada (Health)*, 2008 FC 583 at paras 64–65.

[359] For the reasons set out below, I conclude that Claims 1 and 6 of the ’841 Patent, if construed in accordance with the alternative construction, would be invalid for claiming more than the invention made or contemplated by the inventors, and for failing to demonstrate or soundly predict the utility of the claimed process. Conversely, I conclude that Simplot has not established that these claims would be anticipated by the prior art. As my findings on overbroad claiming and utility are determinative of the issue of validity on the alternate construction, I need not address Simplot’s other invalidity arguments, namely insufficiency and obviousness.

[360] In addition to the opinions of the experts, the parties’ invalidity arguments refer to the evidence of the lay witnesses, including evidence regarding the inventors’ experimental work. I will therefore introduce the remaining witnesses and provide a brief overview of the inventors’ experimental work before turning to the grounds of invalidity raised.

B. *The Remaining Witnesses*

[361] As noted above, the two McCain inventors gave evidence at trial. McCain called **Fabrice Desailly**, who gave evidence in person at trial. Simplot tendered the evidence of **Jean-François Cousin**, which was taken through a videotaped deposition conducted in Paris on commission pursuant to Rule 272 of the *Federal Courts Rules*: Exhibit 91 (video); Exhibit 92 (transcript).

The two academic inventors, Dr. Goullieux and Dr. Pain, did not give evidence at trial, although with McCain's consent, Simplot read in certain evidence from a pre-trial examination of Dr. Goullieux conducted under Rule 237(4), together with McCain's position on these aspects of her evidence: Exhibit 112.

[362] McCain called two other McCain employees. **Fraser Stark** is Director of Technical Services for North America for McCain, where he has worked for 25 years. He gave evidence regarding McCain and its potato processing business, its efforts in developing new processing technologies, its processes for producing french fries, and the importance of improving recovery and reducing costs in those processes in the competitive potato market. He also spoke to the incorporation of pulsed electric field technology into McCain's potato processing operations, including through the purchase of equipment from Elea.

[363] **Marie Lottin** is Continuous Improvement Program Manager at a McCain subsidiary in Belgium, but used to report to Mr. Cousin and Mr. Desailly at McCain Alimentaire. She spoke to her involvement in the implementation of PEF technologies in potato processing at McCain beginning in 2007, reporting first to Mr. Cousin and subsequently to Mr. Desailly, including testing done as part of an industrial pilot project.

[364] In addition to Mr. Englar and Dr. Toepfl, introduced above, Simplot called evidence from **Bruce Walker**, a Research Fellow with Simplot, also based in Idaho. Mr. Walker's evidence pertained to tests he conducted in 2005 in an effort to implement the teachings of the US '540 Patent that is the US equivalent to the '841 Patent.

C. *Overview of the Inventors' Studies*

[365] The inventors' experimental work in connection with the '841 Patent is found in three studies commissioned by McCain Alimentaire and conducted by Dr. Goullieux (first two studies) and Dr. Pain (all three studies), working with Messrs. Cousin and Desailly at McCain Alimentaire. The evidence related to the inventors' experiments was designated as confidential by McCain and was filed on the confidential record. I have therefore kept the following description of the studies brief and have endeavoured to refer as little as possible to objectively confidential information. I also note that the parties filed both the original French versions of the study reports arising from the studies and English translations that they agreed were accurate. In the English version of these reasons, I will quote or refer to the text of the agreed English versions without indicating in each instance that it is a translation, it being understood that the original document is the French version.

(1) First Study

[366] The first study, conducted between May and July 1997, looked at the effects of different pretreatments on the sliceability of potato tubers: Exhibit 11 (original); Exhibit 12 (translation). Of relevance, it addressed treating potatoes with an electric field (termed a "pulsed electric field" in the study report, terminology I will return to later). It also sought to develop a method for measuring potato sliceability by texturometry.

[367] Tests were conducted using various "pairs" of electric field strength and treatment time, ranging between 26 V/cm for 220 s and 101 V/cm for 1 s, on standardized slices of potatoes [redacted]. A number of parameters, including the work required to cut the potato samples

(termed the "surface" in the report), were measured by a texturometer fitted with a blade. The potato samples were also sliced manually after the electric field treatment, and a sensory evaluation was conducted [redacted]. Various statistical analyses [redacted] were conducted.

(2) Second Study

[368] The second study, conducted between November 1997 and March 1998, sought to gain a better understanding of the effect of potato variety and size on sliceability following electric field treatment of tubers immersed in a liquid; the effect of the treatment on peeling, dry matter, and weight loss; and the effect of the type and condition of the blade on texturometry measurements: Exhibit 13 (original); Exhibit 14 (translation). As in the first study, the electric field treatments were termed "pulsed electric fields."

[369] [redacted] Based on the results of the first study, three different electric field strengths (45, 55, and 65 V/cm) and two treatment times (3 and 5 s) were studied. Textural characteristics, including the work required to cut the potato, were measured with a texturometer. A sensory evaluation of the potato after cutting was again performed [redacted]

[redacted].

(3) Third Study

[370] The third study, conducted between about February and November 1999, evaluated the impact of electric field treatment on potato tubers and on the quality of the resulting french fries: Exhibit 17 (original); Exhibit 18 (translation). Unfortunately, annexes to the third study report were apparently lost or unavailable and were not filed in evidence, but some of the underlying testing data were filed in spreadsheet form: Exhibits 43, 44; Confidential Transcript, pp 76–77.

[371] The three electric field strengths used in the second study (45, 55, and 65 V/cm) were applied for three treatment times (3, 4, and 5 s) [redacted]. Two textural parameters, including the work necessary to slice the potato, were measured with a texturometer. A sensory evaluation was again conducted after manually cutting the potato [redacted].

[372] Further details regarding these studies and the results they present are discussed below in addressing Simplot's invalidity arguments.

D. *Overbreadth*

(1) Principles

[373] Overbreadth is an independent ground of patent invalidity, although it may overlap with other grounds such as anticipation or insufficiency: *Seedlings* at paras 49–52; *Western Oilfield* at paras 128–130. It flows from the requirement in paragraph 27(3)(a) of the *Patent Act* that the specification correctly and fully describe the invention, the requirement in subsection 27(4) that it end with claims defining distinctly and in explicit terms the subject-matter of the invention, and the bargain theory of patent law more broadly: *Western Oilfield* at para 129; *Free World Trust* at para 13.

[374] A patent claim may be invalid for overbreadth if it claims either (i) more than the invention disclosed in the specification, or (ii) more than the invention made by the inventor, *i.e.*, what the inventor “truly invented”: *Western Oilfield* at para 128; *Pfizer Quinapril (2007)* at paras 115–116; *Leithiser v Pengo Hydra-Pull of Canada, Ltd*, 1974 CanLII 2481 (FCA), [1974] 2 FC 954 at p 965; *ProSlide Technology, Inc v Whitewater West Industries, Ltd*, 2024 FC 1439 at para 145.

[375] With respect to the first branch, a claim will be broader than the invention disclosed if it fails to include a limitation or feature that is essential to the working of the invention as described in the patent: *Seedlings* at paras 52–54, 60; *Amfac Foods Inc v Irving Pulp & Paper Ltd*, 1986 CanLII 7669 (FCA), 12 CPR (3d) 193 at pp 198–201, 204–205. In this context, what is “essential” to the working of the invention does not mean the same thing as the essential elements of a claim: *Seedlings* at para 54. Rather, it is an inquiry as to whether there is an

element of the invention disclosed that goes to the core of the described invention, an inquiry that may be assisted by considering the inventor's proposed solutions to shortcomings in the prior art: *Seedlings* at paras 54, 60, 62. However, a claim will not be overbroad simply because it goes beyond described or preferred embodiments: *Seedlings* at para 58; *Pfizer Quinapril (2007)* at para 115; *Angelcare Canada Inc v Munchkin, Inc*, 2022 FC 507 at paras 462–466, rev'd in part on other grounds, 2024 FCA 156.

[376] With respect to the second branch, a claim may be broader than the invention made if it claims more than the inventor made or contemplated: *ProSlide* at para 193; *AstraZeneca Canada Inc v Apotex Inc*, 2017 SCC 36 [*AstraZeneca Esomeprazole*] at para 46. What was "truly invented" is not inherently limited to either what the inventor actually made or tested, but can include what was contemplated: *ProSlide* at paras 193–194. At the same time, what is "contemplated" must be considered in the context of the requirements for an invention. As the Supreme Court has underscored, "it is not enough for a [person] to say that an idea floated through [their] brain; [they] must at least have reduced it to a definite and practical shape before [they] can be said to have invented a process" [emphasis added by Binnie J]: *Apotex Inc v Wellcome Foundation Ltd*, 2002 SCC 77 [*Apotex AZT*] at para 54, quoting *Christiani and Nielsen v Rice*, 1930 CanLII 81 (SCC), [1930] SCR 443 at p 454.

[377] The essence of the overbreadth analysis is thus a comparison between the scope of the invention as claimed on the one hand and, on the other, either the invention as disclosed or the invention as actually made and contemplated: *Pfizer Quinapril (2007)* at paras 123–127; *Seedlings* at paras 52–54, 60; *Pfizer Canada Inc v Canada (Minister of Health)*, 2008 FC 11 [*Pfizer Quinapril (2008)*] at para 46. The invention that was actually made or contemplated is a

question of fact, to be assessed based on available relevant evidence, including the patent itself, any available evidence from inventors, and secondary evidence such as notebooks, memoranda, or evidence of colleagues: *Nova Chemicals* at para 15; *AFD Petroleum Ltd v Frac Shack Inc*, 2018 FCA 140 at para 49; *Pfizer Quinapril (2008)* at para 46.

[378] With respect to the relevant dates for the assessment, the date for assessing the scope of the claims is clearly the date of publication: *Free World Trust* at paras 52–54. This appears to also be the relevant date for considering the invention as disclosed in the disclosure, since the date of publication is the date for assessing how the POSITA would understand what a patent "disclosed and claimed": *Free World Trust* at para 52; *Seedlings* at para 53.

[379] With respect to the date for assessing the invention as made or contemplated by the inventor, McCain implicitly argues that this should also be undertaken at the publication date. Simplot submits that it is to be undertaken at the filing date. Each position arguably has support in the case law: *Seedlings* at para 53; *Rovi Guides, Inc v Bell Canada*, 2022 FC 1388 at para 304, aff'd without comment on this point 2024 FCA 126. I need not address the distinction as there was no contention that the inventors made any new, different, or additional invention between the filing date in June 2001, and the publication date in December 2001.

[380] Simplot raises both of aspects of overbreadth, asserting that on the alternative construction, the claims are broader than both the invention disclosed and the invention made. As set out below, I conclude that on the alternative construction, Claims 1 and 6 are broader than the invention made or contemplated. I therefore need not address Simplot's argument that the claims

are also broader than the invention disclosed, an argument that essentially parallels its arguments on insufficiency.

(2) Claims broader than the invention made or contemplated

[381] On the alternative construction, Claims 1 and 6 of the ’841 Patent cover the application of any electric field that reduces the *resistance to cutting* of vegetables or fruit, including PEF treatments using electric fields of 1 kV/cm or more. Simplot contends that on this construction, these claims are broader than the invention made or contemplated by the inventors, since the inventors never made or contemplated a process involving the application of 1 kV/cm electric fields in microsecond pulses. McCain argues that the inventors did contemplate such a use as part of their invention, relying on the reference to PEF in the patent, the reference to “pulsed electric fields” in the inventors’ study reports, and the inventors’ sharing of an article regarding PEF in March 2000, shortly before the original French patent application was filed.

[382] For the following reasons, I agree with Simplot and conclude that on the alternative construction, Claims 1 and 6 are invalid for overbroad claiming.

[383] It is common ground that the inventors did not conduct any testing involving electric fields stronger than 101 V/cm or applications shorter than one second. However, as noted above, an invention is not necessarily limited to what was actually made or tested, although the latter can be an indicator of the former: *ProSlide* at paras 193–194. Nor, as McCain correctly argues, is an invention necessarily limited to preferred embodiments described in the disclosure: *Seedlings* at para 58.

[384] At the same time, the fact that a process falls within the scope of a claim does not automatically mean it is an aspect of the invention made or contemplated by the inventors. If this were so, a claim could simply never be broader than the invention made or contemplated by definition, which is not the case.

[385] The relevant question in the present case is whether the inventors of the ’841 Patent, in coming to their invention, contemplated a process that involved the application of electric fields as high as 1 kV/cm, such as are applied for pulses measured in microseconds in PEF treatments. In my view, the evidence is clear that they did not contemplate such a process and that the process that they did contemplate and invent was limited to the application of electric fields of much lower strengths.

[386] In considering this evidence, it is worth recalling that the difference in the application of such fields is not simply a question of the degree of treatment, but a difference in the kind of treatment, given the different impacts of such fields on plant tissues, the different parameters necessary for their implementation, and the different equipment required to apply them. This difference was known to the POSITA and, as discussed further below, is seen in both the inventors’ work on the invention and the McCain inventors’ later work on PEF treatments.

(a) *The disclosure of the ’841 Patent*

[387] I agree with Simplot that the single reference to PEF in the background section of the disclosure of the ’841 Patent is not evidence that the inventors contemplated that the use of electric fields of 1 kV/cm or more was part of their invention. Even if the POSITA might read

the reference to PEF and the extraction of sugar from beets and construe the *high electric field* of Claim 1 as including electric fields of a strength such as typically used in PEF, I do not find that this reference shows that the inventors actually contemplated such fields for use in their invention. Nor does the inventors' use of the term *high electric field* in the disclosure and in the claims show that they contemplated PEF applications, for the reasons I have given above regarding the variable and context-specific nature of the term and the absence from it of the word "pulse."

[388] This is particularly so in light of the other evidence, which must also be considered. Unlike the POSITA reviewing the '841 Patent with an eye to construing it, in assessing the invention actually made or contemplated by the inventors, the Court has additional evidence in the form of the inventors' study reports, the testimony of the two McCain inventors, and evidence of the McCain inventors' own description of their invention in the years following the patent filing.

(b) *Studies and study reports*

[389] None of the study reports prepared by the inventors makes any reference to the possibility, even theoretically, of applying electric fields as high as 1 kV/cm to vegetables or fruit for the purposes of reducing their resistance to cutting, or to doing so for pulses in the range of microseconds. To the contrary, the first study report indicates that the inventors began by "testing <u>two extremes</u> found in the literature, 100 V/cm for one second and 26 V/cm for 160 seconds and then [they] looked for intermediates to try to define <u>lower and upper treatment limits</u>" [emphasis added]: Exhibits 11/12, p 27. It is clear from these values that the literature the

inventors reviewed did not include literature available prior to 1997 regarding PEF technologies using much stronger electric fields in microsecond pulsed applications well outside these "extremes," such as Sale (1967), Knorr (1994), Ho (1995), or Grahl (1996).

[390] Within this 26 to 100 V/cm range of "extremes," the stronger fields were abandoned as being too strong for the inventors' purposes, as they showed gelatinization of the potato (indicating too great an increase in temperature). The inventors subsequently only studied electric fields in the 45 to 65 V/cm range in the second and third studies. The fact that the inventors moved away from stronger electric fields even within the 26 to 100 V/cm range in trying to define their "upper treatment limit" suggests they were not contemplating electric fields ten times the strongest field tested.

[391] As noted above, and as underscored by McCain, the first two study reports refer to the electric treatments studied as "pulsed electric fields." A summary document prepared by Mr. Desailly at around the time of the first study uses the same term: Exhibit 10. I am unable to conclude from the use of this terminology in these documents, or from any other aspect of the study reports, that the inventors contemplated the application of electric fields of 1 kV/cm or more in microsecond or even millisecond pulses (*i.e.*, what is commonly referred to as PEF in the field). In this regard, what is ultimately relevant is what the inventors actually made or contemplated, and not the terminology they used to describe what they made or contemplated, unless that terminology provides an indication that the inventors were contemplating a broader invention. For the following reasons, I find it does not.

[392] As will be clear from the discussion above at paragraphs [151] to [206] and [268] to [271], calling the application of electric fields in the range of 26 to 101 V/cm for between 1 and 220 s a “pulsed electric field” treatment is unusual, and even a misnomer. There is no indication in the cited prior art that such treatments would be understood or referred to by the POSITA as “pulsed electric field” treatments. Indeed, the inventors themselves abandoned this term in describing the treatments described in their experiments, with the third study report and a subsequent summary referring to “high electric field,” “direct electric field,” or “high direct electric field”: Exhibit 17, pp 1, 4, 16/Exhibit 18, pp 1, 4, 24; Exhibits 19/20, pp 1–2.

[393] Nor is there any indication in the first two study documents that by using the term “pulsed electric fields” the inventors were evoking, thinking about, or contemplating the application of electric fields in the range of many hundreds or thousands of V/cm for pulses of microseconds. Such applications would require specialized equipment that was neither used nor referenced in the study reports. To the contrary, while the inventors used a different generator in the second study than in the first study to allow them to generate adequate electric fields in a water bath for the treatment of whole potatoes, it remained similar to the equipment used for ohmic heating and not equipment that could implement a PEF treatment: Exhibit 13, pp 4–5/Exhibit 14, pp 5–6. No discussion of the possibility of using PEF equipment is found in the study reports or related documents.

[394] No evidence was presented from the academic inventors, who authored the study reports, as to their understanding of the term “pulsed electric field” as used in the reports, or as to the scope of the invention as they contemplated it. There was no evidence at all from Dr. Pain, while

the extracts of Dr. Goullieux's discovery filed on consent did not refer to the issue, beyond confirming that she was not involved in any study where an electric field stronger than 101 V/cm was used: Exhibit 112, pp 421–422.

[395] As for the McCain inventors, Mr. Desailly stated in cross-examination that he considered the term "pulsed electric field," as used in the study reports and the summary he authored, to refer to the tests done at UTC: Confidential Transcript, pp 201–202. His evidence also made clear that he had a different understanding of the term "pulsed electric field" than that of the POSITA: Transcript, pp 202–203. Mr. Cousin similarly referred to the study reports and the use of the term "pulsed electric field," but did not testify that the inventors contemplated the use of field strengths of 1 kV/cm or more applied in microsecond or millisecond pulses as part of their invention: Exhibit 92, pp 29–39, 43. Mr. Cousin accepted that the term "pulsed electric fields" was generally used for fields in excess of 1,000 V/cm, although there was no defined boundary between PEF and MEF (moderate electric fields): Exhibit 92, pp 5–6.

[396] Based on the reports themselves and the evidence of the inventors, I conclude that the inventors' use of the term "pulsed electric fields" in the first two study reports is simply an idiosyncratic use by the inventors for their own purposes to describe the particular treatments referred to in the studies, and not a reference to PEF treatments as they are typically considered in the art. The evidence does not indicate that the inventors contemplated, through the use of the term, using field strengths an order of magnitude greater than those they studied or applying them in pulses of a duration several orders of magnitude shorter than the shortest application time studied. Nor does any other aspect of the reports suggest that the possibility of using such

fields was contemplated. To the contrary, as mentioned in paragraph [389], the fields studied were considered to capture the "extremes" in the literature, which were used to define the lower and upper treatment limits of the process.

[397] It is also relevant that the inventors themselves observed that the mechanism for reducing resistance to cutting was <u>not</u> electroporation: Exhibits 13/14, p 17; see also Exhibit 15, p 11; Raghavan Second Report, para 337. If the inventors contemplated that their invention included the application of electric fields of a much higher strength, which were known to cause electroporation, this would no doubt have been discussed at some point in the course of their studies. That it was not again suggests that this was not contemplated as part of their invention.

[398] McCain characterizes this observation in its closing submissions as meaning that "electroporation did not seem to modify the structure of the tuber with their electric field treatment," and argues that it distinguished the invention from prior art that "used electroporation in a destructive way": McCain Closing Submissions, para 93, fn 288. McCain's characterization suggests the inventors believed electroporation was occurring in their tests, but that it was not modifying the structure of the tuber. This characterization is at odds with the language of the observation itself, with the fact that electroporation itself entails a structure modification, and with Dr. Raghavan's understanding of the observation, which was that electroporation was not the key mechanism causing the observed reduction in cutting resistance: Raghavan Second Report, para 337. My reading of the statement accords with that of Dr. Raghavan.

(c) *Evidence of the inventors as to the invention*

[399] The evidence of the inventors as to what they contemplated may of course be relevant to assessing the invention they made or contemplated: *Western Oilfield* at paras 135–136; *Pfizer Quinapril (2008)* at para 46; *ProSlide* at paras 241–245. In the present case, there is no evidence from any of the inventors stating that they contemplated the use of electric fields as high as 1 kV/cm applied for pulses of microseconds as an aspect of their invention.

[400] As noted above, there was no evidence from the academic inventors with respect to their recollection of the invention they contemplated.

[401] Although Mr. Desailly's testimony referred to the study reports and their use of the term "pulsed electric field," as discussed above, he did not claim that he or the other inventors contemplated using a treatment involving field strengths of 1 kV/cm or more applied for microsecond or millisecond pulses: Confidential Transcript, pp 25–110, 145–167 and particularly pp 31, 35–36, 45. To the contrary, while Mr. Desailly said that the inventors believed field strength and time combinations other than the tested pairs could be used, he expressly stated that they did not want to use electric fields such as those used in PEF, as such fields would be too strong for what they wanted to achieve for pretreatment before cutting: Confidential Transcript, pp 102–104.

[402] Mr. Cousin similarly did not state that he or any of the inventors contemplated the use of electric fields of 1 kV/cm or more as part of the process they invented. While he gave his view on the scope of the term *high electric field* as used in the '841 Patent, I ruled during the trial that

this evidence was inadmissible as it went to the construction of the patent: Exhibit 92, p 40; Transcript, pp 296–297.

[403] Neither Mr. Desailly nor Mr. Cousin had expertise in electric fields or their application. Their knowledge and expertise were in potatoes and potato processing, while expertise in electric fields was brought by the academic inventors, Drs. Pain and Goullieux: Transcript, pp 184–185, 197–200; Exhibit 92, p 9. Nonetheless, the fact remains that neither of the two inventors who gave evidence at trial testified that any inventor contemplated the use of PEF treatments, in the usual sense of that term, as part of the invented process at the time of the invention in 2001. In my view, this is a reasonably strong indicator that this was not an aspect of the invention made or contemplated by the inventors.

(d) *Initial meeting with Dr. Vorobiev*

[404] Although Mr. Cousin did not assert that in making the invention he contemplated applying 1 kV/cm electric fields or stronger, he testified that what initially triggered the studies was a meeting with Dr. Vorobiev in 1997, who was studying high voltage pulsed electric fields: Exhibit 92, pp 6–8, 16, 18. McCain in its closing arguments did not rely on this meeting as evidence that the inventors contemplated the use of PEF in their invention, but it is nevertheless worth addressing briefly.

[405] To Mr. Cousin’s recollection, Dr. Vorobiev conducted an initial brief test on a potato using PEF, although Mr. Cousin was unable to say what strength of electric field was used or anything about the pulses in question: Exhibit 92, pp 7–8, 16, 18. He testified that the inventors

used moderate electric fields (MEF) for their studies with Drs. Pain and Goullieux because they were more practical for the experiments at UTC: Exhibit 92, pp 6, 10. Mr. Cousin ultimately described the meeting with Dr. Vorobiev as no more than a coincidence that triggered the ultimate studies: Exhibit 92, p 8.

[406] Dr. Vorobiev had no recollection of this meeting, although he did not rule out the possibility of having briefly met Mr. Cousin: Transcript, pp 818, 820. He also testified that he could not have conducted a PEF experiment as Mr. Cousin suggested, both since it was forbidden at UTC to conduct experiments without a contract and because he only had PEF generators at UTC beginning in the second half of 1998: Transcript, pp 818–819.

[407] It appears from Mr. Cousin's evidence that he may have been seeking to suggest that this initial meeting indicated that PEF treatments were contemplated by the inventors as being an aspect of the invention. However, given the limited nature of Mr. Cousin's evidence and Dr. Vorobiev's convincing explanation that he could not have conducted a PEF experiment in 1997, I cannot conclude that Mr. Cousin's evidence about the meeting shows that the inventors had any contemplation of using PEF as part of their invention. This is particularly so since Mr. Cousin testified that this coincidental meeting occurred at a time when McCain was focused on other techniques and not electric fields: Exhibit 92, p 8. In any event, even if there had been some initial idea of using PEF, of which I find there is no convincing evidence, there is no indication that this idea was "reduced […] to a definite and practical shape" as required for it to have constituted an invention, as opposed to simply being an idea that had "floated through his brain": *Apotex AZT* at paras 54, 97.

[408] I note for the sake of clarity that since Mr. Cousin only identified Dr. Vorobiev as the individual he had met in 1997 shortly before giving his commission evidence, no issue was raised regarding Dr. Vorobiev's ability to testify as an expert based on this meeting: Exhibit 92, p 7.

(e) *Sharing of a PEF article*

[409] McCain points to the fact that the inventors shared an article on PEF prior to the filing of the patent as evidence that they contemplated the use of PEF in their invention. The reference is to an email chain from March 2000, in which Mr. Cousin forwarded to Mr. Desailly a series of three summaries of scientific articles, one of which was by Dr. Knorr at Berlin University regarding PEF: Exhibit 45. Mr. Cousin added to the articles the brief note [TRANSLATION] "For info and transmission to JP PAIN." As suggested, Mr. Desailly forwarded the articles to Dr. Pain, with a brief note saying [TRANSLATION] "Here is an interesting article."

[410] Mr. Cousin did not address this email in his testimony. Mr. Desailly testified that he forwarded the article to Dr. Pain because it related to pulsed electric field and "we worked together on this technology": Transcript, pp 98–99.

[411] There is, in my view, nothing in the simple act of forwarding an article regarding PEF to Dr. Pain that indicates that the inventors made or contemplated the use of PEF in the process they invented. At most, it indicates an awareness of PEF technology, something that is already confirmed by the reference to PEF in the background discussion of the '841 Patent. This is particularly so given the limited evidence regarding the context of the email. Mr. Desailly's

statement about working with Dr. Pain "on this technology" must be viewed with some caution given that (a) McCain was not in fact working with Dr. Pain on pulsed electric field technology of the sort Dr. Knorr's laboratory was working on, despite the use of the term in the first two study reports; and (b) Mr. Desailly's understanding of the term, which as indicated above covered what was being studied with Dr. Pain, was not consistent with the ordinary use of the term, *i.e.*, to describe the treatments being studied by Dr. Knorr.

[412] I therefore do not find this email to be material evidence supporting a conclusion that the inventors contemplated the use of PEF as an aspect of their invented process.

(f) *McCain's later adoption of PEF*

[413] Beginning in late 2004 or early 2005, Mr. Cousin and others at McCain approached Dr. Knorr at Berlin University, a leading scientist in the area of PEF, to undertake experiments investigating the use of PEF for treating potatoes before slicing them. Dr. Knorr referred the project to Dr. Toepfl, who was at that time working on his PhD in Dr. Knorr's laboratory: Transcript, pp 414–415. These experiments later led to the development of an industrial pilot at one of McCain's potato processing factories and ultimately the introduction of PEF treatments into other processing facilities: Transcript, pp 91–92, 111–113. McCain now uses PEF in its french fry processing, although it also uses conventional water preheating in some situations: Transcript, p 110.

[414] The parties and experts each point to McCain's later work on and adoption of PEF processes as supporting its arguments regarding overbreadth. Simplot and Dr. Sastry contend that

the fact that McCain did not study or implement PEF processes until years after the ’841 Patent indicates that it was not contemplated at the time, and point to internal McCain documents describing the project: Sastry First Report, paras 400–401. McCain and Dr. Raghavan suggest that the work on PEF was a “scale up,” “implementation,” or “industrialization” of the invention previously invented, and that it shows the inventors had contemplated the use of such electric fields at the time of the patent: Raghavan Second Report, paras 387, 445, 451; Exhibit 92, pp 10–11, 15, 44.

[415] I do not view the mere passage of time between the patent application or publication in 2001 and McCain’s later introduction of PEF technology as being particularly material, as a variety of factors may influence the timing of a technology being brought into industrial production: see, *e.g.*, Transcript, pp 110–111.

[416] However, two contemporaneous documents related to McCain’s PEF project that were each authored by one of the McCain inventors are relevant to the question of whether the inventors had contemplated the use of PEF as part of the invention of the ’841 Patent in 2000 or 2001. These documents suggest that the inventors themselves did not, at the time, view their investigation of PEF technologies as an implementation or aspect of something they had already invented. To the contrary, they indicate that the inventors believed PEF to be a different technology and that they had not contemplated its use as an aspect of the invention they made in 2001.

[417] The first of these documents is an internal McCain slide deck prepared by Mr. Cousin in March 2006 entitled “Electrical Treatment of Potatoes,” [redacted]

[redacted]: Exhibit 2. Several aspects of this document are of particular relevance. [redacted]

[418] [redacted]

[419] Evidently, neither Mr. Cousin's statement in the March 2006 document nor his view in 2024 of the scope of the patent are relevant to the construction of the '841 Patent: *Bombardier* at para 51. However, the statement in the March 2006 document authored by Mr. Cousin is in my

view relevant from an evidentiary perspective to the question of what the inventors actually invented in 2000 or 2001.

[420] Had Mr. Cousin, as an inventor of the ’841 Patent, contemplated that the inventors had invented the application of PEF to pretreat potatoes before cutting them as part of their invention, one would not expect him to have, not long thereafter, [redacted]

[421] It is in my view telling, particularly in the face of this document, that there is no contrary contemporaneous document—either from the 1997–2001 time frame or from 2006—indicating that any of the inventors thought that what they had invented included the application of electric fields of 1 kV/cm or more in microseconds long pulses. In my view, this document from 2006 provides much better evidence of what the inventors contemplated at the time of the invention in 2001 than Mr. Cousin’s statements in 2024 in the context of this litigation that he considered the patent (not the invention) to cover PEF treatments: Exhibit 92, p 12.

[422] This conclusion is strengthened by the fact that in the same document, Mr. Cousin [redacted]

[redacted]. I will return to this in discussing utility below.

[423] [redacted]: Exhibit 92, pp 10–11, 15, 44. It is also unsupported by any contemporaneous documents indicating that either Mr. Cousin or others at McCain considered the project to be an implementation or industrialization of the patent. I therefore give Mr. Cousin's evidence on this point no weight. Nor do I accept Dr. Raghavan's description of the work in 2005 and later as being a "scale up" or implementation of the invention, characterizations for which he offers no support: Raghavan Second Report, paras 387, 445, 451.

[424] Finally, I note that the reference in the 2006 slide deck to [redacted].

[425] [redacted]

[redacted]

[426] The second internal McCain document was prepared by Mr. Desailly and Ms. Lottin in 2008, after Mr. Cousin's retirement from McCain, [redacted]: Exhibit 47. [redacted].

[427] In my view, the foregoing internal documents prepared by two of the inventors is consistent with the evidence provided by the study reports in indicating that the inventors did not contemplate the application of electric fields of 1 kV/cm or more as being an aspect of their invention in 2001.

(g) *Expert evidence*

[428] In addition to evidence from the inventors themselves, expert evidence may be relevant to the question of what the invention actually made or contemplated by the inventors was, although this is ultimately a question of fact: *ProSlide* at para 246; *Nova Chemicals* at para 15; *AFD Petroleum* at para 49.

[429] Each of the experts opined on whether, on the alternative construction, the claims of the ’841 Patent are broader than the invention the inventors made: Sastry First Report, paras 18, 391–395, 397–406 (I ignore paragraph 396 as it refers to discovery evidence of Dr. Goullieux that was not in evidence at trial); Raghavan Second Report, paras 438–459; Confidential Transcript, pp 737–739. I have referred to aspects of this evidence above.

[430] In my view, both Dr. Sastry and Dr. Raghavan’s opinions have shortcomings. Some of Dr. Sastry’s discussion is focused on what the inventors actually made or tested rather than the invention they <u>made or contemplated</u>: Sastry First Report, paras 394–395. As noted above, what an inventor made may be an indicator of what they contemplated but their invention need not be limited to what they made or tested: *ProSlide* at paras 193–194. Much of Dr. Raghavan’s discussion, on the other hand, focused not on what the inventors themselves made or invented, but on Dr. Raghavan’s construction of the invention as claimed in Claim 1. As a result, his opinion becomes somewhat circular, giving a broad definition of the claim and then effectively asserting that since a skilled person would know that they could vary field strengths, the claim is not overbroad: Raghavan Second Report, paras 441–444.

[431] These shortcomings are not in themselves determinative in either direction, as the inquiry into the invention made or contemplated is principally a factual one. I have considered the experts' reports, including their opinions in respect of the later testing of PEF treatments at the University of Berlin, which I have addressed above. I also consider it worth addressing another issue on which they differ, namely whether trends in the study reports indicate that the inventors contemplated the use of much higher voltages than those tested or discussed.

[432] Dr. Sastry opined that the studies yielded inconsistent results, and that the inventors did not identify any significant trends in the narrow range of field strengths and durations tested, which he considered indicated that the invention did not include field strengths ten times higher than those tested, applied for durations in the range of microseconds: Sastry First Report, para 397. Dr. Raghavan responded that the inventors had emphasized that higher field strengths result in lower resistance to cutting, including as one aspect of cutting quality: Raghavan Second Report, para 446.

[433] Having reviewed the reports and the experts' opinions, I conclude that the inventors did make some conclusions about trends, but that there is no indication that the inventors could have or did extrapolate from these conclusions to electric fields well in excess of those studied so as to contemplate their use in the process of the invention.

[434] As Dr. Raghavan notes, in their third study report, the inventors observed that "[a]n increase in the electric field decreases the energy needed for slicing" for two potato varieties, with a lower effect on the third variety: Exhibit 17, p 11/Exhibit 18, p 16; see also Exhibits 19/20, p 3; Raghavan Second Report, para 344; Sastry First Report, para 341.

Unfortunately, the context for this statement is obscured by the fact that Appendix 2 to the report, which apparently sets out the results of the texturometry tests to which the statement relates, including graphs plotting the electric field against the energy needed for slicing, was not in evidence. However, it is clear that the statement can only have arisen from analysis of the three electric fields (45, 55, and 65 V/cm) and three treatment times (3, 4, and 5 s) studied. No analysis is seen in the report that extrapolates this effect to electric fields over ten times stronger than the studied field or would permit such an extrapolation.

[435] Notably, the inventors had observed in their first study report that at both 1 second and 5 second treatment times, the electric field applied had no significant impact on the energy needed to cut (the "surface") over the larger range of field strengths studied, that is, that there was no significant relationship found between the resistance to cutting and the electric field applied for either 1 second or 5 second treatment times: Exhibits 11/12, pp 28–29; Sastry First Report, paras 320–321. In the second study report, using the same electric field/treatment time pairs as were used in the third, the inventors noted that resistance to cutting dropped when the electric field increased from 45 to 55 V/cm, but that it then remained constant (*i.e.*, from 55 to 65 V/cm): Exhibits 13/14, p 13; Sastry First Report, para 331. The second study also showed that for two varieties, cutting resistance was only reduced when the potato sample showed signs of gelatinization, and thus overheating: Exhibits 13/14, pp 15–16.

[436] Read in this context, to which I will return in considering Simplot's inutility arguments, I find that the inventors' observation that an increase in the electric field decreasing the energy needed for slicing does not provide evidence that the inventors contemplated the use of electric fields an order of magnitude stronger than those tested, as an aspect of their invention. There is

certainly no indication in the document that the inventors considered the statement to be applicable to such fields.

(h) *Citations in the US ’540 Patent*

[437] Before concluding this review of the evidence, I will address McCain’s second reference to the “References Cited” section of the US ’540 Patent (see paragraph [253] above). McCain submits that since the US ’540 Patent cites the 1984 patent to Geren and the 2000 patent to Mittal, which pertain to PEF treatments, this indicates that the inventors contemplated the use of PEF as an aspect of their invention: Transcript, pp 905–907; Exhibit 70.

[438] I cannot agree. As noted above, the US ’540 Patent indicates that the Mittal patent was cited by the examiner, for unknown reasons. This provides no indication that the inventors contemplated the use of PEF as an aspect of the process of their invention. Nor does the reference to the Geren patent, assuming it to have been cited by the inventors in filing their US application. There is no evidence as to why this reference was cited and in particular no evidence, from the inventors or otherwise, that it was cited because the inventors contemplated PEF as an aspect of their invention. At most, the reference to the Geren patent shows an awareness of the existence of PEF technologies, which was already clear from the reference to pulsed electric fields in the disclosure. However, mere awareness of a technology cannot be considered evidence that it was contemplated as an aspect of the invented process. Indeed, it may suggest the opposite: *MediaTube (FC)* at para 51.

(i) *Conclusion*

[439] For the foregoing reasons, I find that the evidence indicates that the inventors did not invent, make, or contemplate a process in which electric fields of a strength of 1 kV/cm or more are applied to fruits or vegetables before cutting to reduce their resistance to cutting. While the inventors were aware of the existence of pulsed electric field applications, they did not contemplate incorporating the much stronger fields used in such applications as an aspect of their invention. To the contrary, the inventors expressly and deliberately limited the electric fields they were studying and considering as part of their invention, seeking to avoid the effects of the much stronger fields. Even after the development of the invention, the two McCain inventors expressly recognized the essential differences between the process they had invented and a process involving the application of much stronger electric fields in pulses of microseconds.

[440] I therefore conclude that, if Claims 1 and 6 of the ’841 Patent were construed in accordance with the alternative construction that McCain advocates for, those claims would be invalid for being broader than the invention made or contemplated by the inventors.

[441] In light of this conclusion, I need not address Simplot’s other arguments based on overbroad claiming. These include an argument that McCain’s internal documents and Dr. Raghavan’s evidence as to the timing and nature of the invention indicate that the control or management of conductivity of the water bath was an essential element of the invention made by the inventors but was only claimed in Claims 4 and 5 and not Claims 1 or 6 (except as Claim 6 depends from Claims 4 or 5): Simplot Closing Submissions, para 116; Raghavan Second Report, paras 363–364; Sastry Third Report, paras 128–129; Confidential Transcript, pp 156, 206, 793–795; Exhibit 2, p 3; Exhibit 17, p 16/Exhibit 18, p 24; Exhibit 47, p 6.

E. *Lack of Utility*

(1) Principles

[442] The definition of “invention” in section 2 of the *Patent Act* requires that it be “new and useful.” The requirement that an invention be useful means that a patent claim will be invalid if it lacks utility: *AstraZeneca Esomeprazole* at paras 2, 26, 52–58. Conversely, a claim will not be valid for inutility if the subject-matter of the invention as claimed is capable of a practical purpose, on a standard of a “scintilla” of utility: *AstraZeneca Esomeprazole* at paras 54–55; *Western Oilfield* at para 124. Utility is assessed on a claim-by-claim basis: *Teva Sildenafil* at paras 48, 80. The analysis involves first identifying the subject-matter of the invention claimed, and then asking whether that subject-matter is useful in the sense of being capable of a practical purpose: *AstraZeneca Esomeprazole* at para 54.

[443] The utility of a claimed invention must have been either demonstrated or soundly predicted at the time of the application, rather than at some later point, to avoid the granting of patents to speculative inventions: *AstraZeneca Esomeprazole* at paras 55–56; *Apotex AZT* at para 56. A claim that has no scintilla of utility, or whose utility was not demonstrated or soundly predicted at the time of the application, will therefore be invalid. A claim that encompasses embodiments that simply do not work, *i.e.*, are inoperable, will similarly be invalid, unless it would be obvious to the POSITA to avoid such an unsuitable embodiment: *Apotex AZT* at para 56; *Burton Parsons Chemicals, Inc v Hewlett-Packard (Canada) Ltd*, 1974 CanLII 2 (SCC), [1976] 1 SCR 555 at pp 563, 565–566; *Société des Usines Chimiques Rhone-Poulenc et al v*

Jules R. Gilbert Limited et al, 1968 CanLII 104 (SCC), [1968] SCR 950 at p 954; *Greenblue Urban North America Inc v Deeproot Green Infrastructure, LLC*, 2024 FCA 19 at para 13.

[444] Canadian case law has long distinguished between demonstrated utility and utility based on a sound prediction, although the line between the two may be at times vague: *Apotex Inc v Janssen Inc*, 2021 FCA 45 at paras 50–51, citing N Siebrasse, "Must the Factual Basis for Sound Prediction be Disclosed in the Patent?" (2012) 28:1 CIPR 38 at p 47; *ProSlide* at para 153; *Apotex AZT* at paras 46, 56–66, 70–72; *Monsanto Company v Commissioner of Patents*, 1979 CanLII 244 (SCC), [1979] 2 SCR 1108 at pp 1116–1118; *Eli Lilly Canada Inc v Apotex Inc*, 2009 FCA 97 [*Lilly Raloxifene*] at paras 14–20; *Bell Helicopter Textron Canada Limitée v Eurocopter*, 2013 FCA 219 at paras 146–155; *Pharmascience Inc v Teva Canada Innovation*, 2022 FCA 2 [*Pharmascience Glatiramer*].

[445] What amounts to demonstrated utility is evidence that establishes that the embodiment at issue does in fact work: *Bell Helicopter* at para 147. Thus, evidence such as calculations or computer simulations showing the embodiment <u>should</u> work amounts to a prediction rather than a demonstration of utility, while a computer simulation combined with a successful prototype may constitute actual demonstration: *Bell Helicopter* at para 147; *Seedlings* at paras 151–152. What is required to demonstrate utility will vary depending on the nature of the invention: *ProSlide* at para 153.

[446] For the utility of a claim to be soundly predicted, there must be (1) a factual basis for the prediction; (2) an articulable and sound line of reasoning from which the desired result can be

inferred from the factual basis; and (3) proper disclosure: *Apotex AZT* at para 70; *Sandoz Canada v Janssen Inc*, 2023 FCA 221 at para 7. These elements are to be assessed as a function of the knowledge and understanding of the POSITA: *Bell Helicopter* at para 152; *Apotex Inc v Allergan Inc*, 2015 FCA 137 at para 9. The prediction need not be scientifically certain, but there must be a *prima facie* reasonable inference of utility and a "solid teaching" based on exact science that goes beyond mere belief, hypothesis, or speculation: *Sandoz* at paras 8, 14–16, citing *Apotex AZT* at paras 25, 59–60, 62–64, 69–70, 83–84; *Eli Lilly Canada Inc v Novopharm Limited*, 2010 FCA 197 [*Lilly Olanzapine*] at paras 84–85.

[447] Where the factual basis and line of reasoning for the prediction can be found in scientifically accepted laws or principles or in the CGK of the POSITA, no disclosure of the factual basis and line of reasoning may be required in the patent, but where they rely on data that is not part of the CGK, disclosure may be required to support a sound prediction: *Bell Helicopter* at paras 153–155; *Pharmascience Glatiramer* at paras 5, 17. The Federal Court of Appeal recently phrased the disclosure requirement as follows:

> The doctrine of sound prediction calls for disclosure of the factual basis and line of reasoning […], <u>unless such factual basis and line of reasoning would be self-evident</u> to a person skilled in the art. This disclosure requirement exists because "the sound prediction is to some extent the *quid pro quo* the applicant offers in exchange for the patent monopoly."
>
> [Emphasis added; citations omitted; *Pharmascience Glatiramer* at para 5.]

[448] The parties agree that the three requirements set out in *Apotex AZT* and reiterated recently by the Federal Court of Appeal in *Sandoz* and *Pharmascience Glatiramer* apply, including the disclosure requirement. While there had been some earlier question about whether *Apotex AZT*

established a heightened or enhanced disclosure requirement in cases involving sound prediction (or all cases involving sound prediction), I take *Pharmascience Glatiramer* to be the Court of Appeal's most recent binding statement on the state of the law: see *Teva Sildenafil* at paras 37–43; *Apotex Inc v Sanofi-Aventis*, 2013 FCA 186 at paras 132–135, per Gauthier JA, concurring; *Bell Helicopter* at paras 150–155.

(2) The subject-matter of the claims

[449] On the alternative construction, the subject-matter of Claim 1 of the '841 Patent is a process in which any electric field of sufficient strength, including an electric field in the range of 1 kV or more, is applied to vegetables and fruit before cutting them to reduce their resistance to cutting without increasing the temperature of the vegetable or fruit to the extent caused by hot water preheating. The subject-matter of Claim 6 is the same, but limited to applying the electric field to potatoes before cutting them into strips to make french fries.

[450] I note that since the inventors' studies were performed on potatoes for making french fries, the subject-matter of the limitations of Claim 6, the parties addressed the issue of utility in these claims together. In other words, they effectively recognized that either the utility of both Claims 1 and 6 was both demonstrated or soundly predicted, or it was not. As a result, while the assessment of utility is a claim-by-claim assessment, the discussion below applies equally to both claims in dispute.

(3) The nature of the utility of the claims

[451] As noted above at paragraph [114], Dr. Sastry construed Claim 1 to require that the process yield a suitable cut quality. In his view, reducing cutting resistance was not in itself a practically useful result, and the specification makes clear that the purpose of the process is to improve the quality of the resulting cut by avoiding feathering and starch gelatinization: Sastry First Report, paras 293, 296–306; Sastry Second Report, para 37. He therefore addressed the question of utility both in respect of reducing cutting resistance and in respect of cut quality: Sastry First Report, paras 309–371. As set out above, I have concluded that Claim 1 does not claim benefits in cut quality, either as I have construed it or on the alternative construction. Requiring an improvement in cut quality would therefore amount to assessing utility against a promise made in the patent but not claimed in the claims, which is not the correct approach: *AstraZeneca Esomeprazole* at para 2.

[452] Rather, the utility of the claimed invention lies in reducing *resistance to cutting* without increasing temperature to the extent of a preheating step. In cross-examination, Dr. Sastry conceded that reducing resistance to cutting in and of itself would have a scintilla of usefulness, as it would save energy, reduce wear on cutting blades, and contribute to a more efficient process: Transcript, pp 701–702.

[453] The question is effectively therefore whether the inventors had, at the time of application in June 2001, demonstrated or soundly predicted that the claimed process would have the claimed utility, *i.e.*, would reduce resistance to cutting without increasing temperature. This demonstration or sound prediction had to have been made across the full scope of Claims 1

and/or 6, and in particular in respect of the application of electric fields in the range of 1 kV/cm or more, which is the "embodiment at issue": *Bell Helicopter* at para 147.

[454] I note on this issue that McCain cannot avoid the requirement to have demonstrated or soundly predicted the utility of its invention across its full claimed scope or subject-matter by relying on claim elements as inherent limitations. By this, I mean that it is not open to McCain to contend that its claim extends only to those electric fields that create a reduction in resistance to cutting without unduly raising the temperature, effectively excluding any electric field that does not work by definition. Such an approach would replace the important requirement that the utility of an invention be demonstrated or soundly predicted at the time of application with a tautology that simply defines away any non-useful embodiment.

[455] The result would be an inventor essentially saying to the public "I claim all that which works to achieve the desired result and disclaim all that which does not; conduct your own experiments to determine where the boundary between these lies." This would effectively allow a patentee to obtain a monopoly on a result without teaching the <u>particular</u> means to achieve it, contrary to basic bargain of patent law: *Free World Trust* at para 32; *Pharmascience Glatiramer* at para 5. This is not to say that an inventor cannot rely on a POSITA's CGK either to work the invention or to avoid known or obviously unsuitable embodiments: *Greenblue* at para 13. However, there is a difference between a POSITA using their CGK to implement an invention and an inventor attempting to limit their claim to only that which ultimately proves to be useful, leaving the POSITA to do more research than the inventor to find that limit.

(4) Lack of demonstrated or soundly predicted utility for PEF treatments

[456] Simplot argues the inventors did not demonstrate a reduction in cutting resistance for treatments even within the range of 45 to 65 V/cm applied for 3 to 5 seconds, provided as an example in the patent (and claimed in Claim 3). It further argues that, in any event, the inventors did not demonstrate or soundly predict the utility of PEF treatments applying electric fields in the range of 1 kV/cm or more.

[457] I will focus on the latter argument, which I accept, for the following reasons.

(a) *Demonstrated utility*

[458] McCain argues the inventors demonstrated the utility of the invention through the three studies reflected in the study reports. As discussed above, however, the inventors' studies were limited to electric fields in the range of 26 to 101 V/cm, with the latter two studies limited to electric fields in the range of 45 to 65 V/cm. As Simplot notes, and McCain does not contest, the inventors did not conduct any testing showing that much higher electric fields, or in particular PEF treatments, reduced the resistance of fruits and vegetables to cutting without increasing temperature as much as a preheating step.

[459] In Dr. Raghavan's view the inventors demonstrated utility through the studies on lower electric fields since they showed the invention worked with some electric fields. In his opinion, "the critical result was that applying the high electric field reduced resistance to cutting, <u>regardless of the specific field strength and application time used</u>" [emphasis added]: Raghavan Second Report, para 368. In my view, this is not the correct approach. The question is whether

the inventors had demonstrated the utility of the claimed invention across all claimed embodiments (or the "embodiment at issue"), not simply whether they had demonstrated the utility of one preferred embodiment.

[460] I accept that a demonstration of utility need not include evidence establishing the utility of each and every possible embodiment falling within a claim. As a straightforward example, in the present case, evidence establishing the utility of the claimed process using electric fields of 45, 55, and 65 V/cm might be taken to demonstrate the utility of the process using electric fields of, say, 60 V/cm, even though fields of 60 V/cm were not directly tested. Alternatively, such evidence might be considered to provide a sound basis to predict the utility of electric fields of 60 V/cm, with the basis for the prediction being readily apparent. Thus, as Justice Manson has observed, "the line separating demonstration from prediction is not always a bright one": *ProSlide* at para 153.

[461] However, with respect to the process claimed in Claims 1 and 6, I conclude that to demonstrate the utility of an embodiment, the inventors must have shown that the embodiment works as claimed, through evidence that the embodiment does in fact reduce resistance to cutting in fruits and vegetables without raising their temperature to the extent of a preheating step. Since the embodiment of the process at issue involves the application of an electric field of 1 kV/cm or more in microsecond pulses, experimental testing or industrial implementation showing that embodiment—or one that involves similar electric fields—works would be required for demonstrated utility. Experimental testing or industrial implementation of a materially different

embodiment is not sufficient, although it may form part of the factual basis for a sound prediction.

[462] I therefore conclude that to the extent that the inventors of the ’841 Patent, through their studies, demonstrated the utility of applying electric fields in the range of 26 to 101 V/cm (the broadest range in the studies) to reduce resistance to cutting, they cannot be said to have demonstrated the utility of applying electric fields 10 times the strength of the highest field tested: Sastry First Report, paras 352–361.

[463] The question is thus whether the inventors had an articulable and sound line of reasoning from which the utility of PEF treatments in reducing cutting resistance could be inferred.

(b) *Factual basis*

[464] The studies conducted by the inventors constitute the primary factual basis from which any prediction of utility must be assessed. Simplot contends that these studies cannot amount to a factual basis, since they did not study PEF treatments. However, this is effectively an assertion that conclusions about PEF cannot be drawn from the studies conducted, which in my view is better considered not as part of the first inquiry (the factual basis, *i.e.*, the starting point) but as part of the second inquiry (sound line of reasoning, *i.e.*, the path from the starting point to the invention).

[465] For purposes of the following analysis, I will consider the relevant factual basis to be that electric fields in the range tested by the inventors reduced resistance to cutting of potato samples

without increasing their temperature to the extent of a preheating step. While Simplot challenges this factual basis as not being established by the inventors' studies, I accept it for present purposes as I conclude that even starting from this factual basis, the inventors had no sound line of reasoning to reach the conclusion that PEF treatments could be used to reduce resistance to cutting.

[466] Dr. Raghavan cites two other matters as part of the factual basis for the inventors' prediction, namely (i) the inventors' observation in the third study report that higher field strengths resulted in reduced resistance to cutting; (ii) a graph presented by the inventors in the first study report, said to identify [redacted]: Raghavan Second Report, paras 382–383; Confidential Transcript, p 736.

[467] These matters might be considered either part of the "factual basis" (in that they are drawn from the studies the inventors conducted), or as part of the "line of reasoning" (in that Dr. Raghavan appears to cite them as allowing an extrapolation from the electric fields studied to the conclusion that much higher field strengths would reduce resistance to cutting): Raghavan Second Report, para 382. I will address them as part of the line of reasoning analysis, while recognizing that there is some overlap between the two.

(c) *Sound line of reasoning*

(i) Differences in the nature and effects of electric treatments

[468] As Simplot reiterates, and as discussed above, electric fields in the range of many hundreds or thousands of V/cm were known by the POSITA to have effects on plant tissues that

are materially different from those caused by electric fields in the range of 26 to 101 V/cm. These effects, and in particular the electroporation of plant tissues, combined with the very short times for which such electric fields are typically applied to control the significant amount of heat they generate, are such that PEF applications are considered distinct types of treatment and areas of research: Sastry First Report, paras 56–64; Vorobiev First Report, paras 43–47; Transcript, p 805; see paragraphs [165] to [179] above.

[469] As discussed above at paragraph [397], the inventors concluded that the electric fields they studied "[redacted]": Exhibits 13/14, p 17; Exhibit 15, p 11. As indicated, I agree with Dr. Raghavan that this statement means the inventors concluded that [redacted], and reject McCain's different characterization: Raghavan Second Report, para 337; McCain Closing Submissions, para 93, fn 288. Given that higher electric fields were known to cause electroporation, a different effect and mechanism, the mere fact that lower fields reduced resistance to cutting through some other mechanism is insufficient in itself to justify an inference that much higher electric fields would have the same effect on cutting resistance.

[470] Relevant in this regard is Dr. Raghavan's discussion of Angersbach (1997), a prior art study of the effects of PEF on potato samples, in the context of his responding opinions on anticipation: Raghavan Second Report, paras 185–194; Sastry First Report, paras 210–219. The paper identifies the critical field strength for potato cells as being about 0.3-0.4 kV/cm. Dr. Raghavan stated that since the authors did not test electric fields below this critical value, the

POSITA would not draw conclusions about the effect of such lower field strengths from the authors' studies on stronger electric fields: Raghavan Second Report, para 190. He further underscored that the POSITA could not infer reduced resistance to cutting from the cell membrane permeabilization measurements reported in the study or from the texturometry measurements that used a conic probe: Raghavan Second Report, paras 187, 189, 193.

[471] In discussing utility, however, Dr. Raghavan contended that the inventors could predict the effects of much stronger electric fields on resistance to cutting based on their studies of much stronger fields. Dr. Raghavan provides no explanation as to why a sound prediction could be made about the effects of much stronger electric fields on cutting resistance based on the inventors' testing of much lower strength fields, when no such conclusion could be drawn in the other direction from Angersbach (1997).

(ii) Inferences or trends from the inventors' studies

[472] This leads to the other matters raised by Dr. Raghavan, referred to above. The first of these is the inventors' finding in the third study report that an increase in the electric field decreases the energy for slicing, a statement subsequently repeated by Mr. Cousin in an internal McCain document and in the disclosure of the '841 Patent: Exhibit 17, p 11/Exhibit 18, p 16; Exhibits 19/20, p 3; '841 Patent, p 5. I have discussed this statement above at paragraphs [434] to [436]. As noted there, this statement was made based on data from a narrow range of electric fields (45, 55, and 65 V/cm), and in the context of earlier findings that there was no consistent significant relationship between electric field strength, application time, and reduction in cutting resistance over the broader range of electric fields studied (26 to 101 V/cm): Exhibits 11/12, pp 28–29; Exhibits 13/14, pp 13, 15–16; Sastry First Report, paras 320–321, 331; Raghavan

Second Report, paras 317–319, including Tables 6 and 7. The inventors do not in the third study report purport to establish a relationship between electric field and energy needed for slicing over a much broader range of electric fields, and the POSITA would not draw such a conclusion based on the information presented.

[473] It is also worth noting that the observation that Dr. Raghavan relies on only speaks to the influence of the field strength on the resistance to cutting. It does not speak to the influence of the treatment time or the preservation of low temperature. This is relevant given that (a) the inventors only studied three treatment times (3, 4, and 5 s) in the third study; and (b) the extrapolation or line of reasoning that is necessary is one that addresses both much stronger fields and, given the limitation on temperature increase, much shorter treatment times (five or six orders of magnitude shorter). Dr. Raghavan does not address in any detail the nature or context of the inventors' statement or how it can be used to extrapolate the results from the studies to PEF treatments that use much higher electric fields applied for much shorter treatment times.

[474] Nor does Dr. Raghavan address the fact that the purported extrapolation reaches into electric fields that have a qualitatively different impact on potato tissues, as noted above. Dr. Raghavan's evidence was that both cell-level and tissue-level effects are important for cutting resistance: Raghavan Second Report, paras 20, 37. It is in my view inconsistent for Dr. Raghavan to underscore the importance of such effects on cutting resistance for certain purposes, while ignoring them in asserting that the inventors' statement about the energy needed for slicing provides a basis for predicting a reduction in cutting resistance.

[475] I conclude that the inventors' finding of an inverse relationship between field strength and cutting resistance for much lower electric field treatments does not provide a *prima facie* reasonable inference of utility in respect of PEF treatments based on exact science rather than mere hypothesis or speculation: *Sandoz* at paras 8, 14–16; *Lilly Olanzapine* at paras 84–85.

[476] Dr. Raghavan also refers to a graph presented by the inventors in the first study. However, this graph does not, as Dr. Raghavan contends, graph the relationship between electric field and time and/or recognize a relationship in which time decreases, approaching zero, as electric field strength increases: Raghavan Second Report, paras 322, 383; Exhibits 11/12, p 135; Transcript, pp 725–726. Rather, the graph plots [redacted]: Exhibits 11/12, pp 38, 135; Confidential Transcript, pp 39–42. The fact that the graph shows [redacted] is therefore not something established by testing data or that shows a relationship. It is simply a function of the inventors [redacted].

[477] To the extent that Dr. Raghavan is relying on a trend line in the [redacted] plotted on the graph, this similarly cannot be accepted, for two reasons. First, Dr. Raghavan appears to have misunderstood some of the symbols on the original graph in colorizing it, interpreting a number of points [redacted] when they in fact showed [redacted]

[redacted]: Raghavan Second Report, para 322 (Figure 12); Confidential Transcript, pp 42, 725–726.

[478] Second, and more importantly, the graph does not relate in any way to resistance to cutting. The data points shown [redacted]. The graph therefore cannot be taken to show anything about a reduction in resistance to cutting, let alone establish a trend or relationship between field strength and treatment time needed to cause a reduction in resistance to cutting. Even less can it be taken to show anything about a reduction in resistance to cutting without raising temperature given that, as Dr. Raghavan himself emphasizes [redacted]: Raghavan Second Report, para 363; Exhibits 11/12, pp 39, 41 and p 49(pdf).

[479] It is also worth noting that Dr. Raghavan's opinion that the graph from the first study report shows a relevant correlation between field strength and treatment time that can be used to make predictions about cutting resistance is contrary to the conclusions of the inventors themselves. Having conducted statistical analysis of the texturometry data, [redacted]. To the contrary, they found that [redacted]: Exhibits 11/12, pp 28–35; Sastry First Report, paras 320–321, 331. In my view, Dr. Raghavan's

willingness to draw more from the graph and report than the inventors themselves weakens his opinion.

[480] I therefore conclude that the graph provides neither any factual basis or any sound line of reasoning pointing to the inference that PEF treatments involving electric fields of 1 kV/cm or more would reduce resistance to cutting without causing an increase in temperature akin to a preheating step.

(iii) Prior art relating to PEF

[481] Dr. Raghavan also asserts that the inventors had a sound line of reasoning based on the prior use of PEF treatments for other objectives, set out in prior art such as the 1999 patent to Eshtiaghi, Rastogi (1999), Angersbach (1997), and Knorr (1998): Raghavan Second Report, para 384. Dr. Raghavan does not explain how the mere existence or knowledge of PEF treatments provides a sound basis to predict that those treatments would reduce resistance to cutting. In this regard, I again conclude that the inconsistency in Dr. Raghavan's approach in different aspects of his evidence undermines his opinion.

[482] I have discussed Dr. Raghavan's evidence in respect of Angersbach (1997) in particular. More generally, as discussed at paragraph [243] above, when addressing the CGK, anticipation and obviousness, Dr. Raghavan opined that the POSITA "would not apply" or "think about" the literature regarding electroporation in the context of cutting resistance because they would not want to modify cells for a food product to be consumed: Raghavan Second Report, paras 34, 157, 180, 206, 232, 282; Transcript, pp 490–491, 517–518. Yet when addressing sound prediction, he asserted, without further explanation, that the same literature on PEF treatments

provided a basis to conclude that an effect not caused by electroporation at much lower strength electric fields would also be seen upon application of the much stronger electric fields used in PEF. I agree with Simplot that these views are irreconcilable.

[483] McCain expanded somewhat on the argument in closing submissions, asserting that the skilled person would know that one could adjust field strength and duration, and that “if an application of 1 second and 100 volts per centimetre produced a particular result, the skilled person would know that there were other field strength/duration pairings that could deliver the same result. And they would look for them”: Transcript, pp 1040–1042; Confidential Transcript, pp 875–878. However, as discussed, Dr. Raghavan’s evidence was that the skilled person would know that the treatments in the PEF literature would create a different result, at a cellular level, than the treatments that were tested, and that this cellular effect would (a) lead the POSITA away from considering such treatments, and (b) affect cutting resistance.

[484] McCain also points to another aspect of the prior art that Dr. Raghavan did not reference, namely data presented in the form of a “cell disintegration index” in Rastogi (1999): Transcript, pp 878–879. This index characterizes the proportion of cells with highly permeable cell walls, on a scale between 0 (representing 100% intact cells) and 1 (representing total cell disintegration). After treating carrot discs with pulsed electric fields, Rastogi reports cell disintegration index values between 0.09 for treatment with 0.22 kV/cm and 0.84 for treatment with 1.60 kV/cm. McCain asserts that the cell disintegration index in Rastogi (1999) does not speak to reduced resistance to cutting, which is consistent with Dr. Raghavan’s evidence addressing the paper in the context of anticipation and obviousness: Raghavan Second Report, paras 180–183, 251.

However, it nonetheless submits that the article shows that correlations can be drawn between results in the application of electric fields: Transcript, p 879.

[485] McCain's analogy is unconvincing and does not provide a sound line of reasoning to extrapolate between the studies conducted by the inventors and reduced resistance to cutting arising from PEF treatments. In addition to being directed to a particular parameter that Dr. Raghavan himself underscores is not resistance to cutting, the relationship Rastogi (1999) shows relates to different degrees of the same phenomenon, namely cell disintegration caused by the application of PEF treatments at electric fields that are strong enough to permeabilize tissues. This does not establish an equivalent relationship for all parameters and all electric fields, and in particular does not provide a sound basis to predict the effect of PEF on cutting resistance based on studies of much lower electric fields.

(iv) McCain's later testing of PEF treatments

[486] Mr. Cousin's evidence also confirms that the inventors did not have a sound line of reasoning to infer the utility of PEF treatments in reducing resistance to cutting. As noted above, Mr. Cousin testified [redacted]: Exhibit 92, pp 12–13. If the inventors had soundly predicted the utility of PEF treatments in reducing resistance to cutting in 2001, they would have known, at least on a *prima facie* basis, that the treatment would work. While I appreciate that Mr. Cousin was not the inventor who brought knowledge of electric fields to the invention, there is no evidence from any other inventor that they were able to predict the utility to any greater degree. Indeed, McCain did not even turn to the academic inventors familiar with electric field applications, Drs. Pain and

Goullieux, when undertaking their research into PEF treatments in 2005–2006, engaging Dr. Knorr at Berlin University instead.

[487] Each party points to the testing actually done at Berlin University to support their arguments on sound prediction. [redacted]: Exhibit 2, pp 10–12; Sastry First Report, paras 369–371; Exhibit 114, pp 823–827. It argues that [redacted] indicates that the inventors had not soundly predicted the utility of PEF treatments in 2001. While I agree that the inventors had not soundly predicted the utility of PEF treatments in 2001 for the reasons set out above, I cannot draw much additional support for this conclusion from the length of the testing at Berlin University, as much of this testing appears to have been directed at [redacted].

[488] Conversely, I cannot accept McCain's argument that the work with Berlin University draws a link between an example embodiment of the '841 Patent and industrial PEF parameters. In experiments conducted in January 2006, Mr. Cousin and Dr. Toepfl sought [redacted]: Exhibits 4, 96; Confidential Transcript, pp 570–575, 634–640. Dr. Raghavan contends that these experiments show that a POSITA would expect [redacted]: Raghavan Second Report, paras 372, 387.

[489] I disagree. Porosity of plant tissues is related to electroporation, measuring the degree of cell permeabilization or disintegration: Exhibit 2, pp 6–9; Exhibit 92, p 14; Exhibit 96. There is nothing in the ’841 Patent that points to porosity as being a relevant or controlling parameter that would guide a POSITA to replicate the results in the patent by seeking equivalent porosity. Nor is there any indication in the study reports or elsewhere that, prior to 2005 or 2006, the inventors understood [redacted]. To the contrary, Mr. Cousin indicated that [redacted]: Exhibit 92, pp 19–20. As Dr. Toepfl described it, the experiments were looking at [redacted]: Confidential Transcript, pp 571–573.

[490] Further, there is nothing in the experimental documents that indicates that [redacted]. The experimental results pertain only [redacted] not claimed in the ’841 Patent: Exhibit 4; Exhibit 92, pp 22–23. [redacted]: Exhibit 92, pp 19–20; Exhibit 2, p 10. [redacted]: Exhibit 96; Confidential Transcript, pp 573, 631–635.

[491] It is to be recalled that the inventors had not identified electroporation as being responsible for either the reduction in cutting resistance or improvement in cut quality. To the contrary, they concluded that electroporation was not the mechanism in play: Exhibits 13/14, p 17; Exhibit 15, p 11; Raghavan Second Report, para 337. The fact that [redacted] in no way establishes, or even suggests, that the inventors had a sound line of reasoning to predict the utility of PEF in reducing resistance to cutting in 2001. This is particularly true given that [redacted]: Confidential Transcript, p 638.

[492] Nor had the inventors identified a clear correlation between cut quality and cutting energy or resistance to cutting such that the one could be used as a proxy for the other. To the contrary, the first study found that [redacted]: Exhibits 11/12, pp 36–37; Confidential Transcript, pp 772–773. After the second study, the inventors concluded that "[redacted]": Exhibits 13/14, pp 15–16; Confidential Transcript, p 152.

(v) Sound prediction and obviousness

[493] I make one final side note on the issue of sound line of reasoning and the citation of prior art by Dr. Raghavan and McCain, namely the interaction between the sound line of reasoning and the question of obviousness. As noted at the outset of this section, a sound line of reasoning may be found in scientifically accepted laws or principles or in the CGK of the POSITA: *Bell*

Helicopter at para 153; *Pharmascience Glatiramer* at para 5. However, if the CGK points to the same inference of utility even in the absence of any inventive step or new factual basis by the inventor, then the claimed invention may simply be obvious. Thus, to the extent that the POSITA could conclude, based on the prior art in respect of PEF, that PEF treatments would reduce the resistance to cutting of fruits and vegetables, then Claim 1 (on the alternative construction), might be invalid as being obvious. This is Dr. Sastry and Simplot's position: Sastry First Report, paras 190–221, 223–224, 230–236, 250–252; Simplot Closing Submissions, paras 146–149.

[494] If, on the other hand, as Dr. Raghavan opines, the prior art in the CGK does not allow the POSITA to conclude that PEF treatments would reduce resistance to cutting, then nothing in the testing performed by the inventors would allow that inference: Raghavan Second Report, paras 167–177, 182–183, 186–193, 213, 216, 235. In particular, the inventors did not, through their testing or otherwise, establish any new correlation between cutting resistance and any of the measurements or parameters discussed in the prior art, such as softness, cell disintegration, turgor pressure, compressive strength, or the results of texturometry using other probes.

[495] In light of my conclusions in respect of other alternative grounds of invalidity, I have concluded I do not need to address Simplot's alternative obviousness arguments. However, the discussion above about Dr. Raghavan's evidence on the prior art related to PEF underscores the importance of treating the prior art consistently rather than applying it differently when considering construction or different grounds of invalidity.

(vi) Conclusion

[496] Whether considered separately or cumulatively, the conclusions and trends identified by the inventors in their studies, the prior art relating to PEF treatments, and McCain's later tests on PEF treatments do not provide the basis for a *prima facie* reasonable inference of utility in respect of PEF treatments based on exact science rather than mere hypothesis or speculation.

[497] I therefore conclude that Simplot has met its onus to establish that the inventors did not have an articulable and sound line of reasoning to infer, based on the studies they had performed and the conclusions they reached arising from those studies, that PEF treatments applying electric fields of 1 kV/cm or more in microseconds long pulses would have the claimed utility of reducing resistance to cutting without raising the temperature of the vegetable or fruit to the extent of a preheating step.

(d) *Disclosure*

[498] Even if the inventors had a sound line of reasoning allowing them to predict the utility of PEF treatments to reduce resistance to cutting, I conclude there was no adequate disclosure of that line of reasoning.

[499] I begin by noting that this is not a situation where the factual basis and line of reasoning would be "self-evident" to a POSITA such that disclosure of them is unnecessary: *Pharmascience Glatiramer* at para 5. As will be clear from the discussion above, it would be far from self-evident to the POSITA that conclusions about the utility of PEF treatments in reducing

resistance to cutting without significantly increasing temperature could be inferred from testing on much lower strength electric field treatments. McCain does not argue it would be. Rather, it submits the inventors did make adequate disclosure.

[500] McCain and Dr. Raghavan contend that the inventors disclosed their prediction in the ’841 Patent by referring to pulsed electric fields being used in other areas of food processing and stating that it would be easy for the POSITA to choose a processing period associated with an electric field of a given intensity: Raghavan Second Report, para 385.

[501] A distinction must be made here between the disclosure of the fact or existence of the prediction and the disclosure of the “line of reasoning” leading to the prediction. The jurisprudence requires disclosure of the latter: *Pharmascience Glatiramer* at para 5 citing, among others, *Lilly Raloxifene* at paras 14–15. On this reasoning, it is not sufficient for an inventor to say that they predict the utility; they must disclose how or why they predict the utility, unless this would be self-evident to the POSITA.

[502] In the present case, I am satisfied that on the alternative construction, the inventors have disclosed the fact or existence of the prediction of utility. I say this based on the following statement in the “Summary of the Invention” section of the ’841 Patent set out at paragraph [208] above but reproduced here for ease of reference:

> According to the invention, said stage consists in the application of a high electric field directly to vegetables and fruit, under such conditions that the resulting temperature increase for the vegetables and fruit is almost zero or at least sufficiently low as not to amount to a preheating stage. The application of a high electric field, such as is used for extracting sugar from beet and precooking

> fries, translates to vegetables and fruit, and particularly to potato tubers, with the effect of softening which is favourable to shear cutting during subsequent stages for transforming the tubers into fry strips.
>
> [Emphasis added.]

[503] I have concluded in Part II of these reasons that the POSITA would not understand this statement, alone or in connection with the reference in the background section of the disclosure to the use of PEF for other purposes to indicate that the term *high electric field* as used in the claims includes the application of electric fields of 1 kV/cm or more applied in microsecond pulses. However, the alternative construction, in which such treatments are included within the process of Claim 1, would presumably be based on the construction arguments McCain puts forward, including the foregoing references in the disclosure. Consistency requires that the POSITA's understanding of these statements be considered in assessing the disclosure for purposes of validity on the alternative construction as well.

[504] On this hypothetical, the POSITA would understand from the above passage that the inventors were stating that PEF treatments reduce resistance to cutting (*i.e.*, have "the effect of softening"). Since the POSITA would see the inventors' references to tests performed on fields in the range of 45 to 65 V/cm, and the absence of any tests involving PEF applications, the POSITA would understand that the inventors were apparently predicting the utility of PEF applications (the fact of the prediction) from the tests conducted on the lower strength fields (the factual basis).

[505] However, they would not understand how the inventors concluded that the utility of PEF treatments could be predicted from the tests conducted, *i.e.*, the line of reasoning that leads from the factual basis to the prediction. Regardless of construction, the POSITA would have the same CGK regarding electric fields and the different effects that PEF treatments have on plant tissues. Neither the single reference to PEF nor the generalized statement that the POSITA can select processing periods associated with an electric field disclose the line of reasoning allowing extrapolation from the disclosed tests on fields in the tens of V/cm applied for 1 to 3 s to the predicted utility of PEF applications. Nor would the inventors' statement that their results showed that the "energy at slicing decreased with an increase in electric field": '841 Patent, p 5. The POSITA reviewing this statement would understand it to relate to the results of the testing performed and described by the inventors on a narrow range of electric fields. For the reasons described above, the POSITA would not understand the line of reasoning the inventors were using to extrapolate from these test results to the predicted utility of PEF applications.

(e) *Conclusion*

[506] I therefore conclude that on the alternative construction, Claims 1 and 6 of the '841 Patent would be invalid for lack of demonstrated or soundly predicted utility, since the utility of PEF treatments applying electric fields of 1 kV/cm or more in microsecond or millisecond pulses had not been demonstrated, and had not been soundly predicted as there was neither a sound line of reasoning to make such a prediction nor disclosure of that line of reasoning in the '841 Patent.

F. *Anticipation*

[507] Each of the foregoing conclusions is determinative of Simplot's alternative submission that on McCain's construction of the '841 Patent, the patent is invalid. I therefore do not need to address their remaining validity arguments, which include arguments that the claims are broader than the invention disclosed, that the disclosure of the '841 Patent is insufficient, and that Claims 1 and 6 would be obvious to the POSITA in light of the prior art. I will, however, address Simplot's argument that Claims 1 and 6 are invalid for anticipation, as I can do so very briefly.

[508] Although a greater number of prior disclosures were raised in pleadings and in Dr. Sastry's First Report, in its closing submissions at trial Simplot rested its anticipation argument on a single prior disclosure, namely a document sent by McCain Alimentaire in connection with a Call for Tender (*Appel à projets*) issued in 1999: Exhibit 52 (original); Raghavan Second Report, Exhibit C-8 (translation). This document was effectively [redacted]: Confidential Transcript, pp 186–188; Exhibit 111, p 1383 (Q 463). It is not disputed that it was submitted [redacted], and thus more than one year before the June 20, 2001, filing date of the '841 Patent (which effectively coincides with the claim date of June 21, 2000): Confidential Transcript, pp 193–194; *Patent Act*, ss 2 ("claim date," "filing date"), 28, 28.1, 28.2(1)(a).

[509] The document includes a [redacted]: Exhibit 52, p 2. This includes reference to [redacted]

[redacted]. However, the document does not refer [redacted].

[510] As set out above, and as the parties agree, reducing resistance to cutting is an essential element of both Claims 1 and 6 of the ’841 Patent.

[511] To constitute prior disclosure that invalidates a patent claim for anticipation, a prior art reference must (1) disclose subject matter which, if performed, would necessarily result in infringement of that claim; and (2) provide enough information to enable the POSITA to perform the claimed invention without the exercise of inventive ingenuity or undue experimentation: *Apotex Inc v Sanofi-Synthelabo Canada Inc*, 2008 SCC 61 at paras 24–37; *Apotex Inc v Shire LLC*, 2021 FCA 52 [*Shire*] at paras 36–40. If a published reference fails to either disclose or enable the essential elements of a claim, the claim is not anticipated: *Shire* at para 36.

[512] As the Call for Tender document relied on by Simplot does not disclose the essential element of reducing resistance to cutting, I find it cannot anticipate either Claim 1 or Claim 6 of the ’841 Patent, regardless of the confidentiality issues disputed by the parties.

[513] As Simplot raises no other document as anticipatory, I conclude it has not met its burden to establish that Claims 1 and/or 6 are invalid for being anticipated by the prior art.

V. Conclusion

[514] For the foregoing reasons, I conclude that Simplot did not, during the life of the ’841 Patent, infringe Claim 1 or Claim 6 of that patent by processing potatoes with the application of pulsed electric field treatments, since its process was not characterized by the application of a *high electric field* as that term would be understood by the POSITA in light of their CGK and in the context of the ’841 Patent at the date of publication.

[515] McCain’s action is therefore dismissed. As Simplot withdrew its counterclaim at trial, it is also dismissed.

[516] Had I reached a different conclusion on issues of construction, and in particular if I had concluded that the term *high electric field* should be construed in accordance with the construction put forward by McCain, I would have concluded that Claims 1 and 6 of the ’841 Patent were invalid for being broader than the invention made by the inventors, and for lacking a demonstration of utility or a sound prediction of utility of embodiments of Claims 1 and 6 that involve the application of pulsed electric fields of 1 kV/cm or more, applied in microsecond or millisecond pulses. As an invalid claim cannot be infringed, I would therefore also have concluded that Simplot did not infringe Claims 1 and 6 on this construction.

[517] In light of the foregoing findings, I have not needed to address Simplot’s other alternative validity arguments. Nor have I had to address its acquiescence and exhaustion defences, which are based on an argument that McCain’s acquiesced in conduct by Elea and an earlier company in developing, marketing, and selling PEF systems for treating potatoes, that Elea relied on

McCain's acquiescence to its detriment, and that McCain is therefore precluded from alleging infringement against Elea's customers by virtue of their use of Elea PEF systems.

VI. Costs

[518] Much to their credit, the parties reached an agreement on costs involving a lump sum payment to the successful party. Their agreement set out their understanding as to who would be deemed successful depending on outcomes on validity and infringement. Based on those definitions and the findings above, Simplot is the successful party and will be awarded the agreed lump sum of C$1,700,000, inclusive of costs and disbursements.

[519] The only issue on which the parties could not agree was the timing of the payment of costs, and each presented brief submissions on that issue before knowing the Court's decision on the merits. McCain asks that payment of costs be deferred pending determination of any appeals of this decision, or after expiry of the deadlines for such appeals. It submits that such an order can be made in the Court's exercise of its broad discretion in respect of costs under Rule 400 of the *Federal Courts Rules*, rather than treating it as a stay of the costs award under Rule 398. On this latter point, it cites two decisions of this Court in which the possibility was considered (although not implemented) without applying the test for a stay: *Eurocopter v Bell Helicopter Textron Canada Limitée*, 2012 FC 842 at para 9, aff'd 2013 FCA 220; *Safe Gaming System Inc v Atlantic Lottery Corporation*, 2018 FC 871 at para 7.

[520] In McCain's submission, deferring payment of costs until final disposition of appeals would be fairer and more efficient to the parties; would avoid imposing the significant burden,

business disruption, and transactional redundancy of paying a seven-figure costs award that may ultimately have to be repaid after a successful appeal; and would not result in prejudice to the successful party since interest would run on the costs award in the interim. It points to the overall context and length of this proceeding and its American counterpart, in which an appeal is apparently pending, suggesting that it would be fairer and more efficient to avoid piecemeal payment of significant amounts between the parties.

[521] Simplot argues that a deferred costs award would effectively grant a stay, citing this Court's decision in *Bauer Hockey Ltd v Sport Maska Inc (CCM Hockey)*, 2020 FC 862 at paras 62–63 and *Tekna Plasma Systems Inc v AP&C Advanced Powders & Coatings Inc*, 2024 FC 1954 at para 77. It argues that McCain has not filed any evidence to suggest that any irreparable harm would be caused to either party by having to pay a costs award pending appeals, and that there are no circumstances that would tip the balance of convenience in favour of granting a stay.

[522] As Justice Grammond noted in *Bauer*, the basic principle is that judgment debts, including costs awards, are payable forthwith: *Bauer* at para 62. I need not decide in this case whether departing from that principle must invariably engage the three-part test for a stay or whether it can simply be an aspect of the Court's broad and general discretion on costs, as I conclude that in either case, there is no reason to depart from the basic principle in this matter. McCain's primary argument in this regard is effectively one of efficiency, namely the avoidance of having to make a payment that might ultimately need to be repaid. In my view, this is insufficient to justify a deferral of costs in this case.

[523] While McCain refers to the disruption of business, I have nothing before me to indicate that payment of costs, even substantial costs, would cause a material disruption to the business of the unsuccessful party (now known to be McCain) given the parties' respective sizes and businesses. I also note that the purpose of costs is to partially defray the expenses already incurred by the successful party during the course of the lengthy litigation to which McCain refers. In my view, deferring that reimbursement further simply on the basis that avoiding a payment would be more convenient does not respect the underlying principles governing costs. While interest on the costs award might mitigate the prejudice of a deferred costs award, particularly if interest were set at an appropriate rate to reflect the full lost business value of the award, this again does not justify the deferral. Nor is there any indication that either party, and particularly Simplot, would be unable or unwilling to repay a costs award in the event of a successful appeal.

[524] In all the circumstances, therefore, I will simply make the usual award, namely that McCain pay Simplot the agreed costs, without further stipulation regarding the timing of that payment. In doing so, I reiterate that counsel are to be commended for agreeing on the quantum of costs and for narrowly limiting the number of outstanding costs issues requiring the Court's determination.

JUDGMENT IN T-1624-17

THIS COURT'S JUDGMENT is that

1. The action and counterclaim are dismissed.
2. Costs of this action are payable to the defendants by the plaintiff in the lump sum inclusive amount of C$1,700,000.

"Nicholas McHaffie"
Judge

APPENDIX A
PATENTS AND LITERATURE CITED

Patents

Cousin, J.-F., Desailly, F., Goullieux, A., & Pain, J.-P. Process for treating vegetables and fruit before cooking. US 6,821,540, issued November 23, 2004.

Eshtiaghi [written "Esthiaghi"], M.N., & Knorr, D. Method for treating sugar beet. WO 99/64634, issued December 16, 1999.

Geren, D.K. Sterilization apparatus. US 4,457,221, issued July 3, 1984.

Hannah, S.C., & Yanda, D.J. Process for preparing fat free frozen french fry style potatoes. US 5,393,544, issued February 28, 1995.

Hodges, J.L., & Green, G.R. Potato strip cutter. US 4,082,024, issued April 4, 1978.

Mittal, G.S., Ho, S.Y.W., Cross, J.D., & Griffiths, M.W. Method and apparatus for electrically treating foodstuffs for preservation. US 6,093,432, issued July 25, 2000.

Robbins, J.A. Process and apparatus for reduction of microorganisms in a conductive medium using low voltage pulsed electrical energy. US 6,331,321 B1, issued December 18, 2001.

Vigerstrom, K.B. Passing an electric current of 50-60 cps through potato pieces during blanching. US 3,997,678, issued December 14, 1976.

Literature

Alvarez, M.D., Saunders, D.E.J., & Vincent, J.F.V. (2010). Effect of turgor pressure on the cutting energy of stored potato tissue. *Eur Food Res Technol*, 210, 331–339.

Angersbach, A., & Knorr, D. (1997). Application of high intensity electric field pulses as pretreatment method for affecting dehydration characteristics and rehydration properties of potato cubes. *Nahrung*, 41(4), S. 194–200.

Angersbach, A., Heinz, V., & Knorr, D. (1999a). Treatment of food systems with high intensity electric field pulses. *Technological Methods to Improve Food Quality*, 79-84.

Literature (cont.)

Angersbach, A., Heinz, V., & Knorr, D. (1999b). Electrophysiological model of intact and processed plant tissues: Cell disintegration criteria. *Biotechnology Progress*, 15(4), 753–762.

Bajgai, R.T., & Hashinaga, F., (2001a). High electric field drying of Japanese radish. *Drying Technology*, 19(9), 2291–2302.

Bajgai, R.T., & Hashinaga, F. (2001b). Drying of spinach with a high electric field. *Drying Technology*, 19(9), 2331–2341.

Bazhal, M.I., Ngadi, M.O., Raghavan, G.S.V., & Nguyen, D.H. (2003). Textural changes in apple tissue during pulsed electric field treatment. *Journal of Food Science*, 68(1), 249–253.

Bazhal, M., & Vorobiev, E. (2000). Electrical treatment of apple cossettes for intensifying juice pressing. *Journal of the Science of Food and Agriculture*, 80, 1668–1674.

Barsotti, L., Merle, P., & Cheftel, J.C. (1999). Food processing by pulsed electric fields. I. Physical aspects. *Food Reviews International*, 15(2), 163–180.

Eliot, S.C., Goullieux, A., & Pain, J.-P. (1999a). Combined effects of blanching pretreatments and ohmic heating on the texture of potato cubes. *Science des Aliments*, 19: 111–117.

Eliot, S.C., Goullieux, A., & Pain, J.-P. (1999b). Processing of cauliflower by ohmic heating: influence of precooking on firmness. *Journal of the Science of Food and Agriculture*, 79: 1406–1412.

Eliot, S.C., & Goullieux, A. (2000). Application of the firming effect of low-temperature long-time pre-cooking to ohmic heating of potatoes. *Sciences des Aliments*, 20: 265–280.

Grahl, T., & Märkl, H. (1996). Killing of microorganisms by pulsed electric fields. *Applied Microbiology and Biotechnology*, 45, 148–157.

Halden, K., De Alwis, A.A.P., & Fryer, P.J. (1990). Changes in the electrical conductivity of foods during ohmic heating. *International Journal of Food Science and Technology*, 25, 9–25.

<u>Literature (cont.)</u>

Hashinaga, F., Bajgai, T.R., Isobe, S., & Barthakur, N.N. (1999). Electrohydrodynamic (EHD) drying of apple slice. *Drying Technology*, 17(3), 479–495.

Hashinaga, F., Kharel, G.P., & Shintani, R. (1995). Effect of ordinary frequency high electric field on evaporation and drying. *Food Science and Technology International*, 1(2), 77–81.

Hiller, S., & Jeronimids, G. (1996). Fracture in potato tuber parenchyma. *Journal of Materials Science*, 31, 2779–2796.

Ho, S.Y., Mittal, G.S., & Cross, J.D. (1997). Effects of high field electric pulses on the activity of selected enzymes. *Journal of Food Engineering*, 31, 69–84.

Ho, S.Y., Mittal, G.S., Cross, J.D., & Griffiths, M.W. (1995). Inactivation of Pseudomonas fluorescens by high voltage electric pulses. *Journal of Food Science*, 60(6), 1337–1343.

Isobe, S., Barthakur, N., Yoshino, T., Okushima, L., & Sase, S. (1999). Electrohydrodynamic drying characteristics of agar gel. *Food Science and Technology Research*, 5(2), 132–136.

Kamyab, I., Chakrabarti, S., & Williams, J.G. (1998). Cutting cheese with wire. *Journal of Materials Science*, 33, 2763–2770.

Kharel, G.P., Hashinaga, F., & Shintani, R. (1996). Effect of high electric field on some fruits and vegetables. *Journal of the Japanese Society for Cold Preservation of Food*, 22(1), 17–22.

Knorr, D., & Angersbach, A. (1998). Impact of high-intensity electric field pulses on plant membrane permeabilization. *Trends in Food Science & Technology*, 9, 158–191.

Knorr, D., Geulen, M., Grahl, T., & Sitzmann, W. (1994). Food application of high electric field pulses. *Trends in Food Science & Technology*, 5, 71–75.

Lebovka, N.I., Bazhal, M.I., & Vorobiev, E. (2001). Pulse electric field breakage of cellular tissues: visualisation of percolative properties. *Innovative Food Science & Emerging Technologies*, 2, 113–125.

Literature (cont.)

Ngadi, M.O., Bazhal, M.I., & Raghavan, G.S.B. (2003). Engineering aspects of pulsed electroplasmolysis of vegetable tissues. *Agricultural Engineering International: the CIGR Journal of Scientific Research and Development*. *Invited Overview Paper*, V (Feb), 1–10.

Palaniappan, S., & Sastry, S.K. (1991). Electrical conductivities of selected solid foods during ohmic heating. *Journal of Food Process Engineering*, 14, 221–236.

Rastogi, N.K., Eshtiaghi, M.N., & Knorr, D. (1999). Accelerated mass transfer during osmotic dehydration of high intensity electrical field pulse pretreated carrots. *Journal of Food Science,* 64(6), 1020–1023.

Ruhlman, K.T., Jin, Z.T., & Zhang, Q.H. (2001). Physical properties of liquid foods for pulsed electric field treatment. In G.V. Barbosa-Cánovas and Q.H. Zhang, *Pulsed Electric Fields in Food Processing: Fundamental Aspects and Application* (pp 45–56). CRC Press.

Sale, A.J.H. & Hamilton, W.A. (1967). Effects of high electric fields on microorganisms: I. Killing of bacteria and yeasts. *Biochimica et Biophysica Acta*, 148(3), 781–788.

Sensoy, I., Zhang, Q.H., & Sastry, S.K. (1997). Inactivation kinetics of Salmonella dublin by pulsed electric field. *Journal of Food Process Engineering*, 20, 367–381.

Singh, A., Lahlali, R., Vanga, S.K., Karunakaran, C., Orsat, V., & Raghavan, V. (2016). Effect of high electric field on secondary structure of wheat gluten. *International Journal of Food Properties*, 19, 1217–1226.

Singh, A., Nair, G.R., Rahimi, J., Gariepy, Y., & Raghavan, V. (2013). Effect of static high electric field pre-treatment on microwave-assisted drying of potato slices. *Drying Technology*, 31, 1960–1968.

Vanga, S.K., Singh, A., Kalkan, F., Gariepy, Y, Orsat, V., & Raghavan, V. (2016). Effect of thermal and high electric fields on secondary structure of peanut protein. *International Journal of Food Properties*, 19, 1259–1271.

FEDERAL COURT

SOLICITORS OF RECORD

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APPEARANCES:

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