Food & Packaged Goods Industry

The following guidelines are intended to provide examples of "experimental development" projects which would qualify for Canadian SR&ED (Scientific Research & Experimental Development) tax credits.

Content Summary:

1 - Formula Ingredient Manufacturing Specs (FIMS):

Scientific or Technological Objectives:

[NOTE: THIS EXAMPLE IS REPRODUCED FROM THE FOOD AND CONSUMER PACKAGED GOODS SECTOR SR&ED GUIDANCE DOCUMENT AS PREPARED BY FOOD AND CONSUMER PRODUCTS MANUFACTURERS OF CANADA (FCPMC) AND CANADA REVENUE AGENCY (CRA)]

Desirable manufacturing and processing attributes are often accomplished by developing specifications for formulations and manufacturing parameters. (F.I.M.S. is the terminology used to describe this activity). In cases where such work involves a SR&ED project, those activities that directly contribute to the resolution of the technological uncertainties, qualify as SR&ED support activities.
[AN IDEAL TECHNICAL DESCRIPTION WOULD QUANTIFY THE OBJECTIVE PERFORMANCE PARAMETERS.]

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:
The technology involved in the development of product formulations and manufacturing process specifications usually requires SR&ED to meet consumer needs throughout worldwide geographical locations and temperature zones including:
1) Product stability,
2) Consistency in quality,
3) Flavor,
4) Texture,
5) Form,
6) Extended shelf life &
7) Safety
As some of the key attributes that this industry designs into its products.
[AN IDEAL TECHNICAL DESCRIPTION WOULD QUANTIFY THE PRESENT PERFORMANCE PARAMETERS MENTIONED ABOVE.]

Field of Science/Technology:

Food and beverages (2.11.01)

Intended Results:

- Develop new processes
- Develop new materials, devices, or products
- Improve existing processes
- Improve existing materials, devices, or products

Scientific or Technological Advancement:

Uncertainty #1: Agricultural material variability

Materials used by the food and consumer packaged goods industry in its wide range of products are primarily derived from agricultural or chemical sources which tend to exhibit chemical and physical variability. In the case of those materials derived from agricultural sources, this variability is largely caused by factors such as:
1) time of harvest,
2) change in species variety,
3) growing location and conditions,
4) seasonal climatic variation,
5) water availability,
6) Stress factors, etc.

The most significant underlying key variables are:
time of harvest (unresolved), species variety, growing location and conditions (unresolved), climatic variation, stress factors

Activity #1-1: Potentially eligible activities

Work performed in Fiscal Year 2009:

Methods of experimentation:

Due to the inherent variability of a wide variety of the materials used in producing food and consumer packaged goods, unanticipated and unacceptable results can occur, creating technological challenges that cannot be resolved using standard practice or knowledge available to the claimant. This may result in the performance of a SR&ED project to resolve the scientific and technological uncertainties encountered.

Results:

[NOTE: IF THERE WERE ANY TEST RESULTS FROM THIS ACTIVITY THAN THESE SHOULD BE STATED HERE]

Conclusion:

[AN IDEAL TECHNICAL DESCRIPTIONS SHOULD PROVIDE TECHNICAL CONCLUSIONS AS TO WHY THESE "RESULTS" AND RELATED "INTEGRATION ISSUES" WERE NOT "READILY PREDICTABLE" TO YOU FROM A TECHNICAL STANDPOINT?]

Key variables resolved: climatic variation, species variety, stress factors

Uncertainty #2: Additive integration

In the case of other materials used for food and consumer packaged goods including preservatives, flavors, binders, fragrances etc., manufacturing or other source specific factors may introduce differing degrees of material variability.

The most significant underlying key variables are:
preservatives (unresolved), flavors, binders, fragrances (unresolved)

Activity #2-1: Scale up and Commercialization

Work performed in Fiscal Year 2010:

Methods of experimentation:

In addition to the actual "small scale" formulations, as a project moves through various phases of development, frequent trials on a larger scale will be required. These experimental trials are often part of a SR&ED project using equipment of any appropriate scale.
[AN IDEAL TECHNICAL DESCRIPTIONS SHOULD DESCRIBE AND QUANTIFY THE TESTING PARAMETERS.]

Results:

[NOTE: SIMILARLY, IF THERE WERE ANY TEST RESULTS FROM THIS ACTIVITY THAN THESE SHOULD BE STATED HERE]

Conclusion:

[SIMIRLARLY FOR EACH ACTIVITY, AN IDEAL TECHNICAL DESCRIPTIONS SHOULD PROVIDE TECHNICAL CONCLUSIONS AS TO WHY THESE "SCALE-UP" AND RELATED "COMMERCIALIZATION ISSUES" DESCRIBED IN THE ACTIVITY ABOVE WERE NOT "READILY PREDICTABLE" TO YOU FROM A TECHNICAL STANDPOINT?]

Key variables resolved: binders, flavors

Uncertainty #3: Types of eligible sensory testing

The CRA admits that, "it is impractical to predict consumer reaction to a given prototype, based solely on meeting certain chemical or physical criteria that have been achieved scientifically." Industrial scientists cannot rely on data from laboratory analysis to predict consumer acceptance, hence consumer testing has emerged as a valid analytical tool used in support of SR&ED projects. Therefore consumer testing is eligible when used in support of a SR&ED project. The testing instrument may be trained sensory panels, employees, consumers and users.

The science of consumer testing involves the use of sensory evaluation techniques, which have been researched and documented by scientists. Sensory evaluation is defined as the scientific discipline used to evoke, measure, analyze and interpret reactions to characteristics of food and consumer products as perceived through the senses of smell, sight, taste, touch and hearing. These techniques are quantifiable and have been correlated to instrumental analytical measurements e.g. theological measurements, HPLC, NMR, NIR, texture analysis etc.

The most significant underlying key variables are:
sensory evaluation

Activity #3-1: Types of ELIGIBLE testing

Work performed in Fiscal Year 2010:

Methods of experimentation:

The term "organoleptic properties" is sometimes used to describe the sensory characteristics of these products. Consumer testing becomes eligible when it is used as an analytical tool in support of a SR&ED project.

The following types of (eligible) testing involving sensory testing are often utilized to evaluate experimental products during the experimental development process:

1. Discrimination testing which would include both Triangle testing and Difference testing.
2. Sensory panel testing which could involve either a professional trained panel of experts or a semi trained consumer group i.e. church group, scouts, guides, seniors etc.
3. Focus group testing or framework testing of experimental prototypes.
4. CLT (Central Location Test): pre recruited personal interviews to evaluate experimental product prototypes.
5. HUT (Home Use Test): an in home placement of experimental product prototypes generally with a questionnaire or other mechanisms to capture information related to the product design attributes.
6. In Situ Test: End use testing for service products used outside the home, in hospitals, food service operations, dental offices etc.

Conclusion:

The types of activities that are eligible are measurable.

Key variables resolved: sensory evaluation

Activity #3-2: Types of INELIGIBLE consumer research

Work performed in Fiscal Year 2010:

Methods of experimentation:

The following types of (ineligible) consumer research are often conducted to obtain information to assist in making marketing or business decisions about a product:

1. V HUT or Volume Home Use Test, which is conducted to measure the volume potential for a potential product launch i.e. a BASES test of commercial ready product to measure the volume potential.
2. Simulated Test Market is used to measure share of market potential and repeat purchase potential.
3. Product Positioning Research which can be done in a central location or in home and where the questions relate the product to the marketing concept, pricing, branding, positioning, and a measure of the purchase intent.
4. Copy Pre Testing where consumers react to advertising copy that describes a product and its use. Measures include product and brand name recall, persuasiveness, intent to purchase, likeability, memorability etc. No product prototypes are used in the test. Examples would include LINK or ASI testing for TV copy or STARCH testing for print advertising copy.
5. Ideation Research where consumers help to build a rough articulation of new products or brand positioning.
6. Continuous Tracking Research, which is typically a telephone based survey to track consumer awareness of advertising and brand imagery.
7. Usage and Attitude (U A) studies in which consumers provide a diary of their consumption behaviour and attitudes regarding a category of products.
8. Focus Group testing related to marketing programs, i.e. concept development, ideation research, product positioning etc.

Conclusion:

[AUTHOR'S NOTE: THE TYPES OF ACTIVITIES THAT ARE NOT ELIGIBLE ARE SUBJECTIVE AND ARE PRIMARILY RELATED TO MARKETING OR BUSINESS DECISIONS]

1 - Formula Ingredient Manufacturing Specs (FIMS)

Benchmarks: Internet searches: 15 sites / articles **Objectives:**

Uncertainty: 1 - Agricultural material variability **Key Variables:** climatic variation, growing location and conditions, species variety, stress factors, time of harvest

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Potentially eligible activities	(none)	(none)	species variety climatic variation stress factors	50.00	164.00	40.00	2009

Uncertainty: 2 - Additive integration **Key Variables:** binders, flavors, fragrances, preservatives

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Scale up and Commercialization	(none)	(none)	flavors binders	55.00	200.00	20.00	2010

Uncertainty: 3 - Types of eligible sensory testing **Key Variables:** sensory evaluation

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Types of ELIGIBLE testing	(none)	(none)	sensory evaluation	20.00	340.00	0.00	2010
2 - Types of INELIGIBLE consumer research	(none)	(none)	(none)	15.00	210.00	0.00	2010

901 - Develop film for crusty bakery products:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective
Tear Strength (g/µm)	5	10
Improve Film thickness (Microns)	5	50
Improve Tear Strength (g per microns)	10	15
Improve Puncture Strength (J per mm)	20	25
Improve Film clarity (%)	12	20
Improve MVTR (g/645 cm2/24 hours)	0.7	0.9
Minimize cost ($ per sq in)	0.23	0.16

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY THE CURRENT PERFORMANCE OF THE OBJECTIVES THEY ARE TRYING TO ACHIEVE. THE CURRENT AND DESIRED VALUES FOR AN OBJECTIVE HAVE BEEN ADDED ABOVE, TO ILLUSTRATE.]

The technological objective of this project is to develop large-scale manufacturing of a monolayer film for the baking industry. The film would be required to meet the following characteristics:
- Film thickness (5-50 microns (µm));
- Tear Strength (>10 g/µm);
- Puncture Strength (>20 J/mm);
- Film Clarity (min 12%); and
- Moisture Vapour Transmission Rate or MVTR (>0.7 g/645 cm2/24 hours).

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 25 sites / articles -- No solution found
- Patent searches: 3 patents -- No solution found
- Competitive products or processes: 10 products -- Current products use multilayer, multi-component structures, or don't meet food requirements.
- Similar prior in-house technologies: 1 products / processes -- breathable monolayer products using compounded additives are available
- Potential components: 1 product -- The use of inorganic fillers to produce breathable monolayer film is known.

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Currently, all breathable food-wrap in this market is made using multilayer, multi-component structures. While multilayer structures provide the necessary breathability for this demanding application, the production of such film is very expensive due to the cost of some of the layer materials and the capital cost of multilayer film extrusion equipment.

Although breathable monolayer products using compounded additives are available for the personal hygiene markets (diapers, medical garments), they have not been utilized for the baked goods packaging market to date. This is due to the technological difficulties related to achieving the required film characteristics for food packaging applications. The use of inorganic fillers to produce breathable monolayer film is known. However, those films do not meet the film clarity specifications for the baked goods industry. In this project the challenge is to provide a clear food wrap that will allow moisture vapor to escape so that the exterior of the bakery product does not soften and stays fresh.

Field of Science/Technology:

Food and beverages (2.11.01)

Intended Results:

- Improve existing processes
- Improve existing materials, devices, or products

Work locations:

Commercial Facility

Scientific or Technological Advancement:

Uncertainty #1: Types and Ratio of Fillers

The advancement sought in this project is to determine the types and ratios of fillers and the processing conditions required to meet the property profile for the baked goods packaging application. The company knew that they could achieve the desired film thickness and breathability separately, but they could not determine from all sources of readily available information how they could simultaneously achieve the required optical characteristics, breathability, and strength parameters for the monolayer film. The advancement sought is in the fields of plastics and extrusion technologies.

The most significant underlying key variables are:
film thickness, breathability, strength, extrusion conditions

Activity #1-1: Effect of various inorganic fillers on the MVTR

Work performed in Fiscal Year 2009:

Methods of experimentation:

- Process trials: 10 runs / samples - 5 different filler combinations tested, for each of two different film thicknesses.

  The purpose of this trial was to run a designed experiment using 4 different inorganic fillers both in isolation and in various combinations, at a loading of 1500 mg/kg, to determine the effect on the MVTR of a general-purpose polyethylene film. In this trial the two film thicknesses of 12 µm and 38 µm were selected to reflect the range of films in the marketplace. The experiment was expected to require 10 days, but there were significant problems encountered with feeding two of the fillers. As a result, after 3 days it was decided that the additive (filler) feed system would have to be modified.

Results:

- Tear Strength: 2 g/µm (no improvement)
- Improve Film thickness: 25 Microns (44% of objective)
- Improve Tear Strength : 10 g per microns (no improvement)
- Improve Film clarity: 8 % (no improvement)

Conclusion:

None of the product made during this experiment was saleable, nor could it be recycled due to the presence of the various fillers. It was sold as scrap. Materials were claimed in the SR&ED submission (see Table 1b). Senior plant management personnel signed off on this plant trial. The experimental trial was substantiated with detailed records.

Key variables resolved: breathability, film thickness, strength

Activity #1-2: Modification of additive (filler) feed system

Work performed in Fiscal Year 2009:

Methods of experimentation:

- Physical prototypes: 1 samples - The changes required were obvious (no alternatives considered), but this work had to be done before testing could continue.

  As a result of problems encountered during Trial 1, a substantial change was made to the additive (filler) feed system in this phase. The feed ports in the main extruder were relocated and the dry feeder auger was completely redesigned. The extrusion line was shut down for a period of 10 days to accommodate these changes.

Results:

[NOTE: IF THERE WERE ANY TEST RESULTS FROM THIS ACTIVITY THAN THESE SHOULD BE STATED HERE]

Conclusion:

A claim was made by the company for the labour needed to complete the equipment modifications. The plant was shut down and there was no production carried out during this phase of the project.

Key variables resolved: breathability, film thickness, strength

Activity #1-3: Further Investigation of the Effect of Fillers

Work performed in Fiscal Year 2010:

Methods of experimentation:

- Process trials: 20 runs / samples - 10 different filler combinations tested, for each of two different film thicknesses.

Due to the feed problems the results that were obtained in Trial 1 were unreliable. Consequently, all of the formulations in the designed trial were tested. Of the 10 combinations tested, only two (Combination A and Combination B) were identified as potential candidates for the intended application.

None of the film met all of the required specifications, and it was sold as scrap at less than 10% of cost. Materials were claimed in the SR&ED submission. Senior management was aware of potential impacts on process stability, but fully endorsed the design and implementation of this plant trial.

Results:

- Tear Strength: 9 g/µm (80% of objective)
- Improve Film thickness: 20 Microns (33% of objective)
- Improve Tear Strength : 11 g per microns (20% of objective)
- Improve Puncture Strength : 21 J per mm (20% of objective)

Conclusion:

At this point it was decided that further trials would be run with only Combination A and Combination B in order to explore the relationships between additive levels and various extrusion conditions on the properties of the monolayer film.

Key variables resolved: breathability, extrusion conditions, film thickness, strength

Uncertainty #2: Processing conditions

The company knew that they could achieve the desired film thickness and breathability separately, but they could not determine from all sources of readily available information how they could simultaneously achieve the required optical characteristics, breathability, and strength parameters for the monolayer film.

Processing conditions: temperature, polymer and additive flow rates, rotation speed.

The most significant underlying key variables are:
temperature, polymer flow rates, additive flow rates, rotation speed

Activity #2-1: Varying Processing Conditions

Work performed in Fiscal Year 2010:

Methods of experimentation:

- Process trials: 8 runs / samples - Varied temperature, polymer and additive flow rates.

[AUTHOR'S NOTE: THE DESCRIPTIONS BELOW WERE PROVIDED IN THE CRA'S EXAMPLE. THE DATA ABOVE (# TRIALS/ALTERNATIVES) IS PROVIDED TO ILLUSTRATE SOME OF THE ADDITIONAL DETAILS THAT WOULD IDEALLY BE INCLUDED.]

There were a number of changes made to key process variables to determine if the product specifications could be met. The extruder operation reached steady-state but the product could only be considered as "A-grade" by the end of Trial 4; prior to that the product was considered to be off-grade and could only be sold to lower-tier customers.

The off-grade product from Trial 4 was sold. The A-grade product was given to XYZ Bakery to manufacture bags and perform off-site tests. The costs associated with materials for off-site testing ($200) were claimed.

Results:

[NOTE: SIMILARLY, IF THERE WERE ANY TEST RESULTS FROM THIS ACTIVITY THAN THESE SHOULD BE STATED HERE]

Conclusion:

[AN IDEAL TECHNICAL DESCRIPTIONS SHOULD PROVIDE TECHNICAL CONCLUSIONS AS TO WHY THESE "RESULTS" AND RELATED "INTEGRATION ISSUES" WERE NOT "READILY PREDICTABLE" TO YOU FROM A TECHNICAL STANDPOINT?]

Key variables resolved: additive flow rates, polymer flow rates, rotation speed, and temperature

Activity #2-2: Additional Process Changes

Work performed in Fiscal Year 2010:

Methods of experimentation:

- Process trials: 5 runs / samples - Varied temperature, rotation speed.

[AUTHOR'S NOTE: THE DESCRIPTIONS BELOW WERE PROVIDED IN THE CRA'S EXAMPLE. THE DATA ABOVE (# TRIALS/ALTERNATIVES) IS PROVIDED TO ILLUSTRATE SOME OF THE ADDITIONAL DETAILS THAT WOULD IDEALLY BE INCLUDED.]

The goal of Trial 5 was to make further changes on the process conditions in order to improve the film optical properties by 10%, as recommended by XYZ Bakery (see off-site bakery trials work description above). For this trial the polymer and additive flowrates were unchanged and the secondary process variables were investigated. The optical properties of the resulting film were measured every four hours. Full evaluations of the entire range of film properties were done on a daily basis over the five days of the trial.

Results:

- Tear Strength: 15 g/µm (200% of objective)
- Improve Film thickness: 45 Microns (88% of objective)
- Improve Tear Strength : 15 g per microns (100% of objective)
- Improve Puncture Strength : 24 J per mm (80% of objective)
- Improve Film clarity: 15 % (37% of objective)
- Improve MVTR: 0.85 g/645 cm2/24 hours (75% of objective)
- Minimize cost: 0.18 $ per sq in (71% of objective)

The film produced had better than 10% improvement in optical properties and met all the other required specifications. The entire output film product was sold to Tier-1 customers as prime or "A-grade".

Conclusion:

The company demonstrated that they sought a technological advancement. The work was
Planned and carried out in a systematic fashion by qualified technical personnel. As such, this project meets the definition of SR&ED, that is, 248(1). All plant trials (1-5) and other work described in this project example is considered to be commensurate with the needs of the SR&ED project.

Key variables resolved: additive flow rates, polymer flow rates, rotation speed, and temperature

Project Name:	Develop film for crusty bakery products	**Start Date:**	2009-01-01
Project Number:	901	**Completion Date:**	2010-12-31

901 - Develop film for crusty bakery products

Benchmarks:
Internet searches: 25 sites / articles
Patent searches: 3 patents
Competitive products or processes: 10 products
Similar prior in-house technologies: 1 products /
Potential components: 1 products

Objectives:
Tear Strength: 10 g/µm
Improve Film thickness: 50 Microns
Improve Tear Strength : 15 g per microns
Improve Puncture Strength : 25 J per mm
Improve Film clarity: 20 %
Improve MVTR: 0.9 g/645 cm2/24 hours
Minimize cost: 0.16 $ per sq in

Uncertainty: 1 - Types and Ratio of Fillers

Key Variables: breathability, extrusion conditions, film thickness, strength

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Effect of various inorganic fillers on the MVTR	Process trials: 10 runs / samples	Tear Strength: 2 g/µm (-60 %) Improve Film thickness: 25 Microns (44 %) Improve Film clarity: 8 % (-50 %) Improve Tear Strength : 10 g per microns (0 %)	breathability film thickness strength	100.00	1,000.00	100.00	2009
2 - Modification of additive (filler) feed system	Physical prototypes: 1 samples	(none)	breathability film thickness strength	40.00	500.00	200.00	2009
3 - Further Investigation of the Effect of Fillers	Process trials: 20 runs / samples	Tear Strength: 9 g/µm (80 %) Improve Film thickness: 20 Microns (33 %) Improve Tear Strength : 11 g per microns (20 %) Improve Puncture Strength : 21 J per mm (20 %)	breathability extrusion conditions film thickness strength	60.00	700.00	0.00	2010

Uncertainty: 2 - Processing conditions

Key Variables: additive flow rates, polymer flow rates, rotation speed, temperature

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Varying Processing Conditions	Process trials: 8 runs / samples	(none)	additive flow rates polymer flow rates rotation speed temperature	80.00	200.00	0.00	2010
2 - Additional Process Changes	Process trials: 5 runs / samples	Tear Strength: 15 g/µm (200 %) Minimize cost: 0.18 $ per sq in (71 %) Improve Film thickness: 45 Microns (88 %) Improve Tear Strength : 15 g per microns (100 %) Improve Puncture Strength : 24 J per mm (80 %) Improve Film clarity: 15 % (37 %) Improve MVTR: 0.85 g/645 cm2/24 hours (75 %)	additive flow rates polymer flow rates rotation speed temperature	90.00	400.00	0.00	2010