Dockets: 2019-894(IT)G
2021-1471(IT)G

BETWEEN:

VORTEX ENERGY SERVICES LTD.,

Appellant,

and

HIS MAJESTY THE KING,

Respondent.

Appeals heard on November 25 and 26, 2024, at Calgary, Alberta

Before: The Honourable Justice David E. Spiro

Appearances:

Counsel for the Appellant: Kim E. Johnson

Counsel for the Respondent: Damon Park

AMENDED JUDGMENT

The appeals of assessments for the Appellant's 2014 and 2019 taxation years are dismissed with one set of costs in accordance with the Tariff.

This Amended Judgment is issued in substitution of the Judgment dated April 28, 2025.

Signed this 2nd day of May 2025.

"David E. Spiro"

Spiro J.

Citation: 2025 TCC 63
Date: 20250502
Dockets: 2019-894(IT)G
2021-1471(IT)G

BETWEEN:

VORTEX ENERGY SERVICES LTD.,

Appellant,

and

HIS MAJESTY THE KING,

Respondent.

AMENDED REASONS FOR JUDGMENT

Spiro J.

[1] In trying to build high-efficiency, direct-contact, water heaters for the fracking industry that were mountable on a truck or trailer (the "project"), did the Appellant engage in "experimental development" in its 2014 and 2015 taxation years within the meaning of the phrase "scientific research and experimental development" ("SR&ED") in subsection 248(1) of the *Income Tax Act* (the "Act")?

2014 Taxation Year – Appeal No. 2019-894(IT)G

[2] The Appellant claimed SR&ED expenditures of $1,454,874 for its 2014 taxation year on the basis that its work on the project in that year constituted experimental development. Most of the work performed during the Appellant's 2014 taxation year was on a pair of ten million BTU units (unit number 1 and unit number 2), the first of which failed catastrophically during testing.

[3] On assessment, the Minister of National Revenue (the "Minister") disallowed the claimed 2014 SR&ED expenditures.

2019 Taxation Year – Appeal No. 2021-1471(IT)G

[4] The Appellant claimed SR&ED expenditures of $507,989 for its 2015 taxation year on the basis that its work on the project in that year constituted experimental development. Most of the work performed during the Appellant's 2015 taxation year was on a single 35 million BTU unit (unit number 3).

[5] On assessment, the Minister disallowed the claimed 2015 SR&ED expenditures. The Appellant did not object to their disallowance but, instead, carried forward the disallowed 2015 SR&ED expenditures into its 2019 taxation year. In reassessing the Appellant's 2019 taxation year, the Minister disallowed the carry-forward.[1]

The Legal Test for SR&ED

[6] The term "scientific research and experimental development" is defined in subsection 248(1) of the Act:

> 248(1) …
>
> scientific research and experimental development means systematic investigation or search that is carried out in a field of science or technology by means of experiment or analysis and that is
>
> > (a) basic research, namely, work undertaken for the advancement of scientific knowledge without a specific practical application in view,
> >
> > (b) applied research, namely, work undertaken for the advancement of scientific knowledge with a specific practical application in view, or
> >
> > (c) experimental development, namely, work undertaken for the purpose of achieving technological advancement for the purpose of creating new, or improving existing, materials, devices, products or processes, including incremental improvements thereto,
>
> and, in applying this definition in respect of a taxpayer, includes

[1] Although the Crown initially questioned the Court's ability to hear the merits of the Appellant's 2015 SR&ED claim on an appeal of the assessment disallowing the carry-forward of the claimed expenditures into its 2019 taxation year, Crown counsel notified the Court at the end of February 2025 that it no longer questioned the Court's ability to do so.

> (d) work undertaken by or on behalf of the taxpayer with respect to engineering, design, operations research, mathematical analysis, computer programming, data collection, testing or psychological research, where the work is commensurate with the needs, and directly in support, of work described in paragraph (a), (b), or (c) that is undertaken in Canada by or on behalf of the taxpayer,
>
> but does not include work with respect to
>
> (e) market research or sales promotion,
>
> (f) quality control or routine testing of materials, devices, products or processes,
>
> (g) research in the social sciences or the humanities,
>
> (h) prospecting, exploring or drilling for, or producing, minerals, petroleum or natural gas,
>
> (i) the commercial production of a new or improved material, device or product or the commercial use of a new or improved process,
>
> (j) style changes, or
>
> (k) routine data collection;[2]

[7] In *Northwest Hydraulic Consultants Ltd. v The Queen*, Judge Bowman provided guidance on interpreting and applying the definition of "SR&ED" in subsection 248(1) of the Act.[3] The five criteria set out in *Northwest Hydraulic* have been endorsed and applied by the Federal Court of Appeal on several occasions, most recently in *National R&D Inc. v Canada*, where Justice Rennie confirmed that those criteria "reflect the court's understanding of what Parliament intended by subsection 248(1)."[4]

[8] *Northwest Hydraulic* teaches that if work is to qualify as SR&ED under subsection 248(1) of the Act, the following questions should be answered in the affirmative:

> 1. Was there a technological risk or uncertainty that could not be removed by routine engineering or standard procedures? The phrase "routine

[2] *Income Tax Act*, R.S.C., 1985, c. 1 (5th Supp.), s. 248(1) "scientific research and experimental development".
[3] *Northwest Hydraulic Consultants Ltd. v The Queen*, [1998] 3 CTC 2520; 98 DTC 1839.
[4] *National R&D Inc. v Canada*, 2022 FCA 72 at para 12.

engineering" describes techniques, procedures and data that are generally accessible to competent professionals in the field.

2. Did the person claiming to be doing SR&ED formulate hypotheses specifically aimed at reducing or eliminating that technological uncertainty?

3. Did the procedures adopted accord with established and objective principles of scientific method, characterized by trained and systematic observation, measurement and experiment, and the formulation, testing and modification of hypotheses?

4. Did the process result in a technological advance?

5. Was a detailed record of the hypotheses, tests, and results kept as the work progressed?[5]

The Appellant's Case

[9] In its pleadings, the Appellant alleged that during its 2014 and 2015 taxation years it:

> … developed technology (the "Technology") described as a high-efficiency direct-fired heater primarily utilized for heating water in the hydraulic fracturing process in oil and gas extraction wells.
>
> The Technology is more particularly described as a mobile direct-fired heating unit which, once in operation, is expected to heat water for use in oil and gas extraction more efficiently than existing processes. The mobile nature of the Technology is expected to allow this more efficient process to be employed in remote oil and gas fields, thereby saving the costs of constructing less efficient heating technologies on site.
>
> The Appellant believes the Technology is the first to combine a direct-fired heating system with mobile capability.
>
> The Appellant's experimental work related to the Technology during the Appellant's [taxation] years ended May 31, 2014 and May 31, 2015 is summarized in the following paragraphs:
>
> (1) Direct-fired heaters differ significantly from indirect-fired heaters. Direct-fired heaters heat water by applying an open flame directly to the water, with both the water and the open flame contained in a chamber. Indirect-fired heaters use a flame external to the chamber containing the water so that the

[5] *Northwest Hydraulic*, *supra*, note 3 at para 16.

flame heats the chamber which in turn heats the water, similar to a conventional boiler. Within the oil and gas industry, direct-fired heaters are more energy efficient than indirect-fired heaters. However, direct-fired heaters are inherently more unstable than indirect-fired heaters. For this reason, indirect-fired heaters are more commonly used in the industry. Stationary direct-fired heaters have been used in indoor locations, though they consume significant capital resources in building and maintenance. There has been no successful mobile direct-fired heater developed. The Appellant sought the development of such a direct-fired heater which, if operational, would promote energy-efficiency by surpassing indirect-fired heaters and reducing costs in the industry by eliminating the need to build multiple stationary direct-fired heaters.

(2) Against this contextual background, the Appellant developed engineering guidelines to design the Technology.

(3) The Appellant faced technological uncertainty in developing such engineering guidelines because of the unprecedented nature of the Technology. The Appellant had no existing prototypes or guidelines to rely upon. In particular, the Appellant did not know how the engineering guidelines should address:

- Large variations in the exterior temperatures surrounding the Technology caused by the extreme climates of remote working areas;

- Large variations in the temperature of the water inside the Technology caused by the extreme climates of remote working areas; and

- The functionality of the small heating chamber in the Technology, likely required to be 60% less volume as compared to existing technology.

(4) The Appellant formulated the hypothesis that a new set of engineering guidelines combined with software-based controls could result in a working direct-fired heating system with mobile capability.

(5) The Appellant built a prototype of the Technology with a transportable chamber and components. This prototype was destroyed in testing.

(6) The Appellant built another prototype with reinforced heaters and enhancements to the software-based control system.

(7) Throughout, the Appellant tested its engineering designs on the prototype, recorded data during testing, evaluated the results, and made adjustments. After each adjustment, the Appellant conducted additional tests.

(8) This experimental process resulted in advancements in the design, structural requirements, and software required for the Technology.

(9) As at March 8, 2019 the Technology is still in the testing and development phase.[6]

The Crown's Case

[10] The Crown pleaded[7] that in determining the Appellant's tax liability for the relevant taxation years, the Minister made certain assumptions of fact, including that:

> …
>
> b) the appellant provides energy-related services to the oil and gas industry, builds swamp mats, and provides mixing and heating systems to the oil and gas industry;[8]
>
> ….
>
> e) the appellant's objectives were to:
>
> i) develop a high-efficiency water heater for a hydraulic fracturing process used in oil and gas extraction; and
>
> ii) develop the heater as a mobile heater installed on a trailer which could be transported to extraction sites;[9]
>
> …
>
> g) to accomplish its objectives, the appellant needed to determine the proper mechanical design for a mobile outdoor burner capable of firing under varying weather conditions and create an automated firing and water circulation control program;[10]

[6] Paragraphs (c)(i) to (iv) of the Amended Notice of Appeal in 2019-894(IT)G. The allegations made in the Notice of Appeal in 2021-1471(IT)G are substantially similar.
[7] The assumptions of fact made by the Minister in assessing are pleaded at paragraph 19 of the Amended Reply in 2019-894(IT)G and paragraph 23 of the Amended Reply in 2021-1471(IT)G with slightly different subparagraph numbers.
[8] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 148, lines 18-22).
[9] These assumed facts were admitted by the Appellant at trial (transcript of November 25, 2024, page 149, lines 1-7).
[10] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 149, lines 12-17).

h) the appellant studied high-efficiency water heaters available on the market and determined that a direct contact heater would be an efficient heater;[11]

i) direct contact heaters for other applications were available, however, they did not meet the appellant's needs because they were not mobile direct contact heaters and had limited capacity;[12]

j) in the appellant's design, water entered into the heater at the top and was sprayed over a layer of packing bed by water spray nozzles. The burner section was located under the packing bed where a burner on the wall of the heater blew a flame into the heater. Water droplets passed through the flame and hot water was collected in the chamber at the bottom of the heater. Combustion gases flew up through the packing, pre-warmed the entering water, and left the heater at the top of the heater;[13]

k) the heater was powered by propane gas;[14]

1) the appellant evaluated various off-the-shelf measurement instruments to determine their suitability for the applicant's product;[15]

m) the appellant completed the construction of a heater with the capacity of 10 million BTU and tested it;[16]

Burner

n) one of the challenges the appellant encountered was the unavailability of a commercial burner capable of producing a flame suitable for a direct contact heater. Accordingly, the appellant attempted to modify a commercially available burner in order to produce a larger flame;[17]

[11] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 149, lines 18-22).
[12] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 149, lines 23-27).
[13] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 149, line 28, to page 150, line 10).
[14] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 150, lines 11-13).
[15] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 150, lines 14-17).
[16] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 150, lines 18-20).
[17] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 150, line 24 to page 151, line 5).

o) the appellant enlarged the air inlet holes on the mixing cone of a commercially available burner to increase volumetric air flow going through the mixing cone;[18]

p) to increase the flame size, the appellant increased the flow rate of propane gas to the burner by increasing the gas pressure;[19]

q) the appellant custom-tuned the proportion of gas to air with respect to flow rated by changing propane gas pressure and air flow rate; [20]

r) the appellant used a larger air blower to increase the flow rate of air to combust excess propane gas in the heater's exhaust;[21]

s) the appellant calculated the burner's efficiency by analysing the heater's exhaust and measuring unburned propane gas;[22]

t) based on existing knowledge in chemical engineering, when there is an adequate proportion of fuel to air, flame size will increase and will result in the consumption of the entire fuel supply;[23]

u) based on established scientific and technological knowledge, making larger holes reduces the resistance to air flow and simultaneously increases air supply;[24]

[18] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 151, lines 6-10).
[19] With the qualification that volume was also increased, this assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 151, lines 11-14).
[20] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 151, lines 15-18).
[21] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 151, lines 19-22).
[22] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 151, line 26, to page 152, line 1).
[23] This assumed fact was admitted by the Appellant at trial (see transcript of November 25, 2024, page 152, lines 2-6).
[24] This assumption of fact was somewhat contentious. According to Mr. Bodner, it did not tell the whole story (transcript of November 25, 2024, page 155, lines 16-25):

> It wasn't this simple case of routine engineering, I should say. With the problems of dealing with air pressures and the harmonics of the burner the flame create, we were able to design an air inlet system in conjunction with the burner holes and the modifications we made to create a flame that would put out the BTUs we would require and minimize the harmonic disturbance that was actually - made the first

Water spray nozzles

v) the appellant needed to modify water spray nozzles in order to achieve a wider spray angle;[25]

w) the appellant hired a contractor to modify water spray nozzles based on specifications provided to the contractor;[26]

x) the contractor's experience was sufficient to provide the requested modifications to the water spray nozzles;[27]

Heater box

y) the burner produced pulses which had a tendency to magnify in a mobile heater and pull the welded joints in the heater apart, especially at the corners. To solve this problem, the appellant redesigned the body of the heater box by increasing the thickness of the material to provide a secondary layer of protection and attaching a bent steel plate at the corners of the heater to form a double wall;[28]

z) based on existing knowledge in mechanical engineering an increase in wall thickness and the addition of an extra plate in the corners of the heater box will increase the resistance of the wall and corners to vibration and mechanical stress;[29]

Overheating inside trailer

aa) the heater designed by the appellant was located inside a trailer;[30]

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heater shake apart, destroy itself. That is what we were claiming our SR&ED because we developed a way to do that.

[25] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 156, lines 22-26).

[26] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 157, lines 17-20).

[27] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 157, lines 21-24).

[28] With the qualification of "that's not all we did", this assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 157, line 25 to page 158, line 7).

[29] With the qualification that weight was also a consideration, this assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 160, line 1 to page 161, line 7).

[30] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 161, lines 9-11).

bb) the appellant used an air blower with a reverse fan to cool down the inside space of the trailer to prevent the heater burner from shutting off as a result of its safety control system;[31]

cc) a blower with a reverse fan replaced warm air in the trailer space with cold air from the outside and cooled down the burner;[32]

Additional design work

dd) the appellant undertook additional design work on the mobile heater as follows:

i) Adding a pump to increase the pressure of propane gas exiting the propane vaporization tank;

ii) providing cathodic protection to the heater to prevent corrosion; and

iii) applying protective spray on the outside surfaces of the heater and tubing;[33]

Automation software

ee) the appellant hired a contractor with specialization in computer programming to supply software;[34]

ff) the computer programming contractor's knowledge base and expertise were sufficient to develop the software;[35]

Crown Motions to Amend the Replies

[11] At the commencement of the hearing, Crown counsel made a motion under section 54 of the *Tax Court of Canada Rules (General Procedure)* to amend each Reply to add, at the end of the assumptions paragraph, additional assumptions made by the Minister in assessing:

[31] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 161, lines 12-16).
[32] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 161, lines 17-20).
[33] Each of these assumed facts was admitted by the Appellant at trial (transcript of November 25, 2024, page 161, lines 21-27).
[34] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 161, line 28 to page 162, line 3).
[35] This assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 162, lines 4-6).

(gg) with respect to the appellant's SR&ED claim in respect of a mobile direct-contact water heater:

i) there existed no scientific or technological uncertainty;

ii) the appellant did not formulate hypotheses specifically aimed at reducing or eliminating that uncertainty;

iii) the appellant's overall approach was not consistent with a systematic investigation or search, including formulating and testing the hypotheses by means of experiment or analysis; and

iv) the appellant's overall approach was not undertaken for the purpose of achieving a scientific or technological advancement.[36]

[12] I was satisfied that these assumptions were made by the Minister in assessing.[37] I was also satisfied that the proposed amendments would assist in determining the real questions in controversy between the parties, would not result in an injustice not compensable in costs, and would serve the interests of justice.[38] The Appellant did not object to the Crown's motions. For all those reasons, I granted the motions with costs fixed in the amount of $500 for each.

[36] This is taken from paragraph 19(gg) of the Amended Reply in 2019-894(IT)G. The same amendments apply to 2021-1471(IT)G with slightly different subparagraph numbers.
[37] During the hearing of the motion, Crown counsel produced a report drafted by the CRA official who reviewed the Appellant's SR&ED applications in which those assumptions are reflected.
[38] See *Jewish National Fund of Canada Inc. v Canada (National Revenue)*, 2025 FCA 75 at para 6 citing, *inter alia*, *Canada v Pomeroy Acquireco Ltd*., 2021 FCA 187 at para 4.

Summary of the Evidence

[13] Mr. Andrew Bodner testified on behalf of the Appellant.[39] He described himself as an entrepreneur and business owner having a diploma in petroleum engineering technology. Immediately before incorporating the Appellant in 2013, Mr. Bodner was an importer and exporter of granite cabinets. Before then, he was employed in various roles by several oil field service companies in Alberta. In cross-examination, he admitted that he was not a professional engineer.[40]

[14] Mr. Bodner has a 25% interest in the Appellant, along with three other 25% shareholders including his father-in-law, who is in the grain business, and Mr. Joe Bazley who is a cattle farmer.

[15] Today, the Appellant's business includes providing various services for the oil and gas industry including drilling and excavating for pipelines and power lines and installing temporary roadways to help drilling rigs and service rigs travel to remote areas. The Appellant also removes drilling waste products and provides portable fire suppression services.

[16] But immediately following its incorporation in 2013, the Appellant's exclusive focus was trying to build high-efficiency, direct-contact, water heaters for the fracking industry that were mountable on a truck or trailer.[41] Heated water

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[39] Mr. Bodner was not the only witness to testify. Crown counsel called the officer of the Canada Revenue Agency who reviewed the Appellant's SR&ED applications. I allowed that witness to testify for the purpose of including the 2014 and 2015 SR&ED applications in the record and hearing evidence on how the Minister reviewed those applications. I did not allow that witness to testify as to whether, in their opinion, the work described in the applications qualified as "experimental development" within the meaning of "SR&ED" in subsection 248(1) of the Act. It is inappropriate to allow any witness, expert or otherwise, to provide an opinion on a pure question of domestic law (see, for example, *Syrek v Canada*, 2009 FCA 53 at paras 28 and 29).

[40] The requirements to qualify as a professional engineer in Alberta are set out in the *Engineering and Geoscience Professions Act*, R.S.A. 2000, c. E-11.

[41] Unfortunately, neither party provided evidence on what "fracking" involves. As the meaning of hydraulic fracturing (or "fracking") itself is non-contentious, the explanation offered by Natural Resources Canada at https://natural-resources.canada.ca/energy-sources/fossil-fuels/shale-tight-resources-canada will suffice for purposes of these reasons:

> **How does hydraulic fracturing work?**
> During hydraulic fracturing, water is injected into the rock unit under very high pressures until the rock cracks and fractures.
> Sand (proppant) is added to the water and injected into the formation to prevent the artificially created fractures from closing. The fractures thus remain open and allow the oil or natural gas to flow to the well-bore.

is necessary for fracking in the winter to keep the water from freezing. It is also necessary in the summer as some of the chemicals must remain above a certain temperature in order to be effective.[42]

[17] According to Mr. Bodner, high-efficiency, direct-contact, water heaters were used by the fracking industry in 2013, but none of them were mountable on a truck or trailer. The Appellant wanted to build mobile units ranging from ten million BTUs to 35 or 36 million BTUs. To that end, it purchased various components, such as burners and burner bodies, from third-party suppliers and then tested and modified them to suit its needs.

[18] Notes taken as part of those tests were produced as Tab 100 (Exhibit A-12). Mr. Bodner described the contents of Tab 100 as "experimental findings and data" and testified that certain physical tests were conducted at Mr. Bazley's cattle farm. For example, Appellant's counsel asked Mr. Bodner about tests performed at the cattle farm on April 8, 2014:

> Q: … If you look at page 502, for instance.[43]
>
> A: Yeah, 502 is just some sketch notes that I made on testing our mixing cones for the burner.
>
> Q: Yeah, so quickly, are those your notes? Those are my handwriting – that's my handwriting.
>
> Q: Yeah, and basically the date. What date is that? April 8th, 2014 test?
>
> A: Yeah, April 8th, 2014 test.
>
> Q: It talks about Alberta Central Permit Office, Quebec Permit Office. So where was this taking place?
>
> A: This was all taking place at Joe Bazley's farm in his shop right there. He had a tank, a 400-barrel tank, which is common in the oil field, that we had filled with water to hook our unit into and do physical tests with.
>
> Q: That's right.

Chemical additives (generally representing less than 1 percent of the fluid) are used for several purposes, mostly to increase viscosity, optimize post-fracturing water recovery or protect the production pipe casing from corrosion. The fracturing fluid used is specific to each operator and differs from one formation to another.

[42] Transcript of November 25, 2024, page 219, line 11, to page 220, line 10.

[43] Page 502 is reproduced at Schedule "A".

JUSTICE: What did he fill with water?

A: A 400-barrel tank.

JUSTICE: What did he use that for?

A: He used it for watering his cattle, but it was tied straight into his wall.

JUSTICE: Oh, okay. It was a cattle farm?

A: It was for his cattle originally. He just had that tank there. He bought it in an oil field auction years ago, and it was an old tank. He cleaned it out and used it for feeding – watering his cattle.[44]

[19] In the words of Mr. Bodner, the Appellant "found out the hard way" that a larger flame creates a larger harmonic disturbance (i.e., vibrations).[45] This is how he described the catastrophic failure of unit number 1:

> But with the bigger flame, you also get a huge harmonic disturbance that we found out the hard way. It destroyed unit number 1 with the vibrations. So instead of just making a bigger flame, we had to fine-tune and kind of create our own burner to, I guess, manipulate the shape of the flame to reduce the harmonics in the chamber to achieve the output we were desiring.[46]
>
> …
>
> The cracks were created by the harmonic - the sound pressure waves inside the vessel itself. It would flex and rumble as you increased the flow rates and the, I guess, turned the volume of the burner up. It would create new sound pressure waves inside your chamber and vibrate the burner body apart. So it was just the vibrations that blew out the welds.[47]
>
> …

[44] Transcript of November 25, 2024, page 114, line 12 to page 115, line 20.
[45] This "finding out the hard way" reflects the nature of the testing conducted by the Appellant which is best described as trial and error. The nature of the testing will be discussed further below.
[46] Transcript of November 25, 2024, page 152, lines 19-25.
[47] Transcript of November 25, 2024, page 176, lines 18-24.

> … it was too loud to hear individual welds popping and cracking. You've got your generator running. You can hear the burner and the sound waves from the burner rumbling. And as the rumbles increase, you know, you increase the harmonics and it just starts leaking, right? The whole thing shakes apart.
>
> JUSTICE: And you weren't injured?
>
> A: No, it was catastrophic to the equipment, but not to human life or safety.[48]

[20] At the time of the hearing in November 2024, the Appellant continued to operate its remaining ten million BTU unit (unit number 2) and the larger unit number 3.[49] Oil companies hire the Appellant to work, as a third party, alongside their fracking crews. According to Mr. Bodner, no mobile units have been built by anyone else.[50] Unit number 2 and unit number 3 are the only units of their kind operating in Alberta's oil patch alongside 30 to 40 conventional (non-mobile) water heating units.[51]

Appellant's Argument

[21] In oral argument, counsel relied heavily on this Court's decision in *Canafric Inc. v The King*. In that case, the appellant made a variety of frozen pies. The projects at issue developed new frozen pies or improved existing frozen pies. Chief Justice Rossiter allowed the appeal after concluding that the appellant:

> [115] … successfully established that the 2013, 2015, 2015 and 2016 SR&ED Claims met all five criteria established in *Northwest Hydraulics*:
>
> i. There was a technological risk or uncertainty, which could not be removed by routine engineering or standard procedures.
>
> ii. Canafric formulated hypotheses specifically aimed at reducing or eliminating that technological uncertainty.
>
> iii. The procedure adopted accord with the total discipline of the scientific method including the formulation testing and modification of hypotheses.
>
> iv. The process resulted in a technological advancement.

[48] Transcript of November 25, 2024, page 177, lines 10-18.
[49] Transcript of November 25, 2024, page 216 line 15-21.
[50] Transcript of November 25, 2024, page 218, line 18-27.
[51] Transcript of November 25, 2024, page 221, line 19 to page 222, line 6.

> v. A detailed record of the hypotheses tested, and results were kept as the work progressed.
>
> [116] I am more than satisfied the Appellant discharged its burden. The appeal is allowed.[52]

[22] Appellant's counsel, Mr. Johnson, also argued that:

> What the Appellant believes was missing from CRA's assumptions of fact was the magnitude of the task faced by the Appellant based on existing technology at the time and the Appellant's accomplishments during the taxation years in question in designing and building a mobile direct fired heater.[53]

[23] Counsel emphasized the amount of work that went into the project. For example, "a lot of work went into finding the correct burner/gas flow configuration."[54] Counsel also submitted that the Minister failed to recognize, among other things, "the technological achievements contained in the Appellant's prototype heater."[55]

[24] Counsel argued that the Court should consider the "why" and the "how" of the work performed. With respect to the latter, he contended that:

> … the Appellant's work on the mobile direct fired heater was done by starting with a current state of the art stationary heater of the desired output and modifying it to meet all of the following parameters:
>
> 1. fit on a trailer that was roadworthy (no more than 8 feet wide or 8 feet high);
>
> 2. withstand vibrations from being transported (unlike a stationary heater);
>
> 3. operate in a variety of temperatures from plus 40° to minus 40° C (unlike a stationary heater);

---

[52] *Canafric Inc. v The King*, 2023 TCC 108 at paras 115-116. For a more recent decision along similar lines, see *Manning Canning Kitchens Inc. v The King*, 2024 TCC 159 involving the beverage industry. Justice Bodie allowed the appeal after concluding at para 31 that "on a balance of probabilities, Manning Canning successfully discharged its burden to answer the five [*Northwest Hydraulic*] questions referred to above in the affirmative."
[53] Appellant's Brief of Law, page 2.
[54] Appellant's Brief of Law, page 5.
[55] Appellant's Brief of Law, page 8.

4. provide a range of water temperatures (unlike a stationary heater); and

5. provide the same heat output as the stationary unit.[56]

[25] Counsel submitted that lack of documentation is not necessarily fatal to an SR&ED claim.[57] In this regard, he relied on the reasons of the Federal Court of Appeal in *RIS-Christie Ltd. v Canada*:

> [14] In addition to developing new products or processes, scientific research connotes the existence of controlled experiments involving the testing of models or prototypes. Thus, evidence of scientific research must be adduced by the taxpayer in order to demonstrate that such research (including testing) was undertaken and that it is eligible for favourable tax treatment: see, for example, Progressive Solutions Inc. v. R., 96 DTC 1232 (T.C.C.). Not only must taxpayers establish that tests were performed, they must also demonstrate that they were conducted in a systematic fashion. In my view, the requirement that research efforts be "systematic" is a higher threshold than simply requiring that research, including testing, be conducted. Although both documentary and viva voce evidence are admissible, the only sure-fire way of establishing that scientific research was undertaken in a systematic fashion is to adduce documentary evidence which reveals the logical progression between each test and preceding or subsequent tests.
>
> [15] Thus, it is reasonable to expect a taxpayer to adduce documentary evidence of systematic research, including testing. If, however, a taxpayer has a plausible explanation for the failure to adduce such evidence, it is still open to the court to hold that, on a balance of probabilities, systematic research was undertaken. For example, where research notes are accidentally destroyed, it should be permissible for the trial judge to infer that systematic research was conducted, having regard to the totality of the evidence. During oral argument, counsel for the Minister accepted this proposition, if only because that scenario was inapplicable in the present case. However, in my view, it should also be permissible to infer that a taxpayer had conducted systematic research where it is established that such research led to a technological advancement. I say this because the whole foundation of the scientific research provisions of the Act and Regulations should not rest solely on the repeatability criterion. Otherwise, repeatability would negate the validity of all other evidence pertaining to scientific research.[58]

[56] Appellant's Brief of Law, page 2. Counsel's written argument should be read with a grain of salt as it refers to a number of facts not in evidence. It also refers to evidence offered by the Appellant but excluded at trial. This reflects an impermissible attempt to put expert evidence in through the back door (see, for example, page 6 of the Appellant's Brief of Law).
[57] Appellant's Brief of Law, pages 6-8.
[58] *RIS Christie Ltd. v Canada*, 1998 CanLII 8876 (FCA) at paras 14-15.

Analysis

[26] The question before the Court is whether the Appellant has demonstrated, on a balance of probabilities, that its work on the project satisfies the *Northwest Hydraulic* criteria and, therefore, qualifies as SR&ED under the Act. In arriving at the answer to that question, I have considered the assumptions and the evidence under each criterion in turn.

1. Was there a technological risk or uncertainty that could not be removed by routine engineering or standard procedures? The phrase "routine engineering" describes techniques, procedures and data that are generally accessible to competent professionals in the field.

[27] Our starting point is the Minister's assumption of fact that:

> (gg) with respect to the appellant's SR&ED claim in respect of a mobile direct-contact water heater:
>
> i) there existed no scientific or technological uncertainty;

[28] In light of this assumption of fact, the onus was on the Appellant to prove that the project presented at least one scientific or technological uncertainty. It failed to do so. The onus was also on the Appellant to demolish each of the following ancillary assumptions of fact:

> ***Burner***
>
> …
>
> t) based on existing knowledge in chemical engineering, when there is an adequate proportion of fuel to air, flame size will increase and will result in the consumption of the entire fuel supply;[59]
>
> u) based on established scientific and technological knowledge, making larger holes reduces the resistance to air flow and simultaneously increases air supply;[60]

---

[59] Far from demolishing this assumed fact, it was admitted by the Appellant at trial (see transcript of November 25, 2024, page 152, lines 2-6).

[60] This assumption of fact was somewhat contentious. According to Mr. Bodner, it did not tell the whole story (transcript of November 25, 2024, page 155, lines 16-25):

> It wasn't this simple case of routine engineering, I should say. With the problems of dealing with air pressures and the harmonics of the burner the flame create, we were able to design

Water spray nozzles

…

x) the contractor's experience was sufficient to provide the requested modifications to the water spray nozzles;[61]

Heater box

…

z) based on existing knowledge in mechanical engineering an increase in wall thickness and the addition of an extra plate in the corners of the heater box will increase the resistance of the wall and corners to vibration and mechanical stress;[62]

…

Automation software

…

ff) the computer programming contractor's knowledge base and expertise were sufficient to develop the software;[63]

[29] The Appellant alleged that it faced technological uncertainty because it:

… **did not know** how its engineering guidelines should address:

- Large variations in the exterior temperatures surrounding the Technology caused by the extreme climates of remote working areas;

- Large variations in the temperature of the water inside the Technology caused by the extreme climates of remote working areas; and

---

an air inlet system in conjunction with the burner holes and the modifications we made to create a flame that would put out the BTUs we would require and minimize the harmonic disturbance that was actually - made the first heater shake apart, destroy itself. That is what we were claiming our SR&ED because we developed a way to do that.

[61] Far from demolishing this assumed fact, it was admitted by the Appellant at trial (transcript of November 25, 2024, page 157, lines 21-24).

[62] With the qualification that weight was also a consideration, this assumed fact was admitted by the Appellant at trial (transcript of November 25, 2024, page 160, line 1 to page 161, line 7).

[63] Far from demolishing this assumed fact, it was admitted by the Appellant at trial (transcript of November 25, 2024, page 162, lines 4-6).

- The functionality of the small heating chamber in the Technology, likely required to be 60% less volume as compared to existing technology.[64]

[Emphasis added]

[30] The problem with the Appellant asserting that it "did not know" is that technological uncertainty is not determined on a subjective basis (what the Appellant knew), but on an objective basis (what a competent professional in the field would have known). As Justice Russell pointed out in *Mold Leaders Inc. v The King*:

> [57] In *Logic Data Products Inc. v. The Queen*, 2021 TCC 36, Justice Monaghan then of this Court observed (para. 69):
>
> > Technological uncertainty does not arise simply because the Appellant does not have the requisite knowledge. The question is whether the uncertainty identified by the Appellant is an uncertainty to those knowledgeable and experienced in the relevant field.
>
> [58] As well, in *Dave's Diesel v The Queen*, 2022 TCC 62, my colleague Justice Spiro specified that the concept of technological uncertainty is not subjective. He wrote (para. 28) that: "[i]f it were subjective, a grade school student trying to build a simple electric motor would meet the test."
>
> [59] Here there was not evidence as to the overall industry state of knowledge in the context of any of the eight projects.[65]

[64] Amended Notice of Appeal in 2019-894(IT)G and Notice of Appeal in 2021-1471(IT)G at para (c)(iv)(3).
[65] *Mold Leaders Inc. v The King*, 2023 TCC 127 at paras 57-59.

[31] In these appeals, the Appellant chose not to lead expert evidence demonstrating (a) technological risks or uncertainties and (b) that any such technological risks or uncertainties could not be removed by routine engineering or standard procedures.[66] The Court, therefore, is obliged to rely on the assumption of fact that there existed no scientific or technological uncertainty.[67]

2. Did the person claiming to be doing SR&ED formulate hypotheses specifically aimed at reducing or eliminating that technological uncertainty?

[32] Assuming there was at least one technological uncertainty to be resolved, our starting point is the assumption of fact made by the Minister that:

> (gg) with respect to the appellant's SR&ED claim in respect of a mobile direct-contact water heater:
>
> ii) the appellant did not formulate hypotheses specifically aimed at reducing or eliminating that uncertainty;

[33] The only hypothesis alleged by the Appellant was a single, overarching hypothesis at paragraph (iv)(4) of the Appellant's Amended Notice of Appeal in 2019-894(IT)G and the Appellant's Notice of Appeal in 2021-1471(IT)G:

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[66] Mr. Bodner testified that one of the subcontractors told him that "we couldn't do it" meaning "we wouldn't get the heat output because we didn't have the volume." (see transcript of November 25, 2024, at page 120, lines 6-13; see also page 139, lines 8-9 and page 139, line 24 to page 140 line 2). Such hearsay evidence is obviously inadmissible.

[67] In appeals involving SR&ED claims in the engineering field, judges should avoid becoming so intrigued by the complexity of the work performed that they take an unjustified leap of faith – in the absence of expert evidence – that the "technological uncertainty" alleged by the appellant could not be resolved by routine engineering (i.e., by using techniques, procedures, and data generally accessible to competent professionals in the field). If the Minister's assumptions of fact have been properly formulated and pleaded, appellants would be well-advised to call expert evidence on the techniques, procedures, and data generally accessible to competent professionals in the field at the time. The evidence of a witness with an interest in the outcome of the litigation, such as Mr. Bodner, is considerably less credible and less reliable on that question than the evidence of an expert engineering witness bound by the Code of Conduct set out in Schedule III to the *Tax Court of Canada Rules (General Procedure)*:

> 1 An expert witness has an overriding duty to assist the Court impartially on matters relevant to his or her area of expertise.
>
> 2 This duty overrides any duty to a party to the proceeding, including the person retaining the expert witness. An expert witness must be independent and objective and must not be an advocate for a party.

> (4) The Appellant formulated the hypothesis that a new set of engineering guidelines combined with software-based controls could result in a working direct-fired heating system with mobile capability.

[34] But that is no hypothesis at all. It is simply a restatement of the objective of the entire project. In *Joel Theatrical Rigging Contractors (1980) Ltd. v The Queen*, Justice Sommerfeldt held that "a hypothesis is a statement to be tested by an experiment or a trial."[68] The Appellant's alleged hypothesis is incapable of being tested by an experiment or a trial. What experiment or trial could prove that "a new set of engineering guidelines combined with software-based controls could result in a working direct-fired heating system with mobile capability"? To use the words of Judge Bonner, the Appellant's alleged hypothesis is simply "too vague".[69]

[35] Furthermore, in *Northwest Hydraulic*, Judge Bowman described a five-stage process to determine whether the person claiming to have done SR&ED formulated hypotheses specifically aimed at reducing or eliminating the technological uncertainty. According to Judge Bowman, such a person would have engaged in:

> a. the observation of the subject matter of the problem;
>
> b. the formulation of a clear objective;
>
> c. the identification and articulation of the technological uncertainty;
>
> d. the formulation of a hypothesis or hypotheses designed to reduce or eliminate the uncertainty; and
>
> e. the methodical and systematic testing of the hypotheses.[70]

[68] *Joel Theatrical Rigging Contractors (1980) Ltd. v The Queen*, 2017 TCC 6 at para 26.
[69] *CW Agencies Inc v The Queen*, 2000 CanLII 519 (TCC) at para 23, aff'd at 2001 FCA 393 (CanLII).
[70] *Northwest Hydraulic*, *supra*, note 3 at para 16.

[36] Judge Bowman used the plural "hypotheses" throughout *Northwest Hydraulic*, particularly in the second, third, and fifth criteria. The *Northwest Hydraulic* criteria do not contemplate a single, overarching hypothesis, as the Appellant assumes, but a particular hypothesis that precedes each test and that is subject to modification in light of the results of that test. I saw no evidence of that here.

3. Did the procedures adopted accord with established and objective principles of scientific method, characterized by trained and systematic observation, measurement and experiment, and the formulation, testing and modification of hypotheses?

[37] Our starting point is the assumption of fact made by the Minister that:

> (gg) with respect to the appellant's SR&ED claim in respect of a mobile direct-contact water heater:
>
> iii) the appellant's overall approach was not consistent with a systematic investigation or search, including formulating and testing the hypotheses by means of experiment or analysis;

[38] Mr. Bodner's oral evidence and the contents of Tab 100 (Exhibit A-12) – to which we shall return later – demonstrate that the tests performed by the Appellant were conducted by trial and error. In other words, there was no systematic investigation. As Chief Justice Rossiter noted in *Canafric* (citations omitted):

> [101] This Court has consistently held that trial and error does not come within the scientific method if used alone. Trial and error aim to solve a functional problem using different options. Unlike the systematic investigation required under subsection 248(1) ITA, trial and error does not attempt to understand why a particular option did not work and simply moves on to the next option.[71]

4. Did the process result in a "technological advance"?

[39] Has the Appellant demonstrated, on a balance of probabilities, that building high-efficiency, direct-contact, water heaters for the fracking industry that were mountable on a truck or trailer was a "technological advance"? The answer is no.

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[71] *Canafric*, *supra*, note 52 at para 101.

In the absence of expert evidence from a professional engineer, I have no way of knowing whether that work constituted a "technological advance".[72]

5. Was a detailed record of the hypotheses, tests, and results kept as the work progressed?

[40] The Appellant has not demonstrated that, with respect to any test, or series of tests, performed during its 2014 or 2015 taxation years, it recorded:

(a) the formulation of a hypothesis;

(b) the testing of that hypothesis; and

(c) the modification of that hypothesis in light of the results of the test.

[41] As we shall see below, Mr. Bodner testified – quite candidly so – that "we were trying to just achieve an end goal of what would work. Half of our failures were just, okay, well, that didn't work, let's try this." That is the essence of trial and error.

[42] Mr. Bodner made that statement during a *voir dire* on the admissibility of the contents of Tab 100. During that *voir dire*, I gave Mr. Bodner an opportunity to explain the contents of Tab 100. The scattered and disorganized nature of Mr. Bodner's oral evidence is consistent with the scattered and disorganized nature of Tab 100:

A: It's an example of the tests that we were doing.

JUSTICE: How many tests?

A: Countless.

JUSTICE: Countless tests...

A: I would do...

JUSTICE: ...are under Tab 100?

[72] For the reasons set out in note 67 above, the evidence of Mr. Bodner on "technological advance" is considerably less credible and less reliable than the evidence of an impartial, independent, and objective expert engineer. No such expert evidence was called by the Appellant.

A: This is one example of numerous tests that we did for...

JUSTICE: One example. Where are all the tests located?

A: We didn't document a lot of them because a lot of them were failures. We weren't looking...

JUSTICE: No, but don't you document the failures so that you can learn from them and then do it right the next time? Keep trying?

A: **When a pump fails because of some sort of - we just - okay, that pump failed, we're going to do this now.** We didn't document it per se. We were never looking to go out and, you know, I didn't know anything about an SR&ED program.

…

A: Yeah. So, I mean, **we were trying to just achieve an end goal of what would work. Half of ours were just, okay, well, that didn't work, let's try this.** Nothing that I had written down. And I mean, I do have pages, notes at home, books and books and books of what we had done and stuff that were part of our submission to SR&ED.

JUSTICE: Okay. I don't really care what was part of the submission to CRA. I'm just asking about Tab 100, which your counsel wants to have marked as an exhibit. I'm just not quite sure what it is.

A: It's just an example of some of the notes that we took for (INDISCERNIBLE).

JUSTICE: Well, I don't know that it's an example of anything. It's – like, when does it start and when does it end, and it's a test or a number of tests? I don't know. I don't have a clue. Let's start with page - we'll go page by page. Page 483, what's that?

A: These are tests that we performed on our unit to test our theories of modifying a (INDISCERNIBLE).

JUSTICE: Okay. Which unit?

A: This is unit number 1 and 2.

JUSTICE: And what were the theories?

A: We needed a higher output of the burner to produce a higher output for our water. So when we would turn the burner up to its maximum capacity, we wouldn't get our desired results that they would get in their stationary units.

JUSTICE: Where do I see that?

A: You don't see it. This is just notes of those tests.

MR. JOHNSON: Well, I guess – (INDISCERNIBLE) page 485. Looking at page 485.[73]

JUSTICE: But what was the test? Was it item 3 in page 485, results of tests? But what were the tests?

A: These tests were for our heat output. So we were testing, you know, at water flow rates, what temperature differentials we were getting, how much heat was getting into the water, how much heat we were losing, what our flue gas analysis emissions were.

JUSTICE: And this is all with a view to doing what?

A: Increasing heat output of a portable unit.

JUSTICE: What are the variables?

A: Pardon me?

JUSTICE: What are the variables?

A: Of?

JUSTICE: Increasing the output?

A: I guess burner size, burner function, harmonics within the unit.

JUSTICE: Where do I see all of that?

A: Those are all results of our tests.

JUSTICE: So page 485.

A: This is just one of the tests that we did.

JUSTICE: Okay. And what was the result of that test?

A: The result of that test, I believe this one was – let me see it for a second.

MR. JOHNSON: Yeah and look at page 513 for instance.

A: This test was to test the size of the flame, how we could minimize the size and shape of the flame to eliminate the harmonics of the unit.

[73] Pages 483-486 and 513 of Tab 100 (Exhibit A-12) are reproduced at Schedule "B".

JUSTICE: Where does it say that?

A: It doesn't say that. In the conclusion there - conclusion test.

JUSTICE: Page?

A: At the bottom of page 485. Conclusion on test 46.[74]

[Emphasis added]

[43] And as we saw earlier, Mr. Bodner testified that the Appellant "found out the hard way" that a larger flame creates a larger harmonic disturbance (i.e., vibrations).[75] Finding out something the hard way was a result of trial and error.

[44] The Appellant alleged that it:

> … tested its engineering designs on the prototype, recorded data during testing, evaluated the results, and made adjustments. After each adjustment, the Appellant conducted additional tests.[76]

[45] The Appellant has failed to prove this allegation on a balance of probabilities.[77] For example, where are the records of the tests leading to the destruction of unit number 1? How high were the relevant pressures immediately before its failure? How high were the relevant temperatures at that time? What was the frequency of the vibrations that were shaking the unit apart? What was the source of those vibrations?

[74] Transcript of November 25, 2024, page 129, line 13 to page 136, line 17.
[75] Transcript of November 25, 2024, page 152, lines 19-25.
[76] See paragraph (c)(iv)(7) of the Amended Notice of Appeal in 2019-894(IT)G and the Notice of Appeal in 2021-1471(IT)G.
[77] On a similar note, the Appellant did not prove its allegation that it "developed engineering guidelines to design the Technology" (paragraph (c)(iv)(2) of the Amended Notice of Appeal in 2019-894(IT)G and the Notice of Appeal in 2021-1471(IT)G). Indeed, no "engineering guidelines" of any kind were put into evidence by the Appellant.

[46] Such records are nowhere to be found. Why not? Because, by his own admission, Mr. Bodner chose not to keep records of experiments that failed. As Justice Russell has noted: "technological advancement includes new knowledge that results even from a failed attempt to achieve a technological advance."[78]

[47] The Appellant's trial and error method is a far cry from the way that testing was conducted on a cooling system for a massive tractor engine in *Buhler Versatile Inc. v The King* (citation omitted):

> [39] The appellant tested the cooling system using the dynamometer (called dyno testing) as well as doing field testing. Mr. Minaker stated that the dyno testing took place in a test cell which was a large enclosed room. The tractor would run at full throttle for 6 to 8 hours at a time and approximately 30 variables such as temperatures, pressures, and flows would be measured to determine how the cooling system was working.[79]

[48] In *Buhler Versatile*, Justice Wong concluded that the work qualified as experimental development after finding the following facts:

> [64] The appellant was focused and methodical in the way it uncovered, recognized, and resolved the issues involving cooling and the torsional coupler, as two examples of the larger challenges. It did not always know whether a specific theory would successfully resolve a particular issue but it always knew why it was testing that theory.
>
> [65] For example, the appellant moved away from rubber couplers to spring-based ones because the rubber was breaking; however, the appellant did not know that the spring couplings would work. The appellant then eventually moved away from a 2-piece welded design to a one-piece design. As another example, the appellant knew that the larger cooling system must be accommodated without knowing how to do so. It systematically formulated and tested theories, resulting in a combination of changes to component orientation, spacing, the design of the charge air cooler, and two increases in the size of the tractor itself, among other things.[80]

[49] In these appeals, the Appellant's evidence fell far short of the mark.

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[78] *6298316 Canada Inc. v The Queen*, 2021 TCC 17 at para 35.
[79] *Buhler Versatile Inc. v The King*, 2023 TCC 18 at para 39.
[80] *Ibid* at paras 64-65.

Conclusion

[50] The Appellant has failed to show, on a balance of probabilities, that its work on the project during its 2014 or 2015 taxation years qualified as "experimental development" within the meaning of SR&ED in subsection 248(1) of the Act. Accordingly, the appeals must be dismissed.

These Amended Reasons for Judgment are issued in substitution of the Reasons for Judgment dated April 28, 2025.

Signed this 2nd day of May 2025.

"David E. Spiro"

Spiro J.

Date

Alberta Central Permit OFFice 1-800-662-7138
Quebec Permit OFFice 1888-461-2439

Heating Test April 8, 14

reading #1 (gas recommended pressure)
ΔT = 16.8
O^2 = 5.3%
Co = 2214 ppm
EFF = 99.8%
Co_2 = 9.4
T-Stk 28.7
T-Air 31.8
EA = 39.4
Flow Rate 1779 L/min

#2 gas pressure increased 5psi
ΔT = 17.2
O^2 = 5.7%
Co = 2341 ppm
EFF = 92.7%
Co_2 = 9.7
T-Stk = 98.8
T-Air = 30.4
EA = 38.2%
Flowrate 1878 L/min

Reading #3 gas pressure decreased By 5psi
ΔT = 14.4
O^2 = 5.8
Co = 2228
EFF = 100%
CO_2 = 9.1
T-Stk = 28.7
T-Air = 35.2
Flow Rate = 1880

* increasing gas Flow pressure decreases combustion EFficiency

Page

SCHEDULE "B"

Date : June 27 th 2014

By : Luc Mandeville

Subject : Visit to Vortex June 25 th 2014

Object : Run tests on Percofrac-10 unit no 1

Presents : Andrew Bodner, Travis Gilberson, Luc Mandeville, Shane (technician from Gritt), Joe Bazley (for discussion after tests).

1- Things to change as soon as possible :
   A- The double wall level detector , a proximity switch reading the water presence in the sight glass, does not trip the burner when not reading water ; THIS IS NOT ACCEPTABLE ; IT HAS TO TRIP THE BURNER. François please communicate with Andrew to correct this . Andrew may want something to by-pass (temporarely) this security but I insist that on normal automatic operation , a low water level in the double wall trip the burner and initiates an alarm. Please Andrew , do not operate the Percofrac until this has been corrected.
   B- Two set points have to be re-entered every time the Percofrac is started : Andrew please confirm these :
      a- Minimum water flow.
      b- Maximum gas flow.
      c- François please correct.
   C- Send the list of lockout causes for the BMS.
   D- Alarms set points :

Travis will correct back the alarms set points we changed for the tests :

a- PT-1 : back to 2 PSIG.

b- TE-5 : back to 120 C

c- TE-2 : back to 80 C.

2- Recommendations :

A- Add a ½" thick (minimum) rubber pad underneath the body of the heater.

B-Add access doors on the trailer to the Percofrac sides.

C-Change the kind of detection device for the double wall water level ; presently a proximity switch ; to change to a Wika pressure transmitter just like LT-1 ; this will be called LT-2 on the flow sheet. Range to be 0 to 12 " water column.

D-All temperature elements :

a- To be installed in a vertical down position as much as possible.

b- To be installed in a thermo well filled with with conductive powder.

E- Burner Management System : BMS :

The alarms that trip the burner ; showed as lockout number (x) on the digital screen of the BMS ; the list of causes has to be programmed into our PLC for the operator to consult it.

F- Joe wants the future units to be equipped with a combustion air forced draft fan with 30 % additional spare capacity over the Percofrac rating.

b- Luc agrees and indicates that this can be done by adding wa
some washers inside the spray nozzles.
c- Travis will try.

3- Results of tests :

A- Test at 13:45 hour : the water in the tank was warm so water was getting into the Percofrac at 48C.
a- Stack temperature : 58 C
b- Efficiency : 89%
c- Water flow : 992 liter/minute.
d- Temperature differential on water ; 35.5 C
e- Heat injected in the water : 8,400,000 BTU/HR.
f- Heat produced by the burner : 8.4/0.89= 9,400,000 BTU/HR.
g- Flue gases analysis :
CO : 574PPM
CO2 : 11.3 %
O2 : 3.8 %
Stack temperature : 58 C
Efficiency : 89%
h- Amperages :

	Measured	Full rating
P-1 :	18.5 amps	21 amps
P-2 :	15 amps	27 amps
Fan :	17.1 amps	21 amps

4- Conclusions on tests :

A- At the tests conditions, the flame extends to between 50% and 75% of the heater's length.

B- When we increase the propane gas pressure in order to increase the heating power (BTU/HR), the flame quenches on the water surface ; this make it so that we read high CO (2,000 PPM). We will try to test the unit with a lower operating level ; as low as 45 cm from the bottom of the body (Andrew-Travis not the reading of LT-1).

C- The next units will have bigger combustion air fans.

D- Andrew says that CO (PPM) does not bear much importance for Vortex. I suggest Vortex run the unit with as much as 2,500 PPM of CO , at a lower water level operation and see what we get as heating power .

E- This will become quite easier when Vortex gets it's gas analyser that they ordered ; within 2 weeks.

June 25/2014

Date

Heater test with Luc at Joe's

Modification to be made on all units

- Level sensors and Inlet pressure Sensors
  - No pigtail siphons
  - Slope to drain where possible
  - use air columns to stabilize readings
  - need a drain for inlet pressure sensor
  - no setra sensors as they are not reliable please use wika as they are more durable

- Blower
  - Blower outlet is to be vertical
  - no miter elbow from blower to burner
  - no silencer box
  - make sure ID of blower flange matches the burner flange
  - Hole for PS-3G thread-o-let to be drilled at bottom of pipe bore, not top.
  - Also mount sensor vertically so moisture does not accumulate

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Page

CITATION:	2025 TCC 63
COURT FILE NOS.:	2019-894(IT)G 2021-1471(IT)G
STYLE OF CAUSE:	VORTEX ENERGY SERVICES LTD. AND HIS MAJESTY THE KING
PLACE OF HEARING:	Calgary, Alberta
DATES OF HEARING:	November 25 and 26, 2024
AMENDED REASONS FOR JUDGMENT BY:	The Honourable Justice David E. Spiro
DATE OF AMENDED JUDGMENT:	MAY 2, 2025

APPEARANCES:

Counsel for the Appellant:	Kim E. Johnson
Counsel for the Respondent:	Damon Park

COUNSEL OF RECORD:

For the Appellant:

Name:	Kim E. Johnson
Firm:	Crease Harman LLP Victoria, British Columbia

For the Respondent:	Shalene Curtis-Micallef Deputy Attorney General of Canada Ottawa, Canada