Docket: 2018-379(IT)G

BETWEEN:

AIRZONE ONE LTD.,

Appellant,

and

HER MAJESTY THE QUEEN,

Respondent.

Appeal heard on December 6, 7 and 8, 2021, at Toronto, Ontario

Before: The Honourable Justice Robert J. Hogan

Appearances:

Counsel for the Appellant:	Mahyar Makki
Counsel for the Respondent:	Robert Zsigo Jason Winter

JUDGMENT

The Appellant's appeal with respect to the 2014 and 2015 taxation years is allowed and the matter is referred back to the Minister for reconsideration and reassessment in accordance with the attached reasons for judgment.

The parties will have until March 30, 2022 to agree on costs, failing which they are directed to file their written submissions on costs no later than March 30, 2022. Such submissions should not exceed 10 pages.

Signed at Ottawa, Canada, this 21st day of February 2022.

"Robert J. Hogan"

Hogan J.

Citation: 2022 TCC 29
Date: 20220221
Docket: 2018-379(IT)G

BETWEEN:

AIRZONE ONE LTD.,

Appellant,

and

HER MAJESTY THE QUEEN,

Respondent.

REASONS FOR JUDGMENT

Hogan J.

I. OVERVIEW

[1] The Appellant, Airzone One Ltd. ("Airzone") provides comprehensive air quality monitoring services to government agencies and departments, international organizations, and for-profit businesses. Airzone and predecessor corporations to Airzone has provided these services since 1979.

[2] The Appellant carried out work on three projects in each of its 2014 and 2015 taxation years. The Appellant deducted the expenses incurred in connection with these six projects as scientific research and experimental development ("SR&ED") expenditures and claimed investment tax credits ("ITCs") for these expenses (the "Appellant's SR&ED Claims").

[3] The Minister of National Revenue (the "Minister") disallowed all of the Appellant's SR&ED Claims on the grounds that the work carried out in connection with the projects did not constitute SR&ED as defined in subsection 248(1) of the *Income Tax Act*, Canada (the "ITA").

[4] The Respondent's Reply to Airzone's Notice of Appeal contains a recital of a number of factual assumptions that the Respondent alleges were made by the Minister in disallowing Airzone's SR&ED claim in full. These factual assumptions relate to how and why Airzone carried out work on the six projects. How work is

carried out and why work is carried out are the two key factors that must be considered to determine whether work qualifies as SR&ED within the meaning of that term.

[5] The "how factors" are based on the manner in which work is conducted. To satisfy the "how factors", a taxpayer must establish that the work was carried out by way of systematic investigation or search through experiment and analysis of a hypothesis. The results of the work must also be preserved. At the end of the hearing, counsel for the Respondent acknowledged that the evidence establishes that the work carried out by Airzone satisfied the "how factors" and that the contrary factual assumptions alleged to be made by the Minister in the Reply in this regard were incorrect.

[6] To satisfy the "why factor" a taxpayer must demonstrate that the work was carried out to resolve technical uncertainties that could not be solved through standard procedures and methods. The Respondent now agrees that the sole factual assumption that the Appellant must rebut is the Minister's assumption that Airzone resolved the technical uncertainties in each project by applying standard practices, methods or processes of routine analytical chemistry or engineering used in Airzone's field to conduct air quality monitoring. Airzone defends the contrary position.

[7] This issue is largely a question of fact. Airzone bears the burden of demonstrating that the Minister's factual assumptions, in this regard, are incorrect.

[8] I believe that Airzone has satisfied its evidentiary burden with respect to projects 1, 2 and 3 for the 2014 taxation year, and project 2 for the 2015 taxation year. In contrast, I am of the view that Airzone has failed to satisfy its burden of proof with respect to projects 1 and 3 for the 2015 taxation year. The reasons for my opinions are stated below.

[9] The parties have agreed on the allocation of the expenses incurred by Airzone among the six projects and the ITCs related thereto. Therefore I do not have to address this matter.

II. MATERIAL FACTS

[10] The evidence reveals that air quality monitoring is based on a three-step process. First, a device must be identified for the purpose of gathering samples from

the air in a designated area. A process must be selected for the purpose of separately extracting contaminants that may be present in a sample to allow for their proper identification. Finally, a contaminant must be identified and quantified based on its known attributes.

[11] Airborne contaminants can be actively or passively sampled. For example, active sampling often requires the use of a pump to direct air flow to the sampling medium. Passive sampling of airborne contaminants captures airborne pollutants on a collection medium based on the dry or wet deposition of contaminants on the collection medium. In both cases, the medium must be collected, and the contaminants must be extracted separately to allow for their unique identification and quantification.

III. ISSUES TO BE CONSIDERED

[12] The issues in this appeal are:

a) whether the Minister was justified in concluding that none of the work carried out by the Appellant on the six projects constituted SR&ED;

b) whether the Minister was justified in denying the corresponding ITCs in relation to the denied expenditures with respect to the Appellant's 2014 and 2015 taxation years.

IV. ANALYSIS

[13] SR&ED is defined in subsection 248(1) of the ITA as follows:

> "scientific research and experimental development"
>
> "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
>
> 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 in 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;
>
> [Emphasis added.]

The definition is based on a "catch and release" concept. The definition first includes a broad category of development activities under paragraphs (a) to (c), then items otherwise included are excluded under paragraphs (e) to (k).

[14] The definition of SR&ED encompasses basic research, applied research and experimental development. The outcome of this case concerns whether or not the work carried out by Airzone qualifies as "experimental development". This concept cannot be considered in the abstract. As noted earlier, the reason why the work was carried out is a deciding factor.

[15] To qualify the work on the projects as experimental development, Airzone must demonstrate that it undertook the work to tackle technical uncertainties for the purpose of gaining "know-how" or "technical knowledge" not available within its organization or through publicly available sources. The "technical knowledge" or "know-how" in this context includes creating or improving methods, procedures and processes to carry out air quality detection in unique environments. On this point, I observe that the concept of "experimental development" includes activities undertaken to achieve incremental improvements to existing methods or procedures.

[16] The factors that must be considered to determine whether a particular project qualifies as an eligible SR&ED project are now well known. In *CW Agencies Inc v The Queen*,[1] the Federal Court of Appeal summarized the factors as follows:

> 1. Was there a technological risk or uncertainty which could not be removed by routine engineering or standard procedure?
>
> 2. Did the person claiming to be doing SRED formulate hypotheses specifically aimed at reducing or eliminating that technological uncertainty?
>
> 3. Did the procedure adopted accord with the total discipline of the scientific method including the formulation testing and modification of hypotheses?
>
> 4. Did the process result in a technological advancement?
>
> 5. Was a detailed record of the hypotheses tested, and results kept as the work progressed?

[17] The factors described in paragraphs 2, 3 and 5 require the Court to examine how the work was conducted by a taxpayer. I referred to these factors earlier as the "how factors". As noted, the Respondent has conceded that the evidence demonstrates that the manner in which Airzone carried out the work on the six projects satisfies the "how factors".

[18] The factors described in paragraphs 1 and 4, in my opinion, are interrelated. These factors require consideration of the purpose of a project. The questions set out in paragraphs 1 and 4 can be reformulated as follows: Did the taxpayer use standard procedures or methods to carry out the work in the taxpayer's field of activity? If the answer is "yes", then there was no technical uncertainty that was required to be

[1] *CW Agencies Inc v The Queen*, 2001 FCA 393 at para 17.

resolved. In such a case, the project was not undertaken to achieve a technological advancement. The work was routine in nature.

[19] While each of the above factors must be considered separately, if a project satisfies the "how factors" this may help tip the balance in favour of a taxpayer when the dividing line between what constitutes the use of standard methods or procedures is blurred. In my opinion, it is unlikely that a taxpayer would conduct experiments in a manner that respects the "how factors", all at additional expense, if the purpose of the work was not to achieve technological advancement.

[20] In their oral submissions, both parties referred me to a number of cases, which I have carefully considered.[2] As is often the case in SR&ED matters, the outcome in those cases is largely fact-dependent.

[21] I will now undertake a review of the evidence on a project-by-project basis to determine whether Airzone has satisfied its evidentiary burden in the context of the above.

[22] As a general comment, before undertaking a review of the evidence, I found Mr. Fellin, the sole witness to be called by the Appellant, to be an extremely knowledgeable, credible and reliable witness. He graduated with a degree in chemistry from the University of Toronto in 1972. He has been employed in one capacity or another in the field of air quality monitoring since 1976.

[23] Mr. Fellin is a founder of Airzone. He was directly responsible for overseeing the work carried out by Airzone on the six projects. I am inclined to give Mr. Fellin's evidence considerable weight, considering all of the above.

[24] Mr. Melnyk, a research and technology advisor for the Canada Revenue Agency (the "CRA") was called by the Appellant and not the Respondent to testify. Mr. Melnyk carried out the technical audit of the six projects on behalf of the CRA.

[25] The Respondent accepted that Mr. Melnyk's examination could be conducted as a cross-examination. His report was entered into evidence.

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[2] *Northwest Hydraulic Consultants Ltd v R*, [1998] 3 CTC 2520 [*Northwest Hydraulic*], [1998] TCJ No 340; *Logitek Technology Ltd v R*, 2008 TCC 145; *Kam-Press Metal Products Ltd v The Queen*, 2019 TCC 246, aff'd 2021 FCA 88; *WRD Borger Construction Ltd v The Queen*, 2021 TCC 40; *Flavor Net Inc v The Queen*, 2017 TCC 179; *R&D Pro-Innovation Inc v The Queen*, 2015 TCC 186, aff'd 2016 FCA 152.

[26] Mr. Melnyk's pre-trial examination for discovery was conducted by way of written questions. His questions and answers formed the basis of the Appellant's cross-examination at trial.

[27] On discovery, Mr. Melnyk was asked a series of questions regarding how he conducted his technical audit and how he reached his conclusion that all of Airzone's SR&ED claim should be disallowed in total. His answer to Question number 15 is quite revealing. In Question 15, Mr. Melnyk was asked the following: "Please expand upon the conclusion in the TRR for the 2014 taxation year, indicating that the work done in this project was known in the public domain or consisted of standard practice and no new knowledge was created."[3] Mr. Melnyk answered Question 15 as follows:

> The full explanation supporting the conclusion is included within the SR&ED Review Report (SRR). The SRR did not indicate that the work done [in] this project was known and in the public domain or consisted of standard practise [*sic*]. The conclusion was based on the fact that the work did not result in the generation of new scientific knowledge or technological advancement.[4]

[28] On cross-examination, Mr. Melnyk attempted to clarify his answer by stating that he mentioned the absence of "technological advancement" as the reason for disallowing Airzone's SR&ED Claim because he believed that that factor was sufficient to deny Airzone's claim.

[29] Mr. Melnyk was asked a series of questions regarding how he prepared himself for the audit and the finalization of his report. He answered that he conducted a Google search to determine what information was available on the processes and methods used to conduct air quality analyses. He answered that he found some general references that describe the type of procedure and methods on the topic of air quality monitoring but he acknowledged that the references were general in nature and did not provide much insight on the nature of the work undertaken by Airzone in connection with the six projects. He was also asked to cite his sources. He answered that he could not recall exactly what he consulted because he did not cite the material within his report. I believe that Mr. Melnyk did not cite the sources he consulted because they were not of particular relevance.

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[3] Questions on Written Examination for Discovery of Nick Melnyk, Question 15.
[4] Answers on Written Examination for Discovery of Nick Melnyk, Question 15.

[30] On a series of follow-up questions regarding the rationale for his answers, he stated as follows:

> There is a lot out there, but there isn't – if you were to read the literature, you can't get the specific details to determine whether or not it aligns exactly with what Airzone did, so the exact temperatures that were used or the exact pressures.

[31] Some of the factual assumptions alleged to have been made by the Minister appear to me to be helpful to the Appellant's case. For example, the following is stated as a factual assumption made by the Minister with respect to the first three projects:

> The Appellant encountered technical challenges in achieving detectable results through various tests, which were aimed at determining the suitability of each technique and optimizing existing methods rather than developing new methodologies to detect each compound.[5]

[32] The phrase "technical challenges", in my opinion, is synonymous with the phrase "technical uncertainty".

[33] The phrase "optimizing existing methods" appears to me to be an acknowledgement by the Minister that Airzone undertook the work for the purpose, at least, according to the Minister, of improving existing processes, "including incremental improvements thereto". The foregoing is specifically recognized as a technological advancement in the context of experimental development work.

[34] While Mr. Melnyk has a scientific background, I found his knowledge of Airzone's specialized field of activity to be understandably quite limited compared with Mr. Fellin's breadth of knowledge and experience.

[35] Technical uncertainty can occur in two ways. It may be uncertain whether the objective can be achieved at all; or the claimant may be fairly confident that the goals can be achieved, but it is uncertain which of several alternatives will work.[6] Technological advancement can also occur in two ways. Experimental development can lead to the creation of a new process or method or the improvement of an existing process or method. In both cases this allows a taxpayer to earn recurring revenue.

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[5] Respondent's Reply to the Notice of Appeal at para 3(p).
[6] *Indusol Industrial Control Ltd v The Queen*, 2020 TCC 103 at para 61.

Experimental development can also establish that a process or method that was experimented on by a taxpayer does not work.[7]

V. 2014 TAXATION YEAR

A. Project #1 Optimizing Passive Monitoring of Low-Concentration Compounds

[36] Mr. Fellin described the reasons why Airzone undertook this project. Airzone had been involved in establishing air detection protocol for air quality monitoring in residential homes beginning as early as 1987. In a domestic setting, airborne contaminants are found at low concentration levels. This means that detection devices and techniques used in an industrial or commercial work environment must be adapted to obtain reliable measurement of harmful contaminants in a domestic setting.

[37] In prior years, Airzone had success in establishing a detection protocol for a suite of 44 types of airborne compounds that may be present in a home environment at low levels of concentration.

[38] According to Mr. Fellin, Airzone undertook the experimental work on this project to increase the range of detectable compounds from 44 to 52. Airzone did so to stay abreast of its competition in this highly specialized field.

[39] To obtain reliable measurements of these additional eight compounds, Airzone believed that it could not rely on the extraction and identification protocol that it had established for the initial 44 compounds.

[40] In light of this, Airzone first experimented with extraction times. The hypothesis that the work was conducted under was that the modification of the solvent used to extract the additional eight compounds would compromise the analysis of the existing suite of compounds. Mr. Fellin explained that that is why they started their test by using the existing solvent used for the original compounds. Extraction techniques are known to fail because compounds are not separated from each other in a way that allows for the measurement of the concentration levels of each compound. After failing to obtain reliable data through a variation of extraction

[7] *Northwest Hydraulic, supra* note 2 at para 16.

times, Airzone decided to test the hypothesis that a more polar solvent would improve measurement of the concentration levels of the additional eight compounds.

[41] Mr. Fellin explained that Airzone, rather than replace the solvent that it typically utilized, experimented with modifying the solvent with additives to attain the desired extraction efficiency for the additional compounds while retaining detection efficiency for the other 44 compounds. While this proved successful overall, further analysis of the experimental data led Airzone to conclude that butanol proved most successful because of the higher recovery efficiency. Airzone continued experimentation with a solvent combining carbon disulphide with 5% butanol to confirm that the solvent would work efficiently for the full suite of compounds.

[42] Mr. Fellin indicated that additional experimentation was then necessary to adjust the chromatographic variables typically utilized to analyze each compound. These variables include temperature, column length, column type, flow rate through the column, carrier gas, and injection volume. Airzone carried out experiments with each variable to improve its detection abilities.

[43] After completing his technical audit, Mr. Melnyk recommended that Airzone's SR&ED claim be disallowed for this project for the reasons set out below:

> For the 8 new compounds of interest, optimization of the passive monitoring device and detection method required various parameter/condition modifications using a similar approach as the previous year. For example, each set of tests for each compound included modifying extraction times, solvent mixtures, solvent modifiers (to alter polarity), and chromatographic conditions with different chromatography machines.
>
> . . .
>
> The work described above involved optimizing established detection techniques and applying commercially available passive monitoring tools (3M brand) in an attempt to enhance detection limits of multiple compounds of interest. Although the claimant encountered challenges in achieving detectable results through various tests, these tests were aimed at determining the suitability of each technique and optimizing existing methods rather than the development of new methodologies to detect each compound. Although the optimization/modification of these protocols allowed for greater detection sensitivity of each compound, there was no generation

> of new scientific knowledge or advancement in technology related to airborne contaminant detection.[8]
>
> [Emphasis added.]

[44] The words "optimizing", "optimization" and "modifications" are apt descriptions of what Airzone set out to achieve. In my opinion, Airzone undertook the experiments described above for the purpose of establishing a method in order to obtain a reliable identification and quantification method for 52 contaminants rather than 44.

[45] I was surprised when I read the CRA's reasons for disallowing Airzone's SR&ED claim considered in light of what CRA's published guideline describes as eligible experimental development. The most recent CRA guideline is dated August 13, 2021. The definition of SR& ED has not changed. Here is what the guideline describes as experimental development:

> **The "Why" requirement in the context of experimental development**
>
> In the context of experimental development, the work is conducted for the purpose of achieving technological advancement. In other words, the work is conducted for the generation or discovery of knowledge that advances the understanding of technology.
>
> When developing new or improved . . . processes, problems can occur when there is a need to achieve a set of . . . constraints.
>
> . . .
>
> Here are some characteristics of problems that may suggest the technological knowledge is insufficient:
>
> - Existing design methods are not applicable;
> - Requirements or specifications do not conform to existing standards;
> - Too many variables or unknowns;
> - Parameters or conditions are outside of the normal operating range;

[8] "Scientific Research and Experimental Development ("SR&ED") Review Report with respect to the Appellant's tax years ended on September 20, 2014 and 2015, prepared by a CRA Research and Technology Advisor, dated August 10, 2016", Joint Book of Documents, Tab 19, p 6.

- Nature of the problem is evolving;
- Data is not readily available;
- There are interlocking constraints.[9]

[Emphasis added.]

[46] The part that I underlined described the uncertainty that Airzone sought to resolve. There were too many variables or unknowns for Airzone to be able to accurately detect and measure the full slate of 52 compounds. Data on how to extract the full slate of compounds was not publicly available. Airzone did not have this technical knowledge at the outset. It conducted tests to establish a reliable identification and quantification method.

[47] The evidence shows that standard methods, procedures and equipment may reach their detection limits when contaminants are present in low levels of concentration. Some compounds have similar attributes. In other cases, the attributes of compounds in an air sample may be quite diverse. Extraction procedures can cause compounds to co-elute, which prevents reliable identification and quantification of each sample. According to Mr. Fellin, this was the challenge that Airzone sought to resolve. An improved extraction and identification process was required. This new process could not be established without systematic scientific investigation.

[48] Counsel for the Respondent argued that Airzone used standard methods and procedures to establish an extraction and identification protocol for the full slate of 52 compounds that Airzone was interested in measuring. I disagree. I believe that the Respondent has placed too much importance on the fact that Airzone's personnel used the same sophisticated equipment that they use regularly to sample airborne contaminants. Mr. Fellin explained that the equipment they used was originally designed for industrial settings where the concentration levels of the compounds were occurring at a factor of thousands to millions times higher than the levels found in residential homes. He explained that detecting the compounds at such low concentrations is crucial because in occupational settings the employee is only exposed to the compounds during working hours. On the other hand, in residential

[9] Canada Revenue Agency, "Guidelines on the Eligibility of Work for Scientific Research and Experimental Development (SR&ED) Tax Incentives" (13 August 2021).

settings the occupants are exposed to the compounds at lower concentrations — but for prolonged periods of time, over many years.

[49] Additionally, part of the uncertainty itself was creating a single protocol that could detect all 52 compounds. As Mr. Fellin explained, had Airzone used a separate device or protocol for the eight additional compounds, it would have doubled the cost for any potential client. In this regard, rather than use a new solvent specifically for the eight additional compounds, Airzone purposely sought to modify the solvent used for its existing suite of 44 compounds. This came with its own host of challenges. The previous 44 compounds were simple aromatic hydrocarbons. Therefore, they could all be treated in the same way. Conversely, the eight new compounds had different properties (such as polar groups). This meant that the different compounds could not be extracted from the same medium with the same efficiency. Additionally, because the previously used solvent had been modified, Airzone had to adjust the chromatographic conditions for both the existing suite of 44 compounds and the eight new additional compounds. It was not simply a matter of adding new protocols to its existing methodology. Airzone had to develop a completely new protocol. In the end, Airzone was successful, except for two compounds.

[50] Airzone is a small corporation. It has limited staff. Airzone's staff must multi-task. A large part of the day for Airzone's staff is taken up by routine testing of air samples. On the basis of the evidence, at other times, work is undertaken by Airzone employees for the purpose of establishing a reliable identification and quantification protocol for an air sample that may contain previously untested contaminants. In the above context, experimentation is required to establish a new or revised protocol. Mr. Fellin testified that Airzone was not paid for this project. Only when Airzone successfully established the protocol could it then earn recurring revenue from its sampling activities.

[51] I confess that the dividing link between eligible and ineligible work in technical fields of activity can often be blurred. That said, I am of the opinion that the "why factor" cannot be so strictly applied that only large corporations that employ dedicated research staff can qualify for the SR&ED incentives. Moving the goal post so far afield, in my opinion, would be contrary to the intention of Parliament. This is consistent with the views of Justice Bowman (as he then was) in *Northwest Hydraulic*:

> The tax incentives given for doing SRED are intended to encourage scientific research in Canada (*Consoltex Inc. v. R.* (1997), 97 D.T.C. 724 (T.C.C.)). As such

> the legislation dealing with such incentives must be given "such fair, large and liberal construction and interpretation as best ensures the attainment of its objects" (*Interpretation Act*, section 12).[10]

The SR&ED incentives available to Canadian-controlled private corporations ("CCPCs") for experimental development are more generous than those available to large corporations. I surmise that the former policy was enacted because CCPCs are important sources of innovation. Because of their limited size it is often easier for CCPCs to pursue innovation which is required to grow their business. The constraint that CCPCs typically face is that they have limited financial resources to undertake risky experimental development activities. Undoubtedly that is why Parliament made SR&ED ITCs refundable for CCPCs and not for their larger counterparts.

[52] Airzone is a leader in the field of the detection of low-concentration airborne contaminants. It carried out the work to improve its technical knowledge in this highly specialized field of air quality detection. The evidence shows that detection protocols are for the most part highly guarded secrets. The fact that Airzone carried out multiple experiments to establish a protocol for the full suite of 52 compounds serves as strong corroboration of Mr. Fellin's testimony that Airzone undertook the work on this project to acquire useful technological knowledge.

[53] Consequently, I am satisfied that Airzone satisfied its evidentiary burden for this project.

B. Project #2 Improving Detection of Highly Reactive Sulphur Compounds

[54] In 2014, Airzone was retained by a consortium of oil companies to measure the level of reduced sulphur compounds ("RSCs") emitted from oil sand operations. Airzone had previously worked with the client to identify various RSCs that were unique to oil sands operations. For example, such RSCs would have different profiles than RSCs emitted from sewage plants. However, in the previous project, Airzone was working at the oil sand site itself. This time, Airzone was asked to measure the level of RSCs emitted from the oil sands at ambient sources, ranging from 20 to 60 kilometres from the oil sand site. In this regard, the main uncertainty was the ability to detect low level concentrations of RSCs occurring at ambient levels, in the parts per billion range.

[55] According to Mr. Fellin, RSCs are highly reactive when in contact with any type of media and degrade faster than other compounds. A rapid collection and

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[10] *Northwest Hydraulic*, *supra* note 2 at para 11.

analysis method is required to obtain reliable analytical data on the quantification of RSCs in this specific environment. Mr. Fellin explained that collection of RSCs on sorbent media does not work well because the sorbent will degrade the sample. Airzone identified that RSCs should be collected with a gas method such as Tedlar bags or treated Summa canisters. Because RSC samples are not collected on absorbent media they are not concentrated within the whole sample. Samples collected with these devices still degrade rapidly. Airzone initially believed that the only way of concentrating these samples is through the injection of large air volumes combined with the cryogenic concentration of RSCs, using apparatuses designed for less reactive compounds. Airzone experimented with a suite of 18 RSCs and determined the types of columns and chromatography conditions most suitable for the analysis in gas/air samples, followed by establishing the cryogenic conditions required to concentrate those samples.

[56] Airzone then experimented by using different extraction methods to achieve proper separation of the RSCs to allow for their unique identification and quantification.

[57] Mr. Fellin explained that although good resolution was attained, there was still insufficient separation to identify and quantify each unique compound. Airzone undertook further experiments to determine whether it would be possible to obtain reliable measurements.

[58] Mr. Fellin indicated that Airzone next experimented with different types of chromatography columns. Generally speaking, these chromatography columns are used to separate out compounds in a particular sample. A typical chromatography column is a tube filled with a solid substance that facilitates separation of compounds. Airzone varied the oven temperature, temperature ramps, etc. in an effort to optimize conditions for resolution. While the tested columns proved partially successful in identifying four of the compounds, resolution was an issue due to what Airzone concluded was the insufficient polarity for resolution of the non-polar hydrocarbons in many of the samples.

[59] Airzone then experimented with a GasPro column, a type of column that Airzone thought would be successful in eluting the target RSCs and interfering hydrocarbons because of the properties of the column. The GasPro column is substantially different than the typical columns used for separation purposes. It is a porous layer open tubular column.

[60] Mr. Fellin advised that experimentation with the GasPro column proved effective in eluting the target and interfering compounds. However, the results were still inconclusive.

[61] Mr. Fellin stated that Airzone next experimented with establishing the cryogenic conditions required to concentrate samples, whereby a gas sampling valve introduces the sample into an inlet, which can be cryogenically cooled. Although the inlet prevented compounds from degrading, Airzone's conclusion was that the inlet did not effectively concentrate samples at high enough levels. As a result, the experiments that Airzone carried out were not successful in establishing a reliable identification and quantification protocol for RSCs in the specific environment where tests would be conducted in the future.

[62] The Respondent argues that Airzone used standards, methods and procedures because the experiment consisted of adjusting various parameters (like column type and cryogenic conditions) to achieve the desirable protocol. In my view, this is an oversimplification of the nature of Airzone's work and ignores the novel techniques and challenges it faced. As noted in *Northwest Hydraulic*:

> . . . Most scientific research involves gradual, indeed infinitesimal, progress. Spectacular breakthroughs are rare and make up a very small part of the results of SRED in Canada.[11]

Airzone was using new collection methods. As Mr. Fellin explained, there had been previous attempts to measure RSCs by collecting them on absorbent systems. But they were not successful with all the specific oil sand compounds that Airzone was trying to measure.

[63] Second, the operating environment posed many challenges. Because Airzone was measuring at ambient environments (and not at the source), there were co- pollutants that were interfering with the sample. Natural light also contributed to the challenge because it degraded the compounds. Consequently, Airzone had to work under tight timelines-between 24 and 48 hours depending on the collection technique.

[64] Third, the novel nature of the compounds rendered them incompatible with standard methods. For example, a flame photometric detector can be used to detect sulphur in a sample and, therefore, measure RSCs in samples. However, the presence of high hydrocarbon levels in the samples interfered with the flame photometric

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[11] *Northwest Hydraulic*, *supra* note 2 at para 10.

detector's ability to measure the RSCs. Additionally, Airzone was not measuring a single RSC. It was dealing with a suite of 18 different RSCs that it needed to measure at once. In this regard, different compounds behave differently. Some reacted positively to the cryogenic approach, others could only be concentrated at temperatures below which the columns could operate in. This was a key factor in Airzone not being able to establish protocols for the full suite of compounds.

[65] In considering the above, I am satisfied that the work on this project was undertaken by Airzone to resolve technical uncertainties for the purpose of allowing Airzone to obtain an advancement of its technological knowledge in the field of activity that it conducted business in. The tests demonstrated that the extraction/separation methods that Airzone hypothesized might work to obtain reliable analytical data and quantification data were not insufficiently reliable. Further experimentation was required to establish an effective identification and quantification protocol.

C. Project #3 Improving Detection of New Airborne Compounds

[66] Mr. Fellin testified that Airzone has been working with Environment Canada to test the level of airborne contaminants in the Canadian Arctic since 1987. Mr. Fellin explained that contaminants make their way to the Arctic based on air flow. The process occurs over many years through wet or dry deposition. Ultimately, contaminants are deposited on the ground or in aquatic environments. The contaminants are then ingested by wildlife. Wildlife is an important source of food for local populations, who often live off the land. As a result, air quality monitoring in the Arctic is an essential service for the local population.

[67] The samples gathered in the Arctic over the last 30 years have been preserved. When the samples were re-analyzed, researchers found increasing concentrations of brominated and fluorinated organic compounds from flame retardants (from sources such as forest fires) that were carried to the Arctic. Consequently, researchers wanted to identify both the temporal and spatial trends of these compounds. However, the detection methods that Airzone had developed in the late 1980s were not precise enough to quantify the spatial and temporal trends. So Airzone was again hired by Environment Canada. This was a collaborative initiative. Airzone developed the extraction, sampling and concentration protocol, while Environment Canada worked on the actual analysis to determine the trends.

[68] Because these new compounds are found at very low concentration levels, Airzone had to carry out multiple tests to determine which absorbents and solvents

could be used to obtain reliable measurements of the concentration levels of these new compounds.

[69] Mr. Fellin testified that the challenge with brominated and fluorinated compounds is general laboratory contamination since almost every tool in the laboratory has some brominated or fluorinated compounds. Consequently, Airzone developed a new isolation system. In addition, because some of the compounds were polar and some were apolar, Airzone faced difficulties in reaching sufficient recovery from the sampling media with a single solvent. Following multiple experiments, Airzone established a sequential extraction procedure that uses two different solvents to separate the new compounds that are required to be identified and quantified.

[70] I am satisfied by Mr. Fellin's testimony that Airzone achieved a technological advancement which consists of a novel two-step extraction procedure for contaminants that are now present in air samples in the Canadian Arctic. Airzone achieved this result through systematic testing based on hypotheses that were formulated to achieve reliable extraction results.

[71] Mr. Fellin was subject to rigorous cross-examination. There is no evidence in the record that contradicts Mr. Fellin's testimony that multiple tests were conducted by Airzone to identify this new extraction protocol for these new contaminants. How this project was carried out corroborates Mr. Fellin's testimony that experimentation was required because Airzone did not know in advance how to accomplish this purpose. As noted earlier, Mr. Melnyk's testimony confirms that identification and quantification methods for contaminants are not generally revealed in publicly available sources.

VI. 2015 TAXATION YEAR

A. Project #1 Solving Combustion Issues to Develop Artificial Smouldering

[72] During summer months, coal piles that were stored at a shipping terminal were prone to spontaneous smouldering. Airzone was engaged to identify and measure the compounds emitted from the smouldering coal piles. The evidence shows that because of the risks associated with spontaneous combustion, neither Airzone nor its partner in this project could undertake direct sampling at the coal face using traditional monitoring to do so.

[73] Faced with this difficulty, Airzone decided that the identification and quantification of the compounds had to be measured in a testing device. Airzone designed a testing chamber and used that chamber to collect representative emissions from various types of stored coal. The testing chamber that was designed for this purpose allowed oxygen delivered into the chamber to be controlled so that the smouldering process could occur over a two-hour period without full ignition of the coal. Oxygen levels were controlled to prevent full combustion of the coal. Mr. Fellin explained that burning coal releases fewer emissions than smouldering coal because the fire itself consumes the contaminants typically released by smouldering coal.

[74] In the case of this project, I find that the design of the coal smouldering chamber was based on routine engineering. Once the smouldering process was maintained, Airzone appears to have used standard methods and procedures to identify and quantify compounds emitted from the different types of smouldering coal that Airzone was tasked to test.

[75] In my opinion, a large part of the work undertaken in this project concerned the design of the testing chamber and the use of the chamber to mimic smouldering coal. I agree with the Respondent's submission that the testing chamber, although a little more sophisticated, was not that different from a home use barbecue. There was a heating coal that was inserted in the chamber to provide sufficient heat to commence the smouldering process. There were apertures in the chamber to control the amount of oxygen that flowed into the chamber.

[76] Secondly, unlike the three projects undertaken in 2014, there is no evidence in the record that shows that Airzone had difficulty establishing the identification and quantification of the emissions generated from different types of coal once the smouldering process was started. The smouldering process generated substantial water, which interfered with the measurement of other emissions by the continuous monitors. However, Airzone was nonetheless able to measure these emissions using different monitors, called integrated samplers. Once the emission compounds were measured, Airzone used an existing computer model developed by the United States Environmental Protection Agency to estimate the level of exposure at various locations around the terminal. I am of the opinion that Airzone has not demonstrated that the work undertaken in connection with this project was undertaken to achieve a technological advancement. Rather, I believe that Airzone knew what methods or processes could be used to mimic emissions from a smouldering coal pile and knew how to measure the emissions once the smouldering process was undertaken. What

Airzone did was measure emissions using standard methods and techniques typically employed when contaminants are released in a testing chamber.

[77] For all of these reasons, I conclude that the expenses incurred in connection with this project do not qualify as SR&ED.

B. Project #2 Measuring Phosphate Compounds at Low Concentration Levels

[78] Mr. Fellin testified that he was invited to attend a workshop sponsored by the World Bank to assist 12 African countries in looking at the process of eutrophication in large areas of Lake Victoria. Eutrophication is the process by which the oxygen levels in lakes are depleted because the aquatic environment is enriched with minerals and nutrients, causing algae and weeds to grow. Fishing in Lake Victoria is an important source of protein for people living in the area. The deposition of these compounds on agricultural land was also leading to lower rates of crop production.

[79] Mr. Fellin surmised that the problem was linked to the deposition of airborne phosphate and nitrate. According to Mr. Fellin, phosphate and other contaminants are released into the atmosphere because African farmers have adopted the practice of burning bio-mass to clear their fields for planting before the next rainy season. Once phosphate and other contaminants become airborne, they get carried away by wind currents to places that may be far away from farming activity. Eventually, as a result of dry or wet depositions, the contaminants are deposited in aquatic regions such as Lake Victoria. This leads to algae blooms, a decline in oxygen levels and a corresponding reduction in fishery resources.

[80] Following the workshop, a project was launched to measure airborne phosphate and other contaminants in the sub-Saharan region of Africa. Airzone hypothesized that if it could sample particulate matter in the air containing phosphate, then it would be possible to model the deposition to the ground based on wind field data collected over the sub-Saharan region. Airzone's role in this project was to engineer an appropriate system for collecting the airborne particles in the harsh sub-Saharan environment.

[81] The work undertaken by Airzone in connection with the design of a new detection system included the following:

- Selecting and integrating components, including a control box, a power source, valve pumps, etc. that Airzone hypothesized would be reliable enough to work in harsh environments.

- Programming the system to allow for variable sampling detection. According to Mr. Fellin, the system had to allow for day-time and night-time sampling because of the extreme difference in wind patterns during night and day.

- Conducting a set of tests to determine the air volumes required to achieve reliable detection volume.

[82] Airzone claimed the expenses associated with the above activities. The work undertaken in 2015 led to the production of three working prototypes that were employed in three different African countries to allow for a one-year test period to determine the reliability of the systems.

[83] The Respondent in her Reply acknowledged the automation and programming of the unique detection system designed and constructed by Airzone on its behalf by an electronic programming subcontractor. The Respondent has alleged, however, that the technical difficulties were overcome using established mechanical/electronic engineering knowledge and techniques. The Respondent also alleged that the work undertaken by Airzone involved the optimization of existing sampling techniques under various conditions to achieve greater certainty.

[84] This is a borderline project. On the one hand, I have Mr. Fellin's testimony that Airzone struggled with a lot of unknowns in connection with this project. It had to design and build working prototypes from the ground up. While some components were commercially available, Airzone had to design and build the flow system, control system, and day-time/night-time sampling regime. Airzone also had to conduct tests to write the software for the system, the meteorological parameters, and the sampling protocol. Finally, I have the Respondent's concession that Airzone satisfied all of the "how factors" in relation to the design and programming of this complex, allegedly first-of-its-kind, specialized sampling device. As noted earlier, I found Mr. Fellin to be a knowledgeable, reliable and credible witness. His testimony is also corroborated by the Respondent's concession that Airzone's work in connection with this project satisfied all of the "how factors".

[85] On the other hand, I have the Minister's factual assumption that the "why factor" was not satisfied in connection with this project despite the Respondent's acknowledgement that experimentation was undertaken to resolve challenges encountered with this project.

[86] In the end, I am satisfied that the technical challenges encountered by Airzone in connection with this project were unique and not previously resolved. Mr. Fellin

explained that since farmland burning is only practised in select regions, there have been very few studies on measuring airborne phosphate compounds. Consequently, there was no standard protocol for measuring airborne phosphates. This presented a host of challenges. First, because this was the first time that airborne phosphates were being measured in sub-Sahara Africa, there was no pre-existing data on what the phosphate levels would be. Therefore, the system would have to allow for the measurement of low or varying concentration levels caused by seasonal changes in wind patterns. To this end, Airzone had to balance the system's detection limit against the risk of overloading the filters. For example, increasing the flow rate would improve the detection limit -- but also increase the risk of overloading the filters. This was particularly the case in dry climates like the desert. Second, the sampling system had to withstand varying harsh conditions. One system was placed in the quasi-deserts of Malawi and had to survive frequent sandstorms. Another was placed in the rain forests of Ivory Coast where there were intense periods of rain. Third, because of the remoteness of the sampling locations, the sampling systems had to be both solar-powered and self-contained. The foregoing buttress Mr. Fellin's testimony on the technological advancement made by Airzone in connection with this project. Therefore, I conclude that Airzone has satisfied its factual evidentiary burden with respect to this project.

C. Project #3 Measuring Unknown Emissions in Curing Environments

[87] Plastic extrusion is the process by which different oil-based materials are mixed with different activators and then baked under high temperature to create plastic products. When the materials are subject to high temperature, they undergo a reaction — which may result in emissions that are different than the underlying material. A plastics manufacturer noticed that its employees were experiencing various allergic reactions. Airzone was retained to identify any unknown emissions to determine whether the extrusion process was causing these symptoms. To this end, Airzone sought to resolve two technological uncertainties:

1. Develop a test chamber and procedures for heating cured and uncured test components at 250 degrees Celsius to produce quantitative estimates of unknown emissions for analysis (volatile organic compounds ("VOCs")) and aldehydes were presumed to be the main substances emitted). Initial operation of the test chamber revealed problems sealing with standard materials, i.e., rubber or foam gaskets, since the materials generated spurious emissions and compounds that interfered with measurements. This was determined with blank chamber tests.

2. Experiment with the possibility of using a passive monitoring method to collect, measure and analyze unknown emissions created in a paint curing environment during the paint baking process at automotive manufacturing plants. The baking conditions potentially lead to formation of some degradation products. A comparison study was undertaken using active and passive monitors under typical conditions.

[88] Mr. Fellin indicated that research into existing patents of similar technology, such as US 6094968 A, did not provide directly applicable solutions for Airzone's specific problem. Consequently, experimentation was necessary to overcome the aforementioned technological uncertainties.

[89] December 2014: Mr. Fellin indicated that standard chamber tests are typically performed at ambient temperature (maximum 30 degrees Celsius) and the methods Airzone used to identify the unknown emissions are not used in high temperature situations. Most materials have emissions that increase exponentially under high temperatures and standard gaskets degrade quickly under these conditions and emit compounds that interfere with compounds emitted from the test component and thus their determination. Typically, components used to make chambers use rubberized or foam gaskets. Airzone needed to experiment with several alternative materials before emissions from gasket materials were significantly mitigated while maintaining chamber operating integrity. Eventually, the use of Viton gaskets yielded sufficiently low chamber blank levels that Airzone was able to measure emissions from the testing materials.

[90] Mr. Fellin explained to the Court that Airzone would typically use active sampling devices. However, they are bulky and cumbersome, potentially interfering with normal work performance. As a result, they may yield unrepresentative exposure measurements since normal working movements are modified to accommodate carrying the devices. Consequently, Airzone wanted to investigate the potential for using passive monitoring devices for the measurement of VOC exposures and for airborne degradation products in the oven baking environment and needed to determine their limitations in the determination of the VOCs and airborne degradation products. A comparison was devised between the passive and active devices under typical plant conditions to verify performance for workers in a variety of tasks. The comparison yielded data that demonstrated results within experimental precision for the methods, indicating the viability of the approach and a more convenient method of undertaking exposure studies under these conditions.

[91] Mr. Fellin asserted that as a result of the work with the chamber, Airzone identified a means of undertaking viable chamber measurements at elevated temperatures consistent with manufacturing conditions for typical electronic components. This approach can also be used for assessing emissions from components from other industries wherein higher temperatures are used in the manufacturing process.

[92] Mr. Fellin further asserted that for the monitoring method, Airzone was able to verify the performance of passive devices — they can be used much more conveniently in typical work-place environments and can validate the data produced. This therefore provides an alternative tool for assessing workplace breathing zone exposures while having a minimal impact on task performance for workers, thus making the results more representative.

[93] In my view, the work undertaken in this project constitutes routine engineering. Unlike project #2, the Respondent's argument that the work merely consisted of adjusting various parameters, is not an oversimplification of the work undertaken. The Appellant merely tried different gaskets until it found one that did not degrade under the heat. There was no evidence to suggest that Airzone faced difficulties in doing so. Mr. Fellin testified that while operating under high temperature is not part of standard procedure, they had an "inkling as to what direction [they] needed to pursue."[12] On cross-examination, he admitted that the Viton gasket is a commercial product that is known for its ability to withstand high temperature.

VII. CONCLUSION

[94] Considering the foregoing reasons, I have concluded that the Appellant's SR&ED Claim with respect to projects 1, 2 and 3 for the 2014 taxation year and project 2 for the 2015 taxation year should be allowed. I have also concluded that the Appellant's SR&ED Claim with respect to projects 1 and 3 for the 2015 taxation year were properly disallowed by the Minister.

[95] Therefore, the Appellant's appeal for the 2014 and 2015 taxation years is allowed and the matter is referred back to the Minister for reconsideration and reassessment in accordance with the above.

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[12] Trial transcript, vol 2, p 21.

Signed at Ottawa, Canada, this 21st day of February 2022.

"Robert J. Hogan"

Hogan J.

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