MEUK CORPORATION
SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT
PROJECT DESCRIPTION – GENERAL GUIDELINES

Scientific or Technical Objectives:

[The project technical objectives should try to identify potential "technological advancement" by identification of departures from the "standard practices" outlined above as a basis for the related "technological uncertainties" below.]

Technology or Knowledge Base Level:

[The CRA clarifies that, “Commonly available sources of knowledge or experience are those that can reasonably be assumed to be readily available to those with basic training or experience in the field of concern. These resources enable them to be sufficiently qualified to participate in SR&ED. They also include knowledge that is available in the business context of the firm [but]….An enterprise may not have practical access to information proprietary to a competitor, or known in specialist or academic circles.”]

Scientific or Technological Advancement:

[The CRA clarifies that, “Achieving a technological advance would require removing the element of technological uncertainty through a process of systematic investigation. For an experimental development activity to be eligible the technological advance achieved has only to be slight.” As a result the project technical objectives should try to clarify technological advancement via identification of departures from the “standard practices” outlined above.]

Uncertainty #1: *Sample uncertainty*

[The CRA recognizes that, “the taxpayer may be fairly confident that the goals can be achieved, but may be uncertain which of several alternatives (i.e., paths, routes, approaches, equipment configurations, system architectures, circuit techniques, etc.) will either work at all, or be feasible to meet the desired specifications or cost targets, or both of these…” In this section we should try to clarify which variables are unpredictable with respect to determining the "optimal combination of components?" These issues are created by departures from standard practices.]

Description of Work in this Taxation Year:

Activity #1 - 1: *SAMPLE ACTIVITY*

[In this section we should try to clarify and illustrate examination of the variables in question and further illustrate the existing uncertainties on predicting or optimizing their inter relations.]

Conclusions:

- [In this section you want to reiterate any unexpected results try to provide related technical explanations or hypotheses.]

Activity #1 - 2:

Each Uncertainty (Triangle) can have an unlimited number of Activities (Circles) - **each with its own summary of tasks, conclusions and costs.**

Technical documentation - Ideally, referenced items should be those which exemplify that a series of alternatives had to be contemplated and/or tested, why the testing was felt necessary, and that the results of such testing was recorded.

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MEUK CORPORATION
SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT
PROJECT DESCRIPTION

Project #1 : **Name:** improve compounding equipment
SR&ED for the Fiscal Year Ending December 31, 2004
Date Project Started: June 1, 2003
Project was completed (or estimated to be completed): September 30, 2004
[Author's note: This description is based on the CRA information circular 94-1 (Plastics Industry Application Paper, New equipment, Example 2]

Scientific or Technical Objectives:

This project offers an example of modifying older equipment (the Gelimat) to produce a unique form of compounding equipment with advantages such as:
-high output rates,
-high dispersivity,
-absence of shear,
-ease of cleaning as changes are made from one compound to another, and
-low capital cost relative to conventional systems.

[Author's note: Ideally the taxpayer would attempt to quantify standard practice performance levels & methods and then benchmark these improvements against them.]

Technology or Knowledge Base Level:

Currently the company uses a piece of compounding equipment (the Gelimat) to produce a unique various products. [Author's note: Ideally the taxpayer would attempt to identify the specific methods or variables which create the perceived limitations with respect to obtaining the stated objective(s).]

Scientific or Technological Advancement:

Uncertainty #1: *Temperature control*

Although mechanical development such as changes in the angles of the rotating blades and increased speed permitting timely fluxing of most plastics without any external application of heat, uncertainty remained as to practical ways to sense and control the temperature. A fraction of a second too long near the fluxing point could lead to an increase of over 50ºC, and hence the potentially catastrophic degradation of plastics such as P.V.C.

Description of Work in this Taxation Year:

Activity #1 - 1: *Thermocouples*

Attempts at control by techniques such as by vibration and by thermocouples proved inadequate. [Author's note: Ideally the taxpayer would summarize the testing of the two control techniques and attempt to quantify some of the inter-relations which were observed and any related technical conclusions to explain these results.]

Conclusions:

- This new mixing technology proved unsuccessful for the compounding of P.V.C. and other shear-sensitive and/or temperature-sensitive plastics. [Author's note: Ideally the taxpayer would attempt to quantify some of the inter-relations which were observed and any related technical conclusions to explain these results.]

Activity #1 - 2: *Fibre optics*

Eventually, the development of a (patented) glass fibre-optics temperature-control system based upon sensing at millisecond intervals the infrared radiation given off by the material as it was heated permitted the fine temperature control (+/- 2?C) to process even P.V.C. to within a few degrees of its degradation temperature. [Author's note: Ideally the taxpayer would further attempt to illustrate a: “hypothesis, design, test, & modify” cycle to related to the above experimentation.]

Conclusions:

• This new mixing technology proved successful for the compounding of P.V.C. and other shear-sensitive and/or temperature-sensitive plastics. [Author's note: Ideally the taxpayer would attempt to quantify some of the inter-relations which were observed and any related technical conclusions to explain these results.]

• The R&D Base program also allows users to cross reference supporting information which is generated over the course of the work.

Some examples of the kinds of supporting information that should be available for on-site review by the Canada Customs and Revenue Agency (CRA) may include the following:

- Vibration & thermocouple test results from 140 samples June 11-22
- Fibre-optic preliminary investigation notes from technical meetings June 23 - 28 (22 pages)
- Prototype drawings of 4 fibre optic options - June 29 - July 17
- Prototype construction procedures and test results - July 18-27

- any other relevant material/information that substantiates that "technological uncertainties" were addressed within the SRED work.

[Author’s note: FOR ADDITIONAL “MACHINERY” INDUSTRY EXAMPLES - log into our “R&D Base” database at, www.rdbase.net. Username: user@machinery, Password: user]

ADDITIONAL EXAMPLES on “MOULDS, TOOLS & DIES” - log into our “R&D Base” database at, www.rdbase.net. Username: user@mtd, Password: user]

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SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT
PROJECT DESCRIPTION

Project #2: Software - database methodology

SR&ED for the Fiscal Year Ending December 31, 2004
Date Project Started: February 1, 2004
Project was completed: September 30, 2004
[AUTHOR'S NOTE: This project description is based on the CRA's example of an eligible project from their SR&ED Software development industry guidelines: Information Circular 97-1.]

Scientific or Technical Objectives:

To develop and implement a new data basing method in order to double the speed of the database currently achieved in Version 3.5 of our "property record management system."

Technology or Knowledge Base Level:

XYZ Co. has developed a proprietary DMS (database management system) as part of their PRMS (property record management system) product. The DMS works well with small data sets, but has excessive access times (>30 seconds) with large databases (>1 gigabyte).

[Author's note: This explanation of standard practice should attempt to outline "readily available information" on the topic considered and identify the boundaries of "known" and "unknown" variables. These in turn form the basis of the "technical uncertainties". This information is useful in helping the auditor to evaluate the company's "technical qualifications" with respect to the technologies in question.]

Scientific or Technological Advancement:

Uncertainty #1: *Relational Data Model Analysis -[Supporting Act.]*

What kind of negative effects might result from using a relational data model with the DMS?

Description of Work in this Taxation Year:

Activity #1 - 1: *Literature Review*

Conducted a literature review of relational data models. As a result we looked at 4 alternate data models.

[Author's note: Ideally, claimants would provide specific details as to how these models were evaluated (criteria or significant variables) and how they differed. In addition to a brief overview of the work performed, EACH ACTIVITY should attempt to cross-reference relevant, technical documentation including: document name, date, # of pages and location.]

Conclusions:

- Discovered that relational data models could be inefficient when used in the DMS in some circumstances.

[Author's note: The ideal conclusion would also briefly detail how these results compared with initial expectations and outline any further conclusions which could affect future developments of this nature.]

Uncertainty #2: *Relational Environment Issues*

How will using a data model designed for data communications in a relational environment affect performance?

Description of Work in this Taxation Year:

Activity #2 - 1: *Data Communications Model Analysis*

We experimented to determine if an existing data communications model could be adapted to achieve processing efficiencies, at the expense of additional storage space. [Author's note: Ideally the claimant would identify the test parameters or target specifications to define the efficiencies.]

Conclusions:

• Determined that a data communications model could achieve processing efficiencies. [Author's note: Ideally we would outline additional details such as "pros and cons" discovered with respect to this method - particularly those that were otherwise unexpected.]

This conclusion however uncovered new uncertainty with respect to the optimal method to combine relational and packet access methods. [Author's note: This uncertainty and related Activities are then separately described within Uncertainty #3.]

Uncertainty #3: *Relational Access + Packet Access Combination*

How can we optimally combine relational and packet access against the same database to yield a minimum # of inefficiencies when processing tables in the DMS?

Description of Work in this Taxation Year:

Activity #3 - 1: *Model Comparison Tests*

Conducted 7 comprehensive benchmark tests to compare performance between the two models. [Author's note: Ideally claimants would summarize some of the most significant variables examined and provide specific details as to how these databases differed and why this was believed to be technically significant.]

Conclusions:

• While some of the tables could be processed more efficiently if they were in packet form, others were best managed through relational techniques. [Author's note: The ideal conclusion would compare results with initial expectations and try to provide technical explanations for these differences.]

Activity #3 - 2: *Hybrid Model Attempt*

Experimentally employed a hybrid approach involving both relational and packet data management techniques in upgrading from PRMS 3.5 to 4.0. Created a prototype Data Model DMS with the intention of making it faster than the existing one. [Author's note: an ideal description would outline some of the major technical alternatives contemplated and related assumptions made.]

Initial testing indicated that the new DMS was 75% faster than the existing DMS through use of the newly developed hybrid data access techniques.

Conclusions:

• As a result of this work processing time for query and update capabilities was improved to <10 seconds for >1 GB databases. [Author's note: Ideally claimants would provide specific "conclusions" to explain "results" of the relational and packet data management combination vs. initial expectations. i.e. Why did some sets work better than others?]

[Author's note: FOR ADDITIONAL "SOFTWARE" SPECIFIC EXAMPLES - log into our "R&D Base" database at, www.rdbase.net. Username: user@software , Password: user]

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SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT PROJECT DESCRIPTION

Project #: 3
Project Name: Optimize DA Catalyst Recipe for Consistency improvements
SR&ED for the Fiscal Year Ending December 31, 2004
Date Project Started: August 1, 2004
Project was completed: December 31, 2004

[Author's note: This SRED project is based on an example developed by a Chemicals Industry Canada Customs Revenue Agency (CRA) joint committee entitled, "Chemicals Guidance Document #1 - Shop floor SRED - This document is available from the CRA website at www.CRA-adrc.gc.ca]

Scientific or Technical Objectives:

The primary technological objective of this project is to minimize catalyst batch-to-batch variability in order to increase the consistency of our resin. This will be achieved through the development of a correlation between catalyst fabrication conditions and the HDPE powder properties. For each batch the plant catalyst is tested on the lab-scale reactor. The powder properties (e.g. catalyst efficiency, bulk density, and powder morphology) will be correlated to the catalyst fabrication conditions. The information will be used to:

(a) eliminate Lab Scale Reactor testing of catalyst batches by RD personnel;

(b) determine whether a batch is "in control" with respect to parameters of interest; if out of control, the batch will be scrapped;

(c) predict the effect of catalyst batch on reactor operation and powder-drying system;

(d) develop specific plans for improvements to catalyst fabrication hardware.

A secondary objective was to successfully deploy a fibre optics probe and commission a new lab-scale reactor. The experimental work will require the application of these sophisticated tools to develop an empirical correlation between plant catalyst preparation conditions and polymer properties. This is the first such study of its kind in the shop-floor environment (see Activities).

Technology or Knowledge Base Level:

The company currently experienced catalyst batch-to-batch variability in the consistency of our resin due to unknown variables between catalyst fabrication conditions and HDPE powder properties.

Scientific or Technological Advancement:

Uncertainty #1: *Modelling of catalyst fabrication conditions*

From a technological point of view, it was technically not clear which catalyst fabrication conditions (such as metal ratio, zinc concentration, OH/Cl ratio) would have an impact on the powder properties of interest (i.e. Catalyst efficiency, bulk density, and powder morphology) or if there would be any statistically significant correlation of value for an empirically-based mathematical model.

Description of Work in this Taxation Year:

Activity #1 - 1: *Catalyst test trials*

1. Plant catalyst tested on the new lab scale reactor

2. Powder properties (12, 110 and bulk density) were control charted using a computer program
3. Catalyst preparation conditions (i.e. metal ratio, Zn concentration, OH/CI ratio) were also control charted
4. A preliminary correlation was developed
5. Improvements were made to the sampling system
6. Manufacturing installed a new meter to control the alkyl halide addition
7. Lab scale reactor bulk density and powder morphology information was used to predict drying problems in the unit with plant catalyst tested on the new lab scale reactor
8. Powder properties (12, 110 and bulk density) were control charted using a computer program
9. Catalyst preparation conditions (i.e. metal ratio, Zn concentration, OH/CI ratio) were also control charted
10 A preliminary correlation was developed
11. Improvements were made to the sampling system
12. Manufacturing installed a new meter to control the alkyl halide addition
13. Lab scale reactor bulk density and powder morphology information was used to predict drying problems in the unit

Conclusions:

• Results from this project have provided us with a better understanding of which catalyst fabrication conditions (such as metal ratio, zinc concentration, OH/Cl ratio) would have an impact on the powder properties of interest (i.e. Catalyst efficiency, bulk density, and powder morphology).

The information garnered from the various control charts was successfully used to plan the following years RD and Manufacturing activities, e.g. new meters for catalyst raw material metering, increase frequency of side stream analysis, refinements to catalyst database, etc.

In addition, the preliminary database was used to successfully predict V100 efficiency and powder morphology, which is a significant technology advance within the company. We also learned that coarse lab scale reactor powders often resulted in drying problems within the plant based on the study which showed correlations between various powder parameters and drying properties.

Activity #1 - 2: *Other "post SR&ED" Activities:*

1. Safety training conducted on new systems
2. Safe operating procedures documentation written

[Note: These activities are ineligible for SRED credits purposes since their performance does not directly address any of the stated "technological uncertainties."]

Conclusions:

[Author's note: FOR ADDITIONAL EXAMPLES SPECIFIC TO THE "PLASTICS" AND "CHEMICAL" industries, log into our "R&D Base" database at, www.rdbase.net : Username: user@chemicals , Password: user]

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SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT
PROJECT DESCRIPTION

Project # 4 : Plant breeding example

SR&ED for the Fiscal Year Ending December 31, 2004
Date Project Started: February 1, 2003
Project was completed: September 10, 2004

[Author's note: Reproduced from the CRA Plant Breeding &Seed Industry SR&ED Guidance Paper - available from the Canada Customs & Revenue Agency website at http://www.CRA-adrc.gc.ca/taxcredit/sred/plant-e.html]

Scientific or Technical Objectives:

The objectives of this plant breeding project are to develop soybean cultivars, for the 2600 to 3000 heat unit areas of Eastern Canada, that offer the following improvements over existing cultivars:

- 10% improved yield over currently available cultivars
- 10% improved lodging resistance over currently available cultivars
- no sacrifice of resistance to leaf disease(s) or Phytophthora root rot.

[Author's note: As illustrated above and below, ideally the taxpayer would attempt to quantify standard practice performance levels & methods and then benchmark these improvements against them.]

Technology or Knowledge Base Level:

a) Initial Standard Practice(s):

Soybeans are typically accompanied by maturity delays or increased susceptibly to lodging and disease(s).

The scientific/technological advancement expected in this plant-breeding project is the development of a new cultivar that embodies the genetic traits for higher yield and resistance to lodging in a genotypic combination that surpasses the performance features of existing cultivars without compromising disease resistance. [Author's note: Ideally, the taxpayer would attempt to identify the specific methods or variables which create the perceived limitations with respect to obtaining the stated objective(s).]

Scientific or Technological Advancement:

Uncertainty #1: *feasibility of genetic traits*

The scientific/technological uncertainty relates to the feasibility of combining the desirable genetic traits from different germplasm sources into a superior performing cultivar out of thousands of possible segregating genotypic outcomes resulting from hundreds of crosses.

Description of Work in this Taxation Year:

Activity #1 - 1: *Experimental crosses*

During the current taxation year (2002), the following work was undertaken and progress attained included:

- 120 new parental crosses were made in the nursery
- 4500 F3 lines meeting our selection criteria from the 2001 crosses were advanced to F6 by single seed descent using winter nurseries
- 5000 F6 Lines originating from the 2000 crosses were tested in preliminary yield trials at 2 locations and 200 selected that met the criteria for further advancement
- 150 advanced lines from the 1999 crosses were tested in advanced trials in 4 locations and 6 elite performers selected for wide area testing

- 5 finished. lines originating from the 2000 crosses were tested in pre-commercial co-op trials at 8 locations, and tested in official public co-op registration trials.
- Official tests will be used to corroborate our disease, quality and performance results and select candidates for registration and commercialization.

[Author's note: Ideally, we would also explain "why" any of the above decisions were made.]

Conclusions:

• Incremental advances were made towards some of the intended scientific objectives:
· the enhanced yield trait was more successfully transferred from (xx) genotypes than from (yy) or (zz) genotypes
· there was a negative correlation between yield and early maturity (i.e. < 2900 heat units)

[Author's note: Ideally, we would compare results to initial expectations and provide explanations or "conclusions," for results that were unexpected at the outset of the work.]

Uncertainty #2: *Maintain disease resistance*

Additionally, scientific uncertainty relates to the feasibility of achieving this result without sacrificing disease resistance, which is often compromised with yield improvements.

Description of Work in this Taxation Year:

Activity #2 - 1: *Disease testing*

5 finished lines originating from the 2000 crosses were tested in pre-commercial co-op trials at 8 locations, and tested in official public co-op registration trials. Official tests will be used to corroborate our disease, quality and performance results and select candidates for registration and commercialization.

Conclusions:

• Resistance to soil borne diseases (e.g. Sclerotinia, Alternaria) was influenced more by plant stature (i.e. lodging trait) than the presence of the disease resistance gene itself due to the closer proximity of foliage to the soil in lodged specimens. As a result of this work five lines yielded at least 5% above commercial check varieties, with improved lodging and acceptable disease resistance. [Author's note: Ideally, we would compare results to initial expectations and provide explanations or "conclusions."]

As a guideline, some examples of the kinds of supporting information that should be available for on-site review by the Canada Customs and Revenue Agency (CRA) may include the following:

- background literature related to a project objectives and plan
- record of genetic crosses
- nursery data books
- records of field trials
- notes on experimental procedures
- project note books and/or quantitative measurement data
- results of statistical analyses
- any other relevant material/information (e.g. photos) that substantiates the SR&ED work

[Author's note: FOR ADDITIONAL "AGRICULTURAL" AND "LIFE" SCIENCE EXAMPLES log into our "R&D Base" database at, www.rdbase.net. Username: user@agri, Password: user]