Materials 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:

801 - Development of an UHMW-PE Abrasion Resistant:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective
Flexural modulus (GPa)	3.5	5
Maintain abrasion resistance (%)	100	100
Maintain impact resistance (%)	100	100
Maximum cost ($ per batch)	74	80

[AUTHOR'S NOTE: THIS EXAMPLE WAS ADAPTED FROM THE "PLASTICS MATERIALS, PROCESSING, EQUIPMENT & TOOL MAKING GUIDANCE DOCUMENT & CASE STUDIES" - APRIL, 2004. THIS DOCUMENT IS AVAILABLE FOR DOWNLOAD AT (www.cra.gc.ca/sred). THIS DOCUMENT WAS PREPARED BY A JOINT CANADA REVENUE AGENCY (CRA)-INDUSTRY SECTOR COMMITTEE.]

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY THE OBJECTIVES THEY ARE TRYING TO ACHIEVE. A QUANTIFIABLE OBJECTIVE HAS BEEN ADDED ABOVE, TO ILLUSTRATE.]

The objective is the development of a new product, which maintains abrasion and impact resistance while offering increased flexural modulus.

Additionally find a way to increase the flexural modulus without loss of abrasion resistance and impact resistance.

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 17 sites / articles -- 6 articles on cross-linked sheet
- Patent searches: 4 patents -- none were for similar application
- Similar prior in-house technologies: 1 products / processes -- In-house product needs higher flexural modulus, while maintaining abrasion & impact resistance.
- Queries to experts: 2 responses -- No info on flexural modulus

A company launched a new cross-linked sheet to meet their customer's need for improved abrasion resistance. After launching the product the company received a customer feedback indicating a liking for the abrasion resistance and impact resistance of the new material but a higher flexural modulus was desired. The company decided that it was necessary to try to develop a product that would maintain the abrasion resistance and impact resistance achieved through cross-linking as well as meets this new primary requirement of an increased flexural modulus.

Field of Science/Technology:

Materials engineering & metallurgy (2.05.01)

Intended Results:

- Improve existing materials, devices, or products

Work locations:

Commercial Facility

Scientific or Technological Advancement:

Uncertainty #1: To provide a less flexible product

Increasing the cross-linking of a polyethylene resin increases both the abrasion resistance and the impact resistance. At the same time this increased cross-linking will reduce the flexural modulus of the polymer. The obvious way to provide the customer with a less flexible product (by reducing the cross-linking) cannot be used since this will reduce abrasion resistance and impact resistance of the product. Hence a more creative solution must be found to meet these seemingly contradictory requirements.

The most significant underlying key variables are:
flexibility, abrasion resistance, impact resistance, material formulation, tensile strength, izod impact strength

Project Name:	Development of an UHMW-PE Abrasion Resistant	**Start Date:**	2008-01-01
Project Number:	801	**Completion Date:**	2008-12-31

Activity #1-1: Performing Experiments

Work performed in Fiscal Year 2008:

Methods of experimentation:

- Process trials: 35 runs / samples - 5 blends tested each on 7 different loading levels.

  [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 company carried out an extensive series of small scale laboratory experiments [HOW MANY?] to determine what effect a variety of additives have on the flexural modulus of the cross-linked product. Several additives were found that increased the flexural modulus of the product to the required levels.

  - The flexural modulus, abrasion resistance and all of the other secondary properties including: tensile strength, izod impact strength, coefficient of thermal expansion and coefficient of friction were tested on several [HOW MANY?] blends of each of these additives at a variety [HOW MANY?] of loading levels. These experiments provideds an optimum blend.

  - A production trial was carried out to determine what effect this formulation had on the processing of the product. Using standard processing parameters problems were encountered during both the mixing of the blend and compression moulding of the new material formulation. Laboratory experimentation [HOW MANY EXPERIMENTS?] in addition to several [HOW MANY?] production trials were carried out to determine how to obtain thorough mixing of the product and what the optimum pressure and temperature cycles are for the new formulation.

Results:

- Flexural modulus: 5 GPa (100% of objective)
- maintain abrasion resistance: 100 % (100% of objective)
- Maintain impact resistance : 100 % (100% of objective)
- Maximum cost: 81 $ per batch (116% of objective)

Conclusion:

[AUTHOR'S NOTE: AN IDEAL DESCRIPTION WOULD CONTAIN A CONCLUSION FOR THE CURRENT ACTIVITY. CAN WE PROVIDE ANY FURTHER TECHNICAL CONCLUSIONS AS TO WHY THESE "RESULTS" AND RELATED "INTEGRATED ISSUES" WERE NOT "READILY PREDICTABLE" TO YOU FROM A TECHNICAL STANDPOINT?]

[ADDITIONAL CRA COMMENTS REGARDING ELIGIBILITY: THROUGH THESE TRIALS & EXPERIMENTATION WE DEVELOPED THE KNOWLEDGE THAT ALLOWED US TO DEVELOP A PRODUCT THAT MET BOTH THE PRIMARY PROPERTY REQUIREMENTS OF IMPROVED ABRASION RESISTANCE AND HIGHER FLEXURAL MODULUS AS WELL AS THE SECONDARY PROPERTY REQUIREMENTS OF MAINTAINED TENSILE STRENGTH, IZOD IMPACT STRENGTH, COEFFICIENT OF THERMAL EXPANSION AND COEFFICIENT OF FRICTION.]

Key variables resolved: abrasion resistance, flexibility, impact resistance, material formulation, tensile strength, izod impact strength

801 - Development of an UHMW-PE Abrasion Resistant

Benchmarks:	Internet searches: 17 sites / articles Patent searches: 4 patents Similar prior in-house technologies: 1 products / Queries to experts: 2 responses	**Objectives:**	Flexural modulus: 5 GPa maintain abrasion resistance: 100 % Maintain impact resistance : 100 % Maximum cost: 80 $ per batch
Uncertainty:	1 - To provide a less flexible product	**Key Variables:**	abrasion resistance, flexibility, impact resistance, material formulation, tensile strength, izod impact strength

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Performing Experiments	Process trials: 35 runs / samples	Flexural modulus: 5 GPa (100 %) maintain abrasion resistance: 100 % (100 %) Maintain impact resistance : 100 % (100 %) Maximum cost: 81 $ per batch (116 %)	abrasion resistance flexibility impact resistance material formulation tensile strength, izod impact strength	45.00	0.00	0.00	2008

901 - Material Substitution:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective
Part width (cm)	8	10
Similar property balance (%)	100	100
Reduce cost of material ($ per batch)	75	60
Same shrinkage behaviour (%)	100	100
Improve production speed (batches per day)	2	3
Minimize maintenance required (hrs per week)	10	2

[AUTHOR'S NOTE: THESE EXAMPLES HAVE BEEN ADAPTED FROM THE "PLASTICS MATERIALS, PROCESSING, EQUIPMENT & TOOL MAKING GUIDANCE DOCUMENT & CASE STUDIES" - APRIL, 2004. THIS DOCUMENTS ARE AVAILABLE FOR DOWNLOAD AT (www.cra.gc.ca/sred). THIS DOCUMENT WAS PREPARED BY A JOINT CANADA REVENUE AGENCY (CRA)-INDUSTRY SECTOR COMMITTEE.]

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY THE OBJECTIVES THEY ARE TRYING TO ACHIEVE. A QUANTIFIABLE OBJECTIVE HAS BEEN ADDED ABOVE, TO ILLUSTRATE.]

Our objective is to identify a lower cost alternative to ABS as part of our cost reduction program, and to develop a process that produces extruded profiles for the appliance market using lower cost mass polymerized ABS in place of ABS produced by compounding technology. The initial application was for breaker strips for a refrigerator. Decorative extruded profiles can be manufactured in a similar process.

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 25 sites / articles -- No suitable alternative to ABS found
- Patent searches: 4 patents -- Insufficient data
- Similar prior in-house technologies: 1 products / processes -- Current in-house process uses a more costly material.
- Potential components: 2 products -- 2 machines that can handle extruded profiles
- Queries to experts: 3 responses -- information did not yield a solution

Our company is producing extruded profiles for the appliance market from ABS (Acrylonitrile-butadiene-styrene) produced with compounding technology. As a result of cost pressures in this extremely competitive market, the company was looking for alternative materials that would provide a similar property balance at a lower price. After looking at several alternatives and talking to our suppliers we decided to investigate the possibility of using a mass polymerization grade of ABS. Since a similar grade was chosen, the initial expectation was that the resin switch would be seamless. As part of the manufacturing routine the new profiles were put through the testing procedures to ensure performance was achieved. Although the resins had almost identical specifications, the shrinkage behaviour of the parts made from the new resin was different.

Field of Science/Technology:

Materials engineering & metallurgy (2.05.01)

Intended Results:

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

Work locations:

Commercial Facility

Scientific or Technological Advancement:

Uncertainty #1: Mass Polymerization

We are presently using ABS produced via compounding technology to manufacture extruded profiles for the appliance market. Our supplier has suggested that we can obtain similar results with ABS produced in a different process (mass polymerization). Although we chose a material with similar specifications, as in this case, they will often behave differently.

The most significant underlying key variables are:
Thermal properties, Mechanical properties, Processing conditions, molecular weight

Activity #1-1: Testing of new material

Work performed in Fiscal Year 2009:

Methods of experimentation:

- Process trials: 3 runs / samples - To test the 3 die prototypes.
- Physical prototypes: 3 samples

The new ABS (Acrylonitrile-butadiene-styrene was) was chosen because it had a similar molecular weight and was expected to have similar thermal properties (die swell, thermal conductivity, shrinkage, flow).

400 meters of product were produced in an experimental run that took four hours. This time was required to stabilize the line and allow the production of consistent material.

Testing of the parts produced showed that they met the mechanical requirements, but that the shrinkage was different from that which was predicted and hence the size of the parts was not correct.

The dies had to be modified by systematic investigation, since there was no way to predict the shrinkage with the accuracy required.

In the third trial, parts were obtained which consistently had the correct dimensions.

Results:

- Part width: 10 cm (100% of objective)
- similar property balance : 100 % (100% of objective)
- Reduce cost of material: 65 $ per batch (66% of objective)
- same shrinkage behaviour : 100 % (100% of objective)
- Improve production speed: 2.8 batches per day (80% of objective)
- Minimize maintenance required: 3 hrs per week (87% of objective)

Conclusion:

[AUTHOR'S NOTE: AN IDEAL DESCRIPTION WOULD CONTAIN A CONCLUSION FOR THE CURRENT ACTIVITY. CAN WE PROVIDE ANY FURTHER TECHNICAL CONCLUSIONS AS TO WHY THESE "RESULTS" AND RELATED "INTEGRATED ISSUES" WERE NOT "READILY PREDICTABLE" TO YOU FROM A TECHNICAL STANDPOINT?]

[ADDITIONAL CRA COMMENTS REGARDING ELIGIBILITY: REPLACEMENT OF ONE RESIN BY ANOTHER OR USING THE SAME RESIN PRODUCED IN A DIFFERENT PROCESS WILL OFTEN REQUIRED EXPERIMENTAL DEVELOPMENT. SUBSTITUTING A RESIN FOR A COMPETITIVE MATERIAL PRODUCED BY A DIFFERENT SUPPLIER (OR MANUFACTURED BY THE SAME SUPPLIER AT A DIFFERENT LOCATION) CAN REQUIRE SR&ED BUT IS MUCH LESS LIKELY.

IN THIS CASE SR&ED WAS REQUIRED. IN THE ABSENCE OF SCIENTIFIC PREDICTIONS, A SYSTEMATIC PROCESS OF TRIAL AND ERROR WAS USED TO MODIFY THE EXTRUSION DIES.

THE PROJECT CLAIM SHOULD INCLUDE THE LABOUR REQUIRED TO RUN THE TRIALS AND CARRY OUT THE PRODUCT TESTING. THE RESIN USED IN THESE TRIALS SHOULD ALSO BE PART OF THE CLAIM AS "MATERIALS CONSUMED". DISPOSAL COSTS OF SCRAPPED MATERIAL MIGHT ALSO BE INCLUDED IN THE CLAIM.

WHETHER OR NOT THE PROJECT IS SUCCESSFUL, WORK ON THE DIES CAN BE CLAIMED AS PART OF THE PROJECT. ANY DIES THAT IS SCRAPPED AS PART OF THE SR&ED WORK CAN ALSO BE INCLUDED IN THE CLAIM UNDER "MATERIALS CONSUMED" SECTION. IF THE DIES THEMSELVES ARE USED IN PRODUCTION THEN THEY BECOME "MATERIALS TRANSFORMED".]

Key variables resolved: Mechanical properties, molecular weight, Processing conditions, Thermal properties

Project Name:	Material Substitution	**Start Date:**	2009-01-01
Project Number:	901	**Completion Date:**	2009-12-31

901 - Material Substitution

Benchmarks:
Internet searches: 25 sites / articles
Patent searches: 4 patents
Similar prior in-house technologies: 1 products /
Potential components: 2 products
Queries to experts: 3 responses

Objectives:
Part width: 10 cm
similar property balance : 100 %
Reduce cost of material: 60 $ per batch
same shrinkage behaviour : 100 %
Improve production speed: 3 batches per day
Minimize maintenance required: 2 hrs per week

Uncertainty: 1 - Mass Polymerization

Key Variables: Mechanical properties, molecular weight, Processing conditions, Thermal properties

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Testing of new material	Process trials: 3 runs / samples Physical prototypes: 3 samples	Part width: 10 cm (100 %) Reduce cost of material: 65 $ per batch (66 %) similar property balance : 100 % (100 %) same shrinkage behaviour : 100 % (100 %) Improve production speed: 2.8 batches per day (80 %) Minimize maintenance required: 3 hrs per week (87 %)	Mechanical properties molecular weight Processing conditions Thermal properties	0.00	0.00	0.00	2009

1001 - New material for existing product design:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective
Cost of production ($/part)	0.02	0.01
Maximum Cost of moulded parts ($ per part)	0.06	0.04
Maximum Cost of mould ($)	55000	59000
Maximum Cost of material ($ per batch)	250	275
Increase production speeds (cycles per hour)	2.3	4

[AUTHOR'S NOTE: THIS PROJECT DESCRIPTION IS BASED ON THE CANADA REVENUE AGENCY'S (CRA) EXAMPLE OF AN ELIGIBLE PROJECT FROM THEIR PLASTICS INDUSTRY SR&ED APPLICATION PAPER (INFORMATION CIRCULAR 94-1)]

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY THE OBJECTIVES THEY ARE TRYING TO ACHIEVE. A QUANTIFIABLE OBJECTIVE HAS BEEN ADDED ABOVE, TO ILLUSTRATE.]

Bob works with an injection moulder and wants to develop a less costly material for making a part currently moulded from nylon 6, 6.

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 17 sites / articles -- Insufficient info
- Patent searches: 4 patents -- Formulations work with different processes.
- Similar prior in-house technologies: 1 products / processes -- Want to use existing mould, but it was designed for use with nylon.
- Queries to experts: 3 responses -- No info on alternate materials obtained

Field of Science/Technology:

Materials engineering & metallurgy (2.05.01)

Intended Results:

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

Work locations:

Commercial Facility

Scientific or Technological Advancement:

Uncertainty #1: Departures from standard practice

We are uncertain whether changes in viscosity and rheology resulting from the presence of fibres would permit the use of the existing mould. There was no known flow modeling software capable of predicting the performance or flow characteristics of the proposed material.

[NOTE: IT IS BEST TO PHRASE THE "UNCERTAINTIES" AT THE HIGHEST TECHNICAL LEVELS POSSIBLE AND ILLUSTRATE THE UNDERLYING PROBLEMS THROUGH SECTION III BELOW: I.E. INVESTIGATIVE "ACTIVITIES" AND RELATED CONCLUSIONS.]

The most significant underlying key variables are:
performance, flow characteristics, viscosity, rheology, fibre content

Activity # 1-1: Testing

Work performed in Fiscal Year 2010:

Methods of experimentation:

- Analysis / simulation: 1 alternative - Model developed - correlation of nylon vs. polypropylene flow variables.
- Physical prototypes: 41 samples - Polypropylene samples used to develop model, as outlined below.

[NOTE: CORRELATE RESEARCH STEPS TO THE UNCERTAINTIES IN QUESTION. IDEALLY WE CAN PROVIDE ABILITY TO DISPLAY CROSS-REFERENCES TO SUPPORTING TECHNICAL DOCUMENTATION INCLUDING LAB NOTES, DRAWINGS, RESEARCH PAPERS AND OTHER CORPORATE PAPERS OF TECHNICAL RELEVANCE.]

-We prepared samples of glass-fiber reinforced polypropylene of various compositions and fiber content and attempts to injection mould parts. This involved examination of 34 polypropylene samples: notes, preliminary hypotheses, & related test results (48 pages) - June 11- August 5

-These were used as a base to define the spectrum of expected viscosity & relays parameters under differing fiber levels, temperatures and pressures. Technical meeting notes (18 pages) - August 15-18

-The prototypes were then tested against the anticipated performance parameters. These tests involved the correlation of nylon vs. polypropylene flow variables & concluded that the desired mould could be formed - August 18-28 (22 pages)

-The prototype results were then combined with results from the additional industry models above. The resultant model was then developed involving the correlation of nylon vs. polypropylene flow variables & related conclusions regarding inter-relations of viscosity & rheology on mould parameters - August 30 (12 pages including seven prototype models subsequently revised)

For each research step we should briefly provide allocations or reasonable estimates for each of the following:

-Labor hours / employee
-Costs of any subcontracting, Universities or other third parties + brief explanation of their involvement
-Materials used in prototypes or experimental production + clarify if the prototypes were sold

[NOTE: THESE DETAILS CAN BE PROVIDED FROM YOUR ACCOUNTING SYSTEM (IF YOU USE JOB COSTING SYSTEM) OR AS SEPARATE SUMMARIES OTHERWISE. THE CRA ALSO REQUIRES THAT AT LEAST 90% OF THE WORK MUST BE PHYSICALLY PERFORMED IN CANADA. SUBCONTRACTORS MUST BE CANADIAN.]

Results:

- Cost of production: 0.016 $/part (40% of objective)
- Maximum Cost of moulded parts: 0.04 $ per part (100% of objective)
- Maximum Cost of mould: 60000 $ (125% of objective)
- Maximum Cost of material: 271 $ per batch (84% of objective)
- Increase production speeds: 3.8 cycles per hour (88% of objective)

Conclusion:

We determined that a polypropylene of a specific molecular weight and at defined levels of glass-fibre filling can indeed be successfully moulded, and that it can match the properties of the part previously made from nylon.

We refined our predictive models for injection moulding to include polypropylene of certain restricted glass fibre contents.

[IDEALLY, AN IDEAL DESCRIPTION WOULD PROVIDE FURTHER EVIDENCE OF RESULTS OR CONCLUSIONS, WHICH WERE UNEXPECTED AT THE OUTSET OF THE WORK.]

Key variables resolved: fibre content, flow characteristics, performance, rheology, viscosity

Project Name:	New material for existing product design	**Start Date:**	2010-01-01
Project Number:	1001	**Completion Date:**	2010-12-31

1001 - New material for existing product design

Benchmarks:
Internet searches: 17 sites / articles
Patent searches: 4 patents
Similar prior in-house technologies: 1 products /
Queries to experts: 3 responses

Objectives:
Cost of production: 0.01 $/part
Maximum Cost of moulded parts: 0.04 $ per part
Maximum Cost of mould: 59000 $
Maximum Cost of material: 275 $ per batch
Increase production speeds: 4 cycles per hour

Uncertainty: 1 - Departures from standard practice

Key Variables: fibre content, flow characteristics, performance, rheology, viscosity

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Testing	Analysis / simulation: 1 alternatives Physical prototypes: 41 samples	Maximum Cost of moulded parts: 0.04 $ per part (100 %) Maximum Cost of mould: 60000 $ (125 %) Maximum Cost of material: 271 $ per batch (84 %) Increase production speeds: 3.8 cycles per hour (88 %) Cost of production: 0.016 $/part (40 %)	fibre content flow characteristics performance rheology viscosity	0.00	0.00	0.00	2010

1002 - New Concrete Forming Method:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective
Coefficient of thermal expansion (10^(-6)/C)	13	7.5
Maximum deformation (mm/10cm span)	60	0.5
minimal cost increase ($ per kilogram)	33	35
Improve strength (PSI)	1000	1100

[NOTE: THIS PROJECT DESCRIPTION IS REPRODUCED FROM FACTS OUTLINED IN THE 1996 TAX CASE OF "RIS-CHRISTIE V. THE QUEEN (TAX COURT OF CANADA)"]

[AUTHOR'S NOTE: IDEALLY THE TAXPAYER WOULD ATTEMPT TO QUANTIFY THE OBJECTIVES THEY ARE TRYING TO ACHIEVE. A QUANTIFIABLE OBJECTIVE HAS BEEN ADDED ABOVE, TO ILLUSTRATE.]

The taxpayer in this case had developed a new concrete forming medium that was eventually patented. Though a patent was eventually granted for this process, the CRA went as far as challenging the fact that, "any new technologies were developed." Their main argument focused on the non-existence of, "systematic investigation," in that no evidence of repeatable experiments and subsequent analysis of those experiments took place.

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

- Internet searches: 5 sites / articles -- No relevant info found
- Patent searches: 3 patents -- The taxpayer started with a review of similar patented technology
- Queries to experts: 1 responses -- The taxpayer involved expert advice from an external engineering consulting firm.

[AN IDEAL DESCRIPTION WOULD DESCRIBE THE TECHNICAL LIMITATIONS TO THE READILY AVAILABLE INFORMATION.]

Field of Science/Technology:

Materials engineering & metallurgy (2.05.01)

Intended Results:

- Develop new materials, devices, or products

Work locations:

Commercial Facility

Scientific or Technological Advancement:

Uncertainty #1: Thermal stresses

As it is a composite system, even thermal rise would produce substantial stresses in the various components. Technical uncertainty would likely have existed with respect to the company's ability to model the problem analytically and then measure the thermal deformations.

[AUTHOR'S NOTE: UNFORTUNATELY, THE TAXPAYER PROVIDED VERY LITTLE EVIDENCE IN ITS OWN SUPPORT. HOWEVER, THE CRA EXPERT PROVIDED AN EXAMPLE OF ISSUES (AS DESCRIBED IN THE ACTIVITY SECTION) WHICH HE WOULD HAVE ACCEPTED WITHIN THE REALM OF ELIGIBLE SR&ED IN THIS CIRCUMSTANCE.]

The most significant underlying key variables are:
temperature, stress, time, moisture content

A c t i v i t y # 1 - 1 : P o t e n t i a l l y E l i g i b l e A c t i v i t i e s

Work performed in Fiscal Year 2010:

Methods of experimentation:

- Process trials: 32 runs / samples - 4 formulations each tested at 8 different temperatures.

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

  The expert witness for Revenue Canada provided a list of 10 potential technical issues that he would have expected to see examined in an eligible claim in the area of research under review, including;

  (a) What was the experimental set-up?
  (b) What test specimens were used?
  (c) How many specimens were tested?
  (d) What were the test parameters?
  (e) What temperature ranges was used?
  (f) What loading procedure was used?
  (g) Was foam injected and then temperature measures taken?
  (h) What device was used to measure the temperature?
  (i) At what location were the temperatures measured?
  (j) As it was a composite system, even thermal rise would produce substantial stresses in the various components. Was any attempt made to model the problem analytically and then measure the thermal deformations?

  [AUTHOR'S NOTE: IDEALLY WE WOULD ALSO EXPLAIN "WHY" ANY OF THE ABOVE DECISIONS WERE MADE. THESE TYPES OF ISSUES ARE CONSISTENT WITH THE TYPES OF PROBLEMS OUTLINED IN THE EXAMPLES OF THE PLASTICS INDUSTRY APPLICATION PAPER (IC 94-1) WITH RESPECT TO TECHNICAL CONTENT AND DOCUMENTATION REQUIREMENTS.]

Results:

- Coefficient of thermal expansion: 8 10^(-6)/C (90% of objective)
- Maximum deformation: 1 mm/10cm span (99% of objective)
- minimal cost increase: 35 $ per kilogram (100% of objective)
- Improve strength: 1050 PSI (50% of objective)

Conclusion:

* [AUTHOR'S NOTE: A FULL READING OF THE CASE AND SOME COMMENTS MADE BY THE TAXPAYER TO THE JUDGE HELPED TO ILLUSTRATE ADDITIONAL REASONS WHY THE TAXPAYER WAS UNSUCCESSFUL HOWEVER, THE MAJOR IMPLICATION TO CLAIMANTS IS THAT THE EXISTENCE OF A TECHNICAL PATENT DOES NOT AUTOMATICALLY INDICATE THE EXISTENCE OF ELIGIBLE SR&ED. PROBABLY THE MOST IMPORTANT LESSON FOR SR&ED CLAIMANTS IS THAT WE SHOULD BE ABLE TO ILLUSTRATE ANALYSIS AS TO THE RATIONALE FOR THE RESULTS DISCOVERED SO THAT THE PRINCIPLES CAN BE SYSTEMATICALLY ADDED TO THE COMPANY'S EXISTING KNOWLEDGE BASE.]

Key variables resolved: moisture content, stress, temperature, time

1002 - New Concrete Forming Method

Benchmarks: Internet searches: 5 sites / articles
Patent searches: 3 patents
Queries to experts: 1 responses

Objectives: Coefficient of thermal expansion: 7.5 10^(-6)/C
Maximum deformation: 0.5 mm/10cm span
minimal cost increase: 35 $ per kilogram
Improve strength: 1100 PSI

Uncertainty: 1 - Thermal stresses

Key Variables: moisture content, stress, temperature, time

Activity	Testing Methods	Results - % of Objective	Variables Concluded	Hours	Materials $	Subcontractor $	Fiscal Year
1 - Potentially Eligible Activities	Process trials: 32 runs / samples	Coefficient of thermal expansion: 8 10^(-6)/C (90 %) Maximum deformation: 1 mm/10cm span (99 %) Improve strength: 1050 PSI (50 %) minimal cost increase: 35 $ per kilogram (100 %)	moisture content stress temperature time	0.00	0.00	0.00	2010