SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT (SR&ED)

SECTOR-SPECIFIC GUIDELINES

CHEMICALS GUIDANCE DOCUMENT #2 – QUALIFYING WORK (REVISION 1)*

Table of Contents

* Practical Guide to Self-assessment of an SR&ED Claim

This document has been prepared by a Chemicals Industry and CCRA joint Committee (**see Appendix B**)

SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT (SR&ED)

SECTOR-SPECIFIC GUIDELINES

CHEMICALS GUIDANCE DOCUMENT #2 – QUALIFYING WORK

1. INTRODUCTION

1.1 This guidance document is intended to be used to aid in determining those aspects of chemical-related research and development that meet the definition of Scientific Research & Experimental Development (SR&ED) under subsection 248(1) of the *Income Tax Act*, which defines SR&ED as:

"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 and psychological research where the work is commensurate with the needs, and directly in support, of work described in paragraph (a), (b) or (c) that is undertaken in Canada by or on behalf of the taxpayer,

but does not include work with respect to

(e) market research or sales promotion,

(f) quality control or routine testing of materials, devices, products or processes,

(g) research in the social sciences or the humanities,

(h) prospecting, exploring or drilling for, or producing, minerals, petroleum or natural gas,

(i) the commercial production of a new or improved material, device or product or the commercial use of a new or improved process,

(j) style changes, or

(k) routine data collection.

1.2 The three criteria for characterizing eligibility -- scientific or technological advancement, scientific or technological uncertainty, and scientific and technical content -- are discussed in Sector Specific Guidelines I (Chemicals Guidance Document – Shop Floor SR&ED **[Reference 1]**). It is important that these criteria be understood completely by the claimant prior to submission of the claim. The purpose of this guidance document is to supplement the documents: i) Information Circular 86-4R3 **[Reference 3]**, ii) "Chemicals Guidance Document 1 – Shop Floor SR&ED" **[Reference 1]**, and iii) "Recognizing Experimental Development" **[Reference 9]**, to clarify what work meets the definition of SR&ED, and provide specific examples to assist the "Chemicals SR&ED Performers" in the interpretation and practical application of the SR&ED program. ***"Chemicals Guidance Document 2- Qualifying Work" is intended to assist technical managers and staff in identifying qualifying SR&ED work.*** It will be updated periodically as required to reflect changing technology and other issues that arise. The latest version of this document is posted on the CRA's SR&ED Web site at: http://www.cra-arc.gc.ca/taxcredit/sred/publications/guidance-e.pdf

1.3 This guidance document deals with both the technical aspects of the SR&ED claim and with relevant expenditure-related issues. For a complete description of expenditure-related issues, the reader is referred to Interpretation Bulletin IT-151R5 (Consolidated) **[Reference 2]**, *Scientific Research and Experimental Development Expenditures*. ***It is important to note that, even if a project meets the definition of SR&ED, it does not imply that all the expenditures are allowable; this is discussed further in Interpretation Bulletin IT-151R5* (Consolidated).**

1.4 All of the experimental and analytical work associated with the search to resolve the technological problems in the chemical sector are part of the "*envelope of SR&ED" (**see Glossary**)*, when undertaking basic research, applied research, or experimental development **[Reference 3]**. The "envelope" also allows direct support work concerning engineering or design, operations research, mathematical analysis or computer programming, data collection, testing, or psychological research.

1.5 **Examples have been presented in Section 4 of this guidance document to illustrate how to self-assess an SR&ED claim for actual chemical industry-type projects at different stages of development.** The examples are illustrative of the types of projects claimed in this industry, but are not intended to be exhaustive. The examples have been designed to focus around the following principal stages in the normal cycle of experimental development for many chemical companies:

- Definition of Concept/Technological Challenge (Example 4.1)
- Systematic Program to Achieve Technological Objective (Examples 4.2, 4.3, 4.4; lab-scale, bench-scale, and technical-scale reactors respectively)
- Development of Prototype or Pilot (Example 4.5)
- Scale Up to Commercial Production Stage for a New Technology (Example 4.6)

- Experimental Production or Utilization using New Technology on Existing Equipment (Example 4.7)
- Experimental Production or Utilization using New Technology on Existing Off-site (Customer's) Equipment (Example 4.8)
- Post Production Improvement (Example 4.9)

The technical description that is included for each example is to provide a framework that allows the reader to initiate self-assessment. During the self-assessment phase, potential work and expenditures are identified, and shown in a tabular format at the end of the example. A more detailed discussion on how to prepare a technical project description can be found in Chemicals Guidance Document 1: Shop Floor SR&ED.
http://www.cra-arc.gc.ca/taxcredit/sred/publications/chemdoc-e.pdf

Examples 4.1 through 4.5 illustrate the progressive development of a new catalyst technology from the conceptual stage (Example 4.1), through to various experimental stages, including: lab-scale (Example 4.2), bench-scale (Example 4.3), technical-scale (Example 4.4), and pilot-scale (Example 4.5). For Examples 4.1 through 4.5, a batch mode of operation is assumed.

In comparison, with Examples 4.1- 4.5 (for a batch mode of operation), Examples 4.6 through 4.9 illustrate continuous chemical processes. Example 4.6 illustrates the "non-routine" scale-up to commercial scale of the 'new catalyst technology' (described in Examples 4.1- 4.5). Example 4.7 illustrates experimental development using the 'new catalyst technology' on the shop floor. Example 4.8 focuses on several key concepts involved in the toll manufacturing process (**see also Subsection 2.5.2**). In Example 4.9, a completely different type of process technology (water treatment plant) is presented, and it illustrates the concept of "post-production improvement" to an existing gas-phase polyethylene plant.

2. DISCUSSION OF THE TERMINOLOGY USED WITHIN CONTEXT OF SR&ED PROGRAM

2.1 Work, Projects, and Programs

There is a hierarchy of terms used in describing the SR&ED effort. The top level is a "*program*", which may consist of a number of "*projects*" that typically have a number of linked "*areas of work*". Eligibility is determined at the project or program level. A program's technological objectives are broader and, conceptually, the advancement sought is described at a higher level than that of a project. Claimants should contact their local CRA office prior to filing their work at the program level **[also see Reference 10]**.

Within the context of research and development in the chemical sector, individual work may be routine or standard practice, but is linked to high-level common technological objectives. These individual areas of work may qualify if they are commensurate with the needs, and undertaken directly in support of projects or programs that meet the definition of SR&ED. However, this does not rule out individual work from qualifying as SR&ED on its own merits if it meets the requirements of subsection 248(1) of the Act.

2.2 What Constitutes Standard Practice?

For SR&ED work, it is necessary to take into consideration the "standard practice" of both the industry and the particular company. In general terms, the industry's "standard practice" can best be defined as the body of knowledge within the public domain, which would generally be considered readily available to a company. On the other hand, a company's "standard practice" is a combination of its own knowledge, and the body of knowledge in the public domain.

Experimental development by Company A that duplicates Company B’s proprietary knowledge could represent a technological advancement for Company A if such knowledge was not available to Company A prior to, or during, the course of the work. The project need not be successful in achieving its technological objectives as long as there is the attempt to achieve a technological advancement.

Routine or straightforward application of common practices and knowledge of a different sector (software, for example) to the chemical sector do not qualify. But application of technology in a way previously thought not to be possible or not done, or combining knowledge from multiple technological areas to create new possibilities that lie in the “grey” areas between traditionally recognized areas of technology may be SR&ED. Such determinations have to be made on a facts-based assessment using the three criteria.

For example, while a company may use software in the process of carrying out an SR&ED project, the advancements being sought may be totally unrelated to computer science/information technology, such as the mathematical modelling of complex chemical reactors (see example given below). CRA’s technical reviewer will evaluate whether the software work was commensurate with and directly in support of an eligible SR&ED project. The correct project at the appropriate level needs to be identified by the claimant, which is subsequently reviewed by CRA.

The following example is intended to illustrate a qualifying SR&ED project where custom application software is developed for a specific chemical industrial application. (**See also Table 4.7 (line N)**)

Project Example: LLDPE Exploration - Dynamic Mathematical Model (coded in Visual C++) of the Gas Phase Fluidized Bed Process

Project Description

The work claimed covers SR&ED pertaining to the “Linear Low Density Polyethylene (LLDPE) Gas Phase” project carried out at ABC Chemicals Company. In particular, a dynamic mathematical computer model of the gas phase fluidized bed process was developed for several different reactors used by ABC Chemicals.

Scientific or Technological Objective:

The general objective of this program is to develop sophisticated hydrodynamic and kinetic models (coded in C++) describing the gas phase process for the company's bench scale, technical scale, pilot scale, and commercial scale reactors. The mathematical models were derived from first principles, with a number of simplifying assumptions based upon experimental data collected from the various reactors.

Scientific and Technical Content:

Experimental data was collected from the bench, pilot, and plant-scale reactors by technicians or process operators. At the same time the company's engineering staff was developing sophisticated mathematical models to represent the complex hydrodynamics and reaction kinetics occurring in these gas phase reactors. Work included the incorporation of two-catalyst capability into commercial scale software model to enable catalyst transition studies.

The mathematical models were programmed in C++ by the company's software developers in the IT department. Engineers worked with programmers to ensure that polymer properties were introduced into the mathematical model for melt index and polymer density. Alpha---Cat-C Kinetics was also incorporated, and the compiled C++ code was then validated using the twenty grades produced at the plant.

The models were then calibrated with experimental data obtained from the field. Where the model predictions were not in agreement with the experimental data, the engineers revisited the assumptions used in the model development to account for the discrepancies. After several such iterations, the company had reliable models that were subsequently used to simulate a variety of plant-scale processing strategies.

Scientific or Technological Uncertainty:

There was technological uncertainty as to whether the mathematical models would be sufficiently rigorous to accurately represent the complex hydrodynamics of the gas phase processes. In fact, on the first few iterations of the model development, there was poor correlation observed between the results of the model prediction and the experimental data. It was also technologically uncertain if the models could account for a number of "dead zones" in the plant-scale reactor.

Scientific or Technological Advancement:

With mathematical models that accurately simulate the plant-scale reactor available, the company could rapidly obtain reliable process information on a variety of different processing strategies, without having to carry out costly shop floor runs. In addition, the predictions from the model simulations provide company engineers with valuable insight about the gas phase hydrodynamics occurring in the various reactors that was not previously available.

2.3 Trouble-shooting, Debugging, and Fine-tuning

Trouble-shooting, debugging and fine-tuning generally have technical work associated with them. Such work is often associated with the installation of new equipment, processes or technology or with quality control supporting an on-going operation. Often such work will be to demonstrate the capability of the equipment or process to meet the requirements defined in specifications that have previously been met under very similar circumstances. Such work is not eligible in its own right when the outcome is reasonably predictable based upon a company's technology base and standard practices. However, if it can be shown that in the process of trouble-shooting and debugging a new technological uncertainty occurs, then the work that is directed at resolving this specific uncertainty is eligible. This work should be claimed, identifying the new technological uncertainty and advancement that is involved. The reader is also referred to an illustrative example in Section 5.4 in Reference **[1]** – "Chemicals Guidance Document 1 - Shop Floor SR&ED"**.**

2.4 Pilot Plant

The construction and operation of a pilot plant falls within the scope of experimental development (**also see Example 4.5**). However, capital costs for the acquisition of a building or a leasehold interest in a building, other than a "special-purpose building", as defined in the Income Tax Regulations, will not qualify for SR&ED tax incentives. Current expenditures directly related to the development or operation of a pilot plant may qualify for SR&ED tax incentives. Examples of current expenditures include:

- Labour used and materials consumed or transformed in resolving technological uncertainties
- Labour used and materials consumed or transformed in resolving the technological uncertainties of developing equipment for incorporation in the pilot plant.
- Labour used and materials consumed or transformed in operating a pilot plant.

Capital costs relating to equipment purchased, i.e. "off-the-shelf", or developed for the pilot plant may qualify subject to meeting the "all or substantially all (ASA) test" for SR&ED capital expenditures. Equipment that does not meet the ASA test may be considered to be shared-use-equipment provided the SR&ED use requirements for first and second term shared-use-equipment are met. *The equipment must also not be a prescribed depreciable property* **[see Glossary]**.

The actual size or capacity of such equipment or facilities is not a factor. The pilot plant facilities or prototypes in one case may be larger than the actual commercial facility or equipment in another. What is important is the facts-based determination of the actual use made of the facilities, equipment, or product.

These must be used to resolve technological uncertainties if the associated work is to be considered as SR&ED.

2.5 Experimental Production

A new Application Policy (AP) SR&ED 2002-02R entitled "Experimental Production and Commercial production with experimental development work – Allowable SR&ED Expenditures" has recently been released **[Reference 11].** This document highlights the current CRA Application Policy with regard to the treatment of shop floor SR&ED when there may be mix of commercial production, with or without experimental development, and experimental production.

2.5.1 Allocation of Costs for SR&ED:

The following methodology should be followed for cost allocations for SR&ED. Also see Sector Specific Guidelines I (Chemicals Guidance Document – Shop Floor SR&ED **[Reference 1]**) for a specific example.

- There are two methods that can be used to make an SR&ED claim. The amount of allowable and qualified SR&ED expenditures that can be claimed in a year will depend upon which of these two methods a claimant selects. A claimant may choose to use the traditional method or elect to use the proxy method for the year. The traditional method requires that each overhead expenditure that is claimed must be specifically identified. When the proxy method is used, a notional amount, the prescribed proxy amount (PPA), is calculated to represent an approximation of overhead expenditures. Instead of identifying and allocating the overhead expenditures incurred in the year, the PPA is used to calculate qualified expenditures for ITC purposes. Or instead of including a long explanation, we make refer to Appendix A.1 for an explanation of the two methods.
- Not all labour using the traditional method (e.g., the labour used in putting the product into a saleable state) will be directly attributable to the prosecution of SR&ED.
- Under the proxy method, only directly engaged labour is allowable.
- In the traditional method for claiming overheads and other directly related and incremental expenditures (or simply, "traditional method" in the tables in Section 4), the costs of materials necessary for the experimental production is all or substantially all attributable to the prosecution of SR&ED. This is because the materials are consumed ***or*** transformed in performing the tests.
- The costs of materials consumed and the costs of materials transformed in the prosecution of SR&ED may be claimed when using either the traditional method or the proxy method. On December 20, 2002, the Department of Finance issued Draft Technical Amendments to the *Income Tax Act*, which included a proposal to allow the costs of materials transformed when a claimant elects to use the proxy method. This proposal will apply as if it was law as of December 20, 2002. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

- Unless there are specific comments on the project in the Technical Reviewer's report, there is no technical basis for disallowing the costs of materials or project work related to experimental production. Also see AP 2002-02R **[Reference 11]** for further discussion of this issue.
- There will be a full or partial recapture of ITC relative to materials transformed when products from the experimental production are sold. There is no recapture on SR&ED salaries and SR&ED overheads incurred by the claimant. Also see **[Reference 6]**.

2.5.2 Toll Manufacturing

There are many cases in the chemical industry where the holder of the technology (Company A) needs to outsource the experimental production and/or the commercial production to a potential customer (Company B) or an unrelated third company (Company C). Typically, Company A would require the manufacturing of a value-added product, for which there is already a waiting list of potential customers. This practice is referred to as "***toll manufacturing***". Toll manufacturing is an example of work that a company may outsource.

Company A may choose to practice toll manufacturing for a variety of reasons including:

a) Company A does not have the available capacity with their existing internal process equipment;
b) Company A engages only in the development of new or novel technology, and out sources all manufacturing to Company C;
c) Company A does not have the financial resources to either retrofit existing equipment or purchase new equipment;
d) Company A is experiencing quality control issues with their existing commercial operation;
e) The total cost of manufacturing (including labour, materials, and capital) is prohibitive and is above what senior management is willing to spend;
f) Company A is a small business which has dedicated all of its resources (equipment and experience/qualifications of staff) to the manufacture of one type of product;
g) Company A is unwilling to venture into other business lines before demonstrating the new technology on existing off-site process equipment (at Company B or Company C), to minimize the technical and financial risks to Company A;
h) Company B has a specific need for a niche product for which Company A has the intellectual property (process technology), but Company B has the equipment and process experience with the equipment for other types of chemical processes.

An example of toll manufacturing is provided in Example 4.8 that is intended to illustrate some of the above points, specifically items a), d), e), g), and h). For details regarding the SR&ED claim, see section 4.8.4, "Detailed Project Description".

3. LIST OF ASSUMPTIONS IN GUIDANCE DOCUMENT EXAMPLES

Throughout the course of this guidance document a series of assumptions are made for each of the working examples presented.

It is assumed that:

3.1 Technical descriptions provide sufficient information to determine eligibility. They can also be used to identify areas of work and relevant expenditures that might be claimed. All work must be done in Canada to qualify as part of the SR&ED project.

3.2 Elements of the three criteria are present in each of the examples; however, not all the work included in each of the examples meets the requirements of SR&ED, in the *Income Tax Act*, that is, subsection 248(1). Some of the work claimed is either not considered by the reviewer to be commensurate and directly in support of work described in paragraph 248(1) (a), (b), or (c), or is not included in the specific list of support activities. The accompanying table at the end of each example indicates specific work/expenditures that can be claimed for both the traditional and proxy methods. Some expenditures might not be directly related and incremental under the traditional method, and therefore, not allowable under this heading in the tables. Similarly, some expenditures are already included as part of the "prescribed proxy amount", so they can not be again claimed separately when the claimant elects to use the proxy method.

3.3 The eligibility of definition of concept stage work (see Example 4.1) is dependent on experimentation being carried out at later stages.

3.4 A "Pilot Plant" (See glossary section 5) refers to an experimental facility; no commercial work is intended to ever be carried out at this facility.

3.5 Each of the nine examples in Section 4 of this guidance document is presented as a stand-alone SR&ED project. However, it should be noted that related projects can be claimed as components of a program, as discussed in Section 2.1.

4. EXAMPLES

Self-assessment of a claim

The task in self-assessment of a claim is not just to determine that the work meets the three eligibility criteria, but also to identify work that falls within the "envelope of SR&ED". This includes work that is directly in support, and commensurate with the needs of the SR&ED project. In this section, typical chemicals-related projects *that contain both SR&ED and non-SR&ED work* are presented to illustrate the process of "self-assessment of a claim". The intent is to help companies identify and claim the SR&ED work that is present.

For each of the nine examples provided in Section 4, a detailed list of the areas of work and expenditures identified as part of the project are shown in the attached table(s). Some of these entries are for costs related to specific areas of work in support of an eligible project. Those activities/expenditures captured under "major areas of work" constitute the bulk of the claimed work. Similarly, the activities/expenditures captured under "other areas of work" tend to represent a smaller portion of the claimed project work.

It is important to note that not all of the work and expenditures identified in the table meets the definition of SR&ED as indicated by the "not allowable" items in the tables. This is where a company must self-assess the project work to determine what part meets the definition of SR&ED. Only when the work meets paragraphs 248(1) (a), (b), (c), or (d) of the Act (Appendix A.2), will it be eligible for the investment tax credit. In all other cases the work will *not* constitute part of the envelope of SR&ED. In addition, allowable expenditures must fall within section 37 of the Act.

In the right column of each of the tables is a section for specific "notes" pertaining to the area of work or the expenditure. When work is being referred to (not expenditure), and that work is categorized as supporting work, as defined in paragraph 248(1)(d) of the Act, a specific note is provided (See Section 1.1). If there is no note that work falls into one of the following three categories of SR&ED (See section 1.1): basic research {paragraph 248(1)(a)}, applied research {paragraph 248(1)(b)}, or experimental development {paragraph 248(1)(c)}.

The areas of work and expenditures identified for each of the examples is not intended to be an exhaustive list. However, it is representative of the types of work/expenditures that are often claimed by many chemical companies. If there are other areas of work/expenditures that are not contained in these illustrative examples, the reader is further referred to IC 86-4R3 **[Reference 3]** and IT-151R5 (Consolidated) **[Reference 2],** as well as subsection 248(1) and section 37 of the Act.

4.1 Example 4.1: Definition of Concept/Technological Challenge

This is an example where a project is being identified and feasibility studies (see Glossary, Section 5) could take place at this stage and some preliminary experiments are carried out. *In order to claim a project at this stage, it would be necessary for the company to show that the project would be carried forth through to the next stage (i.e. laboratory experimental development, or bench-scale stage).*

1. Project Code: 4.1

   Project Name: XXYY XC New Catalyst Product Development
   Start Date: dd/mm/yyyy Completion Date: dd/mm/yyyy

   Total Labour Cost: $40k (for current tax year)
   Material Consumed or Transformed: $nil (for current tax year)

2. Capital Expenditures

Capital Item	Cost	Project Code
	$nil	4.1

3.

Name	Role	Project Code	Areas of Work
J. Doe	Project Leader	4.1	Project Management
J. A. Doe	Librarian	4.1	Library Services
J. B. Doe	Customer Liaison	4.1	Data acquisition
J. C. Doe	Project Engineer	4.1	Background research

4. Detailed Project Description

   The XC catalyst is a new catalyst developed at the XXYY Research and Development Center. This catalyst has a different chemical composition from the standard PC catalyst. It has taken several years of research and development to get to the stage where the catalyst is formulated and physically produced. The XC catalyst will require extensive testing before it can be properly assessed. Undoubtedly the catalyst formulation will require refinement. At this point very little is known about the activity and the product that it could produce. The business goal of the company is to increase market share of the company through the manufacture of products using the XC catalyst process.

5. Scientific/Technological Objective

   The technological objective is to manufacture a catalyst that will have properties that are better than or equal to the existing PC catalyst. The desirable catalyst properties sought include: improved and sustained productivity, good processability, improved melt strength, enhanced hydrogen and co monomer response, broad and narrow melt flow ratios, and the capability to produce a wide range of products.

6. Scientific/Technological Advancement

   Since the XC catalyst is new, very little knowledge is available about it at this time. By improving upon the existing PC catalyst, and by developing a catalyst that results in a superior product line, the company will have advanced the current state of the art for the XC-catalyst processing technology. Preliminary lab-scale experiments in this investigation have shown that the physical properties of the XC catalyst are significantly better than the PC catalyst.

7. Scientific/Technological Uncertainty

   Since this catalyst is still in the developmental stages, there is no certainty that this catalyst will be any better than the PC catalyst or that it will meet any of its target objectives. The major technological uncertainties that need to be resolved by scientific experimentation are as follows:

   - Optimum catalyst formulation to improve process stability, kinetic profile, morphology and physical properties of resulting resin.
   - Poisoning of catalyst at lab scale
   - Product benefits offered by new catalyst formulation
   - Range of products that may benefit from property improvements

8. Supporting Information Available for Review

   Preliminary project plan
   Customer Feedback forms
   Completed IRAP application forms
   List of relevant literature/patents cited
   Selected internal company reports
   Experimental results (lab books).

Table 4.1
Definition of Concept/Technological Challenge [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES				
A	Senior technical and management developed business objective of XC-catalyst based products	N		N	
B	Preliminary project plan with technological objectives prepared	Y		Y	
C	Carry out worldwide patent search in Canada at project manager's request to scope possibility of applying the XC catalyst process	Y	Part of technical feasibility work to support project. Legal fees cannot be claimed.	Y	Part of technical feasibility work to support project. Legal fees cannot be claimed.
D	Carry out literature survey to identify technological challenges associated with the XC catalyst as preliminary experiments were initiated	Y	Part of technical feasibility work to support project	Y	Part of technical feasibility work to support project.
E	Develop customer interface by SR&ED team meeting with customers to develop technical objectives	Y	Part of technical feasibility work to support project. E.g. customer driven application development.	Y	Part of technical feasibility work to support project. E.g. customer driven application development.
F	Analyze business fit for XC catalyst process	N		N	
G	Prepare grant application (e.g. IRAP)	Y	Directly related and incremental salaries of claimants' employees. Funds are used to perform SR&ED.	N	Not directly engaged
H	Preliminary lab-scale experiments initiated	Y		Y	

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

Table 4.1
Definition of Concept/Technological Challenge (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES				
I	Examine non-technical competitive strengths & weaknesses, identifying new market opportunities for XC catalyst products	N		N	
J	Carry out market research/ customer base survey for new XC catalyst products	N		N	
K	Determine which locations to manufacture new XC catalyst products and which existing product lines might be affected	N		N	

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

4.2. Example 4.2: Systematic Program to Achieve Technological Objective – Lab Scale

This is an example of laboratory experimental development, and is the first in a series of three examples designed to illustrate the technological objective stage (Examples 4.2 to 4.4).

1. Project Code: 4.2

   Project Name: XXYY XC Catalyst Preparation
   Start Date: dd/mm/yyyy Completion Date: dd/mm/yyyy

Total Labour Cost:	$50k (for current tax year)
Material Consumed or Transformed:	$5k (for current tax year)

2. Capital Expenditures

Capital Item	Cost	Project Code
	Nil	4.2

3. Personnel

Name	Role	Project Code	Areas of Work
J. Doe	Lead scientist	4.2	In charge of formulation
J.E. Doe	Technologist	4.2	Catalyst Synthesis

4. Detailed Project Description

   The XC catalyst is a new catalyst developed at the XXYY Research and Development Center. This catalyst has a different chemical composition from the existing PC catalyst. It has taken several years of research and development to get to the stage where the catalyst is formulated and physically produced for bench scale testing. The XC catalyst will require extensive testing before it can be properly assessed. Undoubtedly the catalyst formulation will require refinement. At this point very little is known about the activity and the product that it could produce.

5. Scientific/Technological Objective

   The objective is to manufacture a catalyst that will be better than or equal to the existing PC catalyst. The desirable properties sought include: improved and sustained productivity, good processability, improved melt strength, enhanced hydrogen and comonomer response, broad and narrow melt flow ratios (MFR), and the capability to produce a wide range of products.

6. Scientific/Technological Advancement

   Preliminary testing with a lab-scale reactor has produced several polymer products with improved/desirable properties in direct comparison with the existing PC catalyst. These properties include a broad and narrow MFR, good processability, improved melt strength, enhanced hydrogen and comonomer response, improved optics, and greater productivity.

7. Scientific/Technological Uncertainty

Since this catalyst is still in the developmental stages, there is no certainty that this catalyst will be any better than the PC catalyst or that it will meet any of its target objectives. The major uncertainties that need to be resolved by scientific experimentation are as follows:

- Optimum catalyst formulation to improve process stability, kinetic profile, morphology and physical properties of resulting resin to be tested in lab reactor.
- Expected lifecycle of catalyst at lab scale
- Product benefits offered by new catalyst formulation
- Range of products that may benefit from property improvements

8. Supporting Information Available for Review

Selected internal company reports
Conference papers/publications
Reports from Contractors
CEPA documents
Experimental results (lab books)
Patents
Lab reactor photographs

Table 4.2
Systematic Program to Achieve Technological Objective - Lab Scale[1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES				
A	Develop technical project plan	Y	Work done by technical staff	Y	Work done by technical staff
B	Develop source of raw materials, costing & procurement	Y	Input by technical personnel	Y	Input by technical personnel
C	Identification of technology that must be developed in project	Y		Y	
D	Specify technological uncertainties and advancement required	Y		Y	
E	Detailed planning of experiments and personnel	Y		Y	
F	**Outside SR&ED contracts:**		Taxable supplier rules apply **[Reference 2]**		Taxable supplier rules apply **[Reference 2]**
	Canadian universities	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)
	Foreign universities	N		N	
	Testing in Canada in support of SR&ED project	Y	"Testing" Carrying out 248(1)(d) (**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d) (**See Appendix A.2)**
	Testing outside Canada in support of SR&ED project	N		N	
	Engineering (In Canada)	Y	"Engineering". Carrying out 248(1)(d) (**See Appendix A.2**)	Y	"Engineering". Carrying out 248(1)(d) (**See Appendix A.2**)

1 Assume experimentation is carried out.
2 Some project work meets definition of SR&ED.
3 Prescribed Proxy Amount

Table 4.2
Systematic Program to Achieve Technological Objective - Lab Scale (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES (CONT.)				
G	Tests required for Canadian Environmental Protection Act (CEPA) new substance notification (NSN) requirements in support of SR&ED project	Y	"Testing" Carrying out 248(1)(d) (**See Appendix A.2)** Or as separate SR&ED project if three criteria are met (see Application Policy 94-03)	Y	"Testing" Carrying out 248(1)(d) (**See Appendix A.2**) Or as separate SR&ED project if three criteria are met (see Application Policy 94-03)
H	Training requirements specific to project claimed	Y	Directly related and incremental.	N	Covered by PPA.
I	Relocation of SR&ED personnel	Y	Only moving expenses	N	Covered by PPA.
J	Recruiting & hiring SR&ED personnel	Y	Directly related and incremental – salaries of claimants' employees	N	Covered by PPA.
K	Consultant to assist with SR&ED tax credit claim	N		N	
L	Chemists/engineers time directly involved in project	Y		Y	
M	Technologist/technician time directly involved in project	Y		Y	
N	Support from internal technical services	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

Table 4.2
Systematic Program to Achieve Technological Objective - Lab Scale (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES				
O	Support staff – safety, maintenance, admin, and information services	Y	If directly related and incremental	N	Covered by PPA.
P	Materials consumed and transformed	Y	Transformed materials are subject to recapture	Y	Transformed materials are subject to recapture **See Note 1**.
Q	Utility costs	Y	If directly related and incremental	N	Covered by PPA.
R	Equipment lease	Y	ASA or directly related and incremental	Y	Only equipment used ASA or primarily for SR&ED. Does not include GPOEF.
S	Gardener	N		N	
T	Municipal taxes on owned building	Y	Reasonable allocation	N	Covered by PPA.
U	Building rent	N		N	
V	Periodical subscriptions	Y	If directly related and incremental. To be a qualified expenditure the periodical subscription must specifically relate to the technology area.	N	Covered by PPA.

Note 1:
On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

Table 4.2
Systematic Program to Achieve Technological Objective - Lab Scale (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES (CONT.)				
W	Legal work for patent application	N		N	
X	Time of non-resident personnel from parent company working in Canada on project when time charged to Canadian affiliate	N	May qualify if taxable supplier rules are met. **[Reference 2]**	N	May qualify if taxable supplier rules are met. **[Reference 2]**
Y	Lab equipment	Y	If ASA -i.e. >90%) in support of SR&ED project. The ASA determination is based on an intent test. Shared use (i.e. >50%) could also apply. Recapture rules could apply.	Y	Only ASA equipment or SUE. Does not include GPOEF. Recapture rules could apply.
Z	Personal computers, furniture, office equipment, LAN, etc.	Y	If ASA -i.e. >90%) in support of SR&ED project. The ASA determination is based on an intent test. Shared use (i.e. >50%) could also apply. Recapture rules could apply.	N	Does not include GPOEF.
AA	Attending general conferences	N	Only technical meetings specific to SR&ED project/technology would be allowable.	N	
AB	Professional society membership fees	N		N	

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

4.3. Example 4.3: Systematic Program to Achieve Technological Objective – Bench Scale

This is an example where a laboratory process is being evaluated at the bench-scale.

1. Project Code: 4.3

   Project Name: XXYY XC Catalyst Bench Scale Reactor (BSR) Trial
   Start Date: dd/mm/yyyy   Completion Date: dd/mm/yyyy

   Total Labour Cost: $100k (for current tax year)
   Material Consumed or Transformed: $6k (for current tax year)

2. Capital Expenditures

Capital Item	Cost	Project Code
	Nil	4.3

3. Personnel

Name	Role	Project Code	Areas of Work
J. Doe	Lead scientist	4.3	In charge of overall trial
J. A. Doe	Lead chemist	4.3	Development of trial/assistance
J. B. Doe	Technologist	4.3	BSR Operator
J. D. Doe	Technologist	4.3	BSR Operator
J.E. Doe	Technologist	4.3	Catalyst Synthesis

4. Detailed Project Description

   The XC catalyst is a new catalyst developed at the XXYY Research and Development Center. This catalyst is continuously evolving and transforming. The BSR is used to screen new formulations of the XC catalyst. The product made at the BSR can be tested for melt index, density, melt flow ratio (MFR), and productivity. Should the results look promising, then the formulation is sent to the technical scale reactor (TSR) for further testing. A BSR experiment is short, usually lasting less than a day and typically producing only several hundred grams of polymer.

5. Scientific/Technological Objective

   The objective is to test a given formulation of XC catalyst on the BSR. The catalyst formulation should yield a product with desirable properties and a high level of sustained productivity. The XC catalyst should be better than or equal to the existing PC catalyst.

6. Scientific/Technological Advancement

   A sequence of experiments carried out on the BSR has produced several polymer products with improved/desirable properties in direct comparison with the existing PC catalyst. These properties include a broad and narrow

MFR, good processability, improved melt strength, enhanced hydrogen and comonomer response, improved optics, and greater productivity.

7. Scientific/Technological Uncertainty

   The major technological uncertainties that need to be resolved by scientific experimentation are as follows:

   - Optimum catalyst formulation to improve process stability, kinetic profile, morphology and physical properties of resulting resin to be tested on BSR.
   - Performance of catalyst at bench scale
   - Product benefits offered by new catalyst formulation
   - Range of products that may benefit from property improvements

8. Supporting Information Available for Review

   Consultant notes and SR&ED reports
   Selected internal company reports
   Conference papers/publications
   CEPA documents
   Experimental results (lab books)
   Patents
   Video of BSR and experimental operation

Table 4.3
Systematic Program to Achieve Technological Objective Stage – Bench Scale[1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES				
A	Develop technical project plan	Y	Work done by technical staff	Y	Work done by technical staff
B	Develop source of raw materials, costing & procurement	Y	Input by technical personnel	Y	Input by technical personnel
C	Identification of technology that must be developed in project	Y		Y	
D	Specify technological uncertainties and advancement required	Y		Y	
E	Detailed planning of experiments and personnel	Y		Y	
F	**Outside SR&ED contracts:**		Taxable supplier rules apply **[Reference 2]**		Taxable supplier rules apply **[Reference 2]**
	Canadian universities	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)
	Foreign universities	N		N	
	Testing in Canada in support of SR&ED project	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)
	Testing outside Canada in support of SR&ED project	N		N	
	Engineering (In Canada)	Y	"Engineering". Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Engineering". Carrying out 248(1)(d)(**See Appendix A.2**)

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

Table 4.3
Systematic Program to Achieve Technological Objective Stage – Bench Scale (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES (CONT.)				
G	Tests required for CEPA NSN requirements in support of SR&ED project	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**) Or as separate SR&ED project if three criteria are met (**see Application Policy 94-03**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**) Or as separate SR&ED project if three criteria are met (**see Application Policy 94-03**)
H	Training requirements specific to project claimed	Y	Directly related and incremental	N	Covered by PPA.
I	Relocation of SR&ED personnel	Y	Only moving expenses	N	Covered by PPA.
J	Recruiting & hiring SR&ED personnel	Y	Directly related and incremental–– salaries of claimants' employees	N	Covered by PPA.
K	Consultant to assist with SR&ED tax credit claim	N		N	
L	Chemists/engineers time directly involved in project	Y		Y	
M	Technologist/technician time directly involved in project	Y		Y	
N	Support from internal technical services	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

Table 4.3
Systematic Program to Achieve Technological Objective Stage – Bench Scale (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES				
O	Support staff – safety, maintenance, admin, and information services	Y	If directly related and incremental	N	Covered by PPA.
P	Materials consumed and transformed	Y	Transformed materials are subject to recapture	Y	Transformed materials are subject to recapture **See Note 1**.
Q	Utility costs	Y	If directly related and incremental	N	Covered by PPA.
R	Equipment lease	Y	ASA or directly related and incremental	Y	Only equipment used ASA or primarily for SR&ED. Does not include GPOEF.
S	Gardener	N		N	
T	Municipal taxes on owned building	Y	Reasonable allocation	N	Covered by PPA.
U	Building rent	N		N	

Note 1:
On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

Table 4.3
Systematic Program to Achieve Technological Objective Stage – Bench Scale (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES (CONT.)				
V	Periodical subscriptions	Y	If directly related and incremental. To be a qualified expenditure the periodical subscription must specifically relate to the technology area.	N	Covered by PPA.
W	Legal work for patent application	N		N	
X	Time of non-resident personnel from parent company working in Canada on project when time charged to Canadian affiliate	N	May qualify if taxable supplier rules are met. **[Reference 2]**	N	May qualify if taxable supplier rules are met. **[Reference 2]**
Y	Lab equipment	Y	If ASA (all or substantially all i.e. >90%) in support of SR&ED project. The ASA determination is based on an intent test. Shared use (i.e. >50%) could also apply. Recapture rules could apply.	Y	Only ASA equipment or SUE. Does not include GPOEF. Recapture rules could apply.
Z	Personal computers, furniture, office equipment, LAN, etc.	Y	If ASA (all or substantially all i.e. >90%) in support of SR&ED project. The ASA determination is based on an intent test. Shared use (i.e. >50%) could also apply. Recapture rules could apply.	N	Does not include GPOEF.
AA	Attending general conferences	N	Only technical meetings specific to SR&ED project/technology would be allowable.	N	
AB	Professional society membership fees	N		N	

1 Assume experimentation is carried out.
2 Some project work meets definition of SR&ED.
3 Prescribed Proxy Amount

4.4. Example 4.4: Systematic Program to Achieve Technological Objective – Technical Scale

This is an example where a bench-scale process is being evaluated at a larger technical scale. Some companies may choose to bypass this stage and progress directly to the pilot-scale stage (Example 4.5).

1. Project Code: 4.4

   Project Name: XXYY XC Catalyst Technical Scale Reactor Trial (Small-scale Pilot Plant)
   Start Date: dd/mm/yyyy Completion Date: dd/mm/yyyy

   Total Labour Cost: $88k (for current tax year)
   Material Consumed or Transformed: $10k (for current tax year)

2. Capital Expenditures

Capital Item	Cost	Project Code
	Nil	4.4

3. Personnel

Name	Role	Project Code	Areas of Work
J. Doe	Lead scientist	4.4	In charge of overall trial
J. A. Doe	Lead engineer	4.4	Development of trial/assistance
J. B. Doe	Lead chemist	4.4	Chemistry support/assistance
J. D. Doe	Technologist	4.4	Product Evaluation
J.E. Doe	Technologist	4.4	Product testing

4. Detailed Project Description

   The XC catalyst is a new catalyst developed at the XXYY Research and Development Center. This catalyst has already undergone numerous formulation changes and transformations to enhance the properties and performance. The bench scale reactor (BSR) was used to screen potentially successful formulations of XC. Information from the BSR is very limited due to the scale and its batch-wise mode of operation. Also, the BSR is only capable of producing several hundred grams of product per batch.

   The technical scale reactor (TSR) will be able to run continuously to produce large quantities of polymer. Although the TSR is not a pilot plant scale reactor it is capable of producing enough polymer for numerous physical tests. Some of the observations found on the TSR can be directly scaled up to the plant scale. Further testing on the TSR is required to validate results, and to continue to develop this catalyst for commercial purposes. The new XC catalyst has been subjected to numerous formulations and testing on the bench scale reactor.

5. Scientific/Technological Objective

   The main objectives of this trial are to safely use the capability of the TSR to operate and produce several specified products with the XC catalyst. The polymer produced is expected to deliver enhanced properties when it is compared with the existing PC catalyst. There are 10 experiments planned for this specific trial. These 10 experiments are designed to foster a clearer understanding of this catalyst behavior. The polymer gathered in these experiments is subjected to various testing. The results of this trial will be used to support further pilot and plant trials.

6. Scientific/Technological Advancement

   The new XC catalyst has produced several polymer products with improved/desirable properties in direct comparison with the existing PC catalyst. Technical scale trials have shown the potential for improved comonomer response, optical properties, melt strength, and processability. The potential benefits of the XC catalyst process allow for the XC-based product to replace blends of linear low density polyethylene (LLDPE) and low density polyethylene (LDPE).

7. Scientific/Technological Uncertainty

   The major technological uncertainties that need to be resolved by scientific experimentation are as follows:

   - Optimum catalyst formulation to improve process stability, kinetic profile, morphology and physical properties of resulting resin to be tested in TSR.
   - Process behavior of catalyst for TSR
   - Product benefits offered by new catalyst formulation
   - Range of products that may benefit from property improvements

   Since there are no direct or reliable empirical correlations between the BSR and the TSR, the new catalyst can often generate a product that has totally unexpected and poor properties.

8. Supporting Information Available for Review

   Selected internal company reports
   Conference papers and journal publications
   Reports from Contractors
   CEPA NSN documents
   Experimental results (lab books)
   e-mail correspondence
   Patents
   TSR photographs
   Flip charts from technical meetings
   Consultant report

Table 4.4
Systematic Program to Achieve Technological Objective – Technical Scale [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES				
A	Develop technical project plan	Y	Work done by technical staff	Y	Work done by technical staff
B	Develop source of raw materials, costing & procurement	Y	Input by technical personnel	Y	Input by technical personnel
C	Identification of technology that must be developed in project	Y		Y	
D	Specify technological uncertainties and advancement required	Y		Y	
E	Detailed planning of experiments and personnel	Y		Y	
F	**Outside SR&ED contracts:**		Taxable supplier rules apply **[Reference 2]**		Taxable supplier rules apply **[Reference 2]**
	Canadian universities	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)
	Foreign universities	N		N	
	Testing in Canada in support of SR&ED project	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)
	Testing outside Canada in support of SR&ED project	N		N	
	Engineering (In Canada)	Y	"Engineering". Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Engineering". Carrying out 248(1)(d)(**See Appendix A.2**)
G	Tests required for CEPA NSN requirements in support of SR&ED project	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**) Or as separate SR&ED project if three criteria are met (**see Application Policy 94-03**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**) Or as separate SR&ED project if three criteria are met (**see Application Policy 94-03**)

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

Table 4.4
Systematic Program to Achieve Technological Objective – Technical Scale (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES (CONT.)				
H	Training requirements specific to project claimed	Y	Directly related and incremental	N	Covered by PPA.
I	Relocation of SR&ED personnel	Y	Only moving expenses	N	Covered by PPA.
J	Recruiting & hiring SR&ED personnel	Y	Directly related and incremental - salaries of claimants' employees	N	Covered by PPA.
K	Consultant to assist with SR&ED tax credit claim	N		N	
L	Chemists/engineers time directly involved in project	Y		Y	
M	Technologist/technician time directly involved in project	Y		Y	
N	Support from internal technical services	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)	Y	If it meets 248(1)(a), (b), (c), or (d) work (**See Appendix A.2**)

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

Table 4.4
Systematic Program to Achieve Technological Objective – Technical Scale (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES				
O	Support staff – safety, maintenance, admin, and information services	Y	If directly related and incremental	N	Covered by PPA.
P	Materials consumed and transformed	Y	Transformed materials are subject to recapture	Y	Transformed materials are subject to recapture **See Note 1.**
Q	Utility costs	Y	If directly related and incremental	N	Covered by PPA.
R	Equipment lease	Y	ASA or directly related and incremental	Y	Only equipment used ASA or primarily for SR&ED. Does not include GPOEF.
S	Gardener	N		N	
T	Municipal taxes on owned building	Y	Reasonable allocation	N	Covered by PPA.
U	Building rent	N		N	
V	Periodical subscriptions	Y	If directly related and incremental. To be a qualified expenditure the periodical subscription must specifically relate to the technology area.	N	Covered by PPA.
W	Legal work for patent application	N		N	

Note 1:
On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

---

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

Table 4.4
Systematic Program to Achieve Technological Objective – Technical Scale (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES (CONT.)				
X	Time of non-resident personnel from parent company working in Canada on project when time charged to Canadian affiliate	N	May qualify if taxable supplier rules are met. **[Reference 2]**	N	May qualify if taxable supplier rules are met. **[Reference 2]**
Y	Lab equipment	Y	If ASA (all or substantially all i.e. >90%) in support of SR&ED project. The ASA determination is based on an intent test. Shared use (i.e. >50%) could also apply. Recapture rules could apply.	Y	Only ASA equipment or SUE. Does not include GPOEF. Recapture rules could apply.
Z	Personal computers, furniture, office equipment, LAN, etc.	Y	If ASA (all or substantially all i.e. >90%) in support of SR&ED project. The ASA determination is based on an intent test. Shared use (i.e. >50%) could also apply. Recapture rules could apply.	N	Does not include GPOEF.
AA	Attending general conferences	N	Only technical meetings specific to SR&ED project/technology would be allowable.	N	
AB	Professional society membership fees	N		N	

[1] Assume experimentation is carried out.
[2] Some project work meets definition of SR&ED.
[3] Prescribed Proxy Amount

4.5. Example 4.5: Development of Prototype or Pilot

This is an example where a technical-scale process is being evaluated at the pilot stage. The reader is also referred to Section 2.4 of this guidance document for more information on what can be claimed as SR&ED in a pilot plant.

1. Project Code: 4.5

   Project Name: XXYY XC Catalyst Pilot Plant Trial
   Start Date: dd/mm/yyyy Completion Date: dd/mm/yyyy

   Total Labour Cost: $120k (for current tax year)
   Material Consumed or Transformed: $40k (for current tax year)

2. Capital Expenditures

Capital Item	Cost	Project Code
Reactor	$160k	4.5

3. Personnel

Name	Role	Project Code	Areas of Work
J. Doe	Lead scientist	4.5	In charge of overall operations
J. A. Doe	Lead engineer	4.5	Development of trial/assistance
J. B. Doe	Lead chemist	4.5	Chemistry support/assistance
J.C. Doe	Technologist	4.5	Process operations/assistance
J. D. Doe	Technologist	4.5	Product Evaluation
J.E. Doe	Technologist	4.5	Product testing

4. Detailed Project Description

   The XC catalyst is a new catalyst developed at the XXYY Research and Development Center. Bench scale and technical scale trials have shown positive results, but these need to be confirmed prior to plant scale up. Pilot plant testing will produce large quantities of resin that can be adequately evaluated.

   In this work the products from the bench and technical scale reactors have been evaluated by gel permeation chromatography, Fourier Transform Infrared spectroscopy (FTIR) and rheological methods to monitor the type of product being produced. One promising formulation has been scaled up to the pilot scale reactor, and a broad range of studies both on process engineering and product characteristics have been completed.

5. Scientific/Technological Objective

   The main objectives of this trial are to safely use the capability of the pilot plant to operate and produce several specified products with the XC catalyst. There will be 7 products made in this trial. Each product will have different properties and will be made under differing conditions. All products will be evaluated, and depending upon the results, there may be further developmental work required, or a plant trial may be planned. These 7 products have all shown improved properties and features at the technical scale facility.

6. Scientific/Technological Advancement

   One of the key results from this series of pilot-scale trials was that there was low variability in the reaction chemistry associated with large changes in the ingredient preparation methods. This finding advances the technology by confirming that the scale up of product performance is not significantly affected by catalyst preparation conditions, and the impact of this variable on plant scale-up is minimal.

7. Scientific/Technological Uncertainty

   Since all of the collected data to date is based on small-scale production, it is technically unclear if the results can be extrapolated beyond the TSR to the pilot unit. In fact, several efforts in duplicating results from the TSR to the pilot facility have already failed. Operability and control at the pilot plant using the XC catalyst are also technically uncertain. There is also a need for pilot trials since improvements in physical properties that were apparent at the technical scale reactor may not show up at the pilot plant scale.

8. Supporting Information Available for Review

   IRAP final report
   Detailed mechanical drawings of Reactor
   Customer trials notebooks
   Hazard review
   Shipping reports
   Experimental results (lab books)
   e-mail correspondence
   Experimental notes and operating instructions
   Video of Pilot-scale equipment and operation

Table 4.5
Development of Prototype or Pilot [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
MAJOR AREAS OF WORK/EXPENDITURES					
Resources:					
A	Personnel	Y		Y	Only the portion of time spent directly engaged in SR&ED.
B	Equipment	Y		Y	Only ASA equipment or SUE. Does not include GPOEF.
C	Materials & Supplies / Utilities	Y	Directly related and incremental	N	Costs are covered by PPA.
D	Raw materials required for pilot trial	Y	Transformed materials could be subject to recapture	Y	Transformed materials could be subject to recapture. **See Note 1.**
E	Maintenance	Y	Directly related and incremental	N	Covered by PPA.
F	Preventative maintenance	Y	Directly related and incremental	N	Covered by PPA.
G	Hazard & operability (HAZOP) reviews	Y	Specific to the SR&ED project	N	Covered by PPA.
H	Development of experimental notes, operating instructions, and closing reports	Y	Specific to the SR&ED project	Y	Specific to the SR&ED project

Note 1:
On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

[1] Some project work meets definition of SR&ED.
[2] Pilot plant used "all or substantially all" for SR&ED is assumed.
[3] Prescribed Proxy Amount

Table 4.5
Development of Prototype or Pilot (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES (CONT.)				
I	Applications development work related to SR&ED project.	Y	This includes costs associated with labour, capital, overheads, materials consumed or transformed.	Y	This includes salaries related to time spent directly engaged in SR&ED, capital, and materials consumed or transformed. Overhead and other expenditures are covered by the prescribed proxy amount.
J	Customer trials by technical personnel	Y		Y	Only the time spent directly engaged in SR&ED
K	Customer trials by sales personnel	N	Qualified technical work might be allowable.	N	Qualified technical work might be allowable - Only the time spent directly engaged in SR&ED
L	Customer trials by marketing personnel	N	Qualified technical work might be allowable.	N	Qualified technical work might be allowable - Only the time spent directly engaged in SR&ED
M	Process design	Y		Y	

[1] Some project work meets definition of SR&ED.
[2] Pilot plant used "all or substantially all" for SR&ED is assumed.
[3] Prescribed Proxy Amount

Table 4.5
Development of Prototype or Pilot (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES (CONT.)				
N	Modifications to building	N		N	
	New pilot plant:				
O	Relocation of SR&ED personnel	Y	Only moving expenses	N	Covered by PPA.
P	Recruiting & hiring SR&ED personnel	Y	Directly related and incremental -salaries of claimants' employees.	N	Covered by PPA.
Q	Building	N		N	
R	Building design & engineering	N	Building design, plumbing and personnel for construction are costs to be capitalized with the costs of the building.	N	Building design, plumbing and personnel for construction are costs to be capitalized with the costs of the building.
S	Equipment (reactor)	Y		Y	
T	Personnel for construction of steel & concrete supports for equipment	Y	If part of equipment costs	Y	If part of equipment costs.
U	Engineering	Y	Engineering carrying out 248 (1) (d) (**See Appendix A.2**)	Y	Engineering carrying out 248 (1) (d) (**See Appendix A.2**)
	OTHER AREAS OF WORK/EXPENDITURES				
V	Purchased equipment for data acquisition/ instrumentation	Y		Y	Only ASA equipment or SUE. Does not include GPOEF.
W	Shipping/ distribution costs of experimental product for internal or customer testing	Y	Commensurate with needs of SR&ED project. Directly related and Incremental.	N	Covered by PPA.
X	Travel to and lodging at customer location to do testing	Y	Directly related and Incremental. In Canada only.	N	Covered by PPA.

[1] Some project work meets definition of SR&ED.
[2] Pilot plant used "all or substantially all" for SR&ED is assumed.
[3] Prescribed Proxy Amount

4.6. Example 4.6: Scale Up to Commercial Production Stage for a New Technology

This is an example where a technology has been successfully demonstrated at the pilot stage and now needs to be proven in a new commercial-scale production facility. Many technological problems are anticipated in the move to commercial operation. Due to the magnitude of the scale-up in this project (450:1), equipment such as distributors and heat transfer equipment could not simply be routinely scaled up from the pilot scale. They had to be designed specifically for the commercial plant based on sound engineering principles using advanced mathematical models to simulate the large-scale process. As might be anticipated, these process components would have a major impact on the resulting product. The reader is also referred to Section 2.5.1 of this guidance document for information pertaining to how to allocate expenditures when there is commercial work intermingled with SR&ED.

1. Project Code: 4.6

   Project Name: Polyethylene Gas Phase Plant Dedicated to XXYY XC Catalyst
   Start Date: dd/mm/yyyy Completion Date: dd/mm/yyyy

   Total Labour Cost: 50k (for current tax year)
   Material Consumed or Transformed: 150k (for current tax year)

2. Capital Expenditures

Capital Item	Cost	Project Code
Item 1	100k	4.6

3. Personnel

Name	Role	Project Code	Areas of Work
J. J. Doe	Project lead	4.6	In charge of overall project
J. A. Doe	Lead engineer	4.6	In charge of overall plant design
J. B. Doe	Lead chemist	4.6	Chemistry support/assistance
J. C. Doe	Team leader	4.6	Coordinating all areas of work
J. D. Doe	Sr. Operator	4.6	Process operations/assistance
J. E. Doe	Sr. Technologist	4.6	Process operations/assistance
J. F. Doe	Sr. Instrument tech.	4.6	Plant Instrumentation
J. G. Doe	Sr. Engineer	4.6	Process design
J. H. Doe	Engineer	4.6	Coordinate construction
J. I. Doe	Technologist	4.6	Process operations/assistance

4. Detailed Project Description

   Based on the results obtained from smaller-scale reactors (see examples 4.2 to 4.5), a series of plant trials on a bubbling bed gas-phase fluidized reactor were conducted to produce three different resin grades. The basic methodology for each plant trial is given below.

- Produce a series of resins using a pre-determined catalyst and set of process conditions.
- Where possible, use a resin grade from a previous plant trial under similar process operating conditions to assess the extent of process drift.
- Vary some process condition (such as temperature, pressure, or process flow rate) and observe the effect on resin specification, product molecular weight density (MWD), composition and other measured properties using well-defined laboratory test methods. Adjust reaction conditions to achieve target product specification. Sample for product testing at XXYY Research facilities.
- Conduct process control step tests allowing the product specification to vary.

5. Scientific/Technological Objective

   The main objectives of this trial are to safely determine the capability of the plant to operate with the XC catalyst on a specified product and to manufacture three commercially attractive XC products in sufficient quantities so that the required internal and external customer evaluations could be performed. Other objectives include analyzing and evaluating: i) transitional material (PC to XC), ii) scale-up data, and iii) conclusions that were based on technical and pilot plant scale results.

6. Scientific/Technological Advancement

   The testing of resin products from the gas-phase bubbling fluidized bed plant trial showed improved processing characteristics, but there was deterioration with respect to the XC catalyst's physical properties. The same XC catalyst batch was also evaluated at an external plant, which confirmed the results obtained for the in-house plant trial. Our scientists have found that the deterioration of catalyst physical properties can be traced to a change of the molecular structure. As a result of these research findings on the shop floor, efforts are now being directed to modify the development of the XC catalyst system to overcome these difficulties, and further optimize the catalyst formulation at the laboratory scale (similar to work described in example 4.2).

7. Scientific/Technological Uncertainty

   Since there have been very few plant trials during the developmental stages of the XC catalyst, there were new technological uncertainties pertaining to operability and optimization at the commercial stage. In particular, the plant trials posed considerable challenges in terms of reactor operability due to unknown behaviour of the new catalyst system. Another key uncertainty was whether it would be possible to improve resin processability without sacrificing other physical properties.

   Scale-up was not routine because of the sensitivity of the XC catalyst to residence time and mixing issues. In addition, the magnitude of the scale-up

(450:1) meant that a lot of process equipment was unproven in its intended use.

Although low levels of impurities were detected in the recycle streams at the pilot plant, it was uncertain whether the distillation and purification system would generate a build-up of any potential catalyst poisons while operating in the XC-catalyst mode. As such, it was recognized that recycle impurities could jeopardize the success of the trials.

8. Supporting Information Available for Review

Shared use equipment logbooks
Detailed mechanical drawings of process equipment
E-mail correspondence
QC testing results
Process Control testing results
Software code for mathematical model
Experimental results (lab books)
Shipping reports
Video of production line equipment
Data acquisition results on hard disk

Table 4.6
Scale Up to Commercial Production for a New Technology [1]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[2]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES				
A	Equipment[3]	Y	Recapture rules apply [**Reference 6**]	Y	Does not include GPOEF. Recapture rules apply [**Reference 6]**
B	Equipment[4]	N		N	
C	Equipment[5]	Y	Recapture rules apply [**Reference 6**]	Y	Does not include GPOEF. Recapture rules apply [**Reference 6]**
D	Scientists, Engineers, Technologists, Technicians directly involved in SR&ED project	Y		Y	Only portion of time spent directly engaged in SR&ED.
E	Raw materials consumed or transformed	Y	Transformed materials could be subject to recapture	Y	Transformed materials could be subject to recapture **See Note 1.**
F	Maintenance	Y	If directly related and incremental	N	Covered by PPA.
G	Lab testing	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)

Note 1:
On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

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[1] Some project work meets definition of SR&ED.
* ASA equipment [2] Prescribed Proxy Amount
[3] ASA equipment
**[4] Intended for commercial use (50% or less for SR&ED use).
***[5] Shared use equipment (>50% SR&ED use over first two years) the first and second periods).

Table 4.6
Scale Up to Commercial Production for a New Technology (Cont.)[1]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[2]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES (CONT.)				
H	Technical support operations	Y	Could satisfy many of 248(1)(d)(See Appendix A.2) e.g. Computer programming, operations research, mathematical analysis etc.	Y	Could satisfy many of 248(1)(d)(See Appendix A.2) e.g. Computer programming, operations research, mathematical analysis etc.
I	Contract personnel	Y	Could satisfy many of 248(1)(d)(See **Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis etc. Taxable supplier rules apply **[Reference 2]**	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis etc. Taxable supplier rules apply **[Reference 2]**
	OTHER AREAS OF WORK/EXPENDITURES				
J	Quality control testing of test material [6]	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)
K	Process control testing of test material [6]	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)

[1] Some project work meets definition of SR&ED.
[2] Prescribed Proxy Amount
[6] Commensurate with needs of SR&ED project

Table 4.6
Scale Up to Commercial Production for a New Technology (Cont.) [1]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[2]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES (CONT.)				
L	Technical Support Operations	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, etc.	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, etc.
M	Implementation of advanced process controls[6]	Y		Y	
N	Modeling of process to optimize[6]	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, etc.	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, etc.
O	Routine automation of process equipment	N		N	
P	Data collection[6]	Y	"Data Collection" Carrying out 248(1)(d)(**See Appendix A.**2)	Y	"Data Collection" Carrying out 248(1)(d)(**See Appendix A.2**)

[1] Some project work meets definition of SR&ED.
[2] Prescribed Proxy Amount
[6] Commensurate with needs of SR&ED project

Table 4.6
Scale Up to Commercial Production for a New Technology (Cont.) [1]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[2]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES (CONT.)				
Q	SR&ED team labour at customer	Y	As applies to experimental product technical evaluation. Only customer can claim customer's costs as part of an SR&ED project. Costs borne by visiting research team can be claimed.	Y	As applies to experimental product technical evaluation. Only customer can claim customer's costs as part of an SR&ED project. Costs borne by visiting research team can be claimed.
R	Customer's salable products	N		N	
S	Products contributed to customer for plant trial	Y		Y	**See Note 1.**
T	Off-grade products of customer	N		N	
U	Waste by-products of customer	N		N	
V	Transitional product between trial and regular production at customer location	N		N	
W	Modification (paid by customer) of customer's equipment subsequently used for commercial production	N		N	
X	Modification (paid by customer) of customer's equipment solely for experimental use	N		N	

Note 1:
On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

[1] Some project work meets definition of SR&ED.
[2] Prescribed Proxy Amount

4.7. Example 4.7: Process or Production Development Experimental Production or Utilization Stage using New Technology on Existing Commercial Equipment

For certain experimental development projects, such as process and equipment improvements, the only way to verify that the technological objectives can be achieved is to carry out trial production runs or "experimental production" (see also Section 2.5). This phase of the development is the period of testing that corresponds with the proving out of the specifications for the product or process. It does not coincide with the usual learning curve for the start-up of established systems, nor can it be characterized as "trouble-shooting, debugging or fine-tuning" (see also Section 2.3). These testing activities are eligible to the extent that they correspond with the needs, and are directly in support, of an eligible experimental development project.

This is an example of introducing new process technology on an existing commercial-scale facility.

1. Project Code: 4.7

   Project Name: XXYY XC Catalyst Plant Trials
   Start Date: dd/mm/yyyy Completion Date: dd/mm/yyyy

   Total Labour Cost: $25k (for current tax year)
   Material Consumed or Transformed $168k (for current tax year)

2. Capital Expenditures

Capital Item	Cost	Project Code
Process Control Loop	$20k	4.7

3. Personnel

Name	Role	Project Code	Areas of Work
J. Doe	Lead scientist	4.7	In charge of overall operations
J. A. Doe	Lead engineer	4.7	Development of trial/assistance
J. B. Doe	Lead chemist	4.7	Chemistry support/assistance
J.C. Doe	Technologist	4.7	Process operations/assistance

4. Detailed Project Description

   The XC catalyst is a new catalyst developed at the XXYY Research and Development Center. This catalyst (which has been several years in development) has proven to work well under full-scale production facilities. A new gas phase (bubbling fluidized bed) polyethylene plant has been built and is currently being employed for shop floor trials. Experimental work at this time was required to optimize the catalyst properties for plant-scale production and further improve product performance characteristics.

In this project a new advanced Process Control scheme was investigated which simultaneously accounts for all variables that contribute to the resin specification. Due to the complexity of the process several experimental iterations were required, since the mathematical models were developed iteratively while the controller was simultaneously being implemented. It was essential that the controller be flexible enough to ensure product consistency and quality, and sufficiently robust to handle all process drifts.

5. Scientific/Technological Objective

The objective of this work was to develop an advanced Process Control scheme to demonstrate a new method for controlling the complex reactor process, to ensure that there is consistency of reactor products between successive trials. A closed loop control of the reactor was also sought, while maintaining the resin specification targets within narrow boundaries. Finally, it was necessary to identify an optimal choice of manipulated variables and product specification, such that a high reproducibility of product performance was achieved.

6. Scientific/Technological Advancement

We were able to show via a majority of trials (using a reference resin) that there was good reproducibility for the process. For a given set of process conditions it was possible to achieve the same resin specification and product performance after that resin was converted to a consumer product. Mathematical models were successfully obtained and a control algorithm was developed which worked well in maintaining consistent resin specification targets. The technology was advanced in that we have demonstrated that viable control systems can be developed for this complex process and reaction system.

7. Scientific/Technological Uncertainty

There were two main technological uncertainties encountered. Firstly, it was not clear if the combination of manipulated variables and product specification definition that were selected was adequate to ensure the end process reproducibility sought. Secondly, it was technically uncertain if the model based process control scheme would carry out the retraining of the models on a timely basis, with drifting process responses and changing product specification targets.

8. Supporting Information Available for Review

Selected internal company reports
Experimental results (lab books)
Experimental operating procedures
Application testing results
Analytical lab results and methods
Blueprints for plant
Video of process control operations

Table 4.7
Process or Product Development Experimental Production or Utilization using New Technology on Existing Commercial Equipment [1]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[2]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES				
A	Addition of new capital to existing equipment	Y	Assuming ASA; Capital subject to recapture	Y	Assuming ASA; Capital subject to recapture
B	Raw materials consumed or transformed	Y	Transformed materials could be subject to recapture	Y	Transformed materials could be subject to recapture. **See Note 1.**
C	Scientists, Engineers, Technologists, Technicians directly involved with SR&ED project	Y		Y	Only portion of time spent directly engaged in SR&ED
D	Maintenance	Y	If directly related and incremental –	N	Covered by PPA.
E	Lab operations [3]	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)
F	Plant Technical support [3]	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, etc.	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, etc.
G	Plant Management directly involved in project [3]	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, etc.	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, etc.

Note 1:
On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

---
[1] Some project work meets definition of SR&ED.
[2] Prescribed Proxy Amount
[3] Commensurate with needs of SR&ED project

Table 4.7
Process or Product Development Experimental Production or Utilization using New Technology on Existing Commercial Equipment (Cont.) [1]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[2]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES (CONT.)				
H	Contract Personnel	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, engineering, etc. Paid to taxable supplier **[Reference 2]**	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis, engineering, etc. Paid to taxable supplier **[Reference 2]**
I	Customer Evaluation [3]	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)
J	Quality control testing of test material [3]	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)
K	Process control testing of test material	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Testing" Carrying out 248(1)(d)(**See Appendix A.2**)
L	Technical support operations [3]	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, engineering, data collection, etc.	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, engineering, data collection, etc.
M	Implementation of advanced process controls [3]	Y		Y	

[1] Some project work meets definition of SR&ED.
[2] Prescribed Proxy Amount
[3] Commensurate with needs of SR&ED project

Table 4.7
Process or Product Development Experimental Production or Utilization using New Technology on Existing Commercial Equipment (Cont.) [1]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[2]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES (CONT.)				
N	Modeling of process to optimize [3]	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis etc.	Y	Could satisfy many of 248(1)(d)(**See Appendix A.2**) e.g. Computer programming, operations research, mathematical analysis etc.
O	Routine automation of process equipment	N		N	
P	Data collection [3]	Y	"Data Collection" Carrying out 248(1)(d)(**See Appendix A.2**)	Y	"Data Collection" Carrying out 248(1)(d)(**See Appendix A.2**)
	OTHER AREAS OF WORK/EXPENDITURES				
Q	Cost of shipping samples [3]	Y	If directly related and incremental –	N	Covered by PPA.
R	Disposal charges of non-salable waste materials [3]	Y	If directly related and incremental –	N	Covered by PPA.
S	Regulatory approvals for operating new process [3]	Y	If directly related and incremental –	N	Covered by PPA.
T	Health and Safety compliance for new process [3]	Y	If directly related and incremental –	N	Covered by PPA.

[1] Some project work meets definition of SR&ED.
[2] Prescribed Proxy Amount
[3] Commensurate with needs of SR&ED project

4.8. Example 4.8: Experimental Production or Utilization using New Technology on Existing Off-site (Customer's) Equipment – "Toll Manufacturing"

"Toll manufacturing" was defined in Subsection 2.5.2 of this guidance document. A specific example of the toll manufacturing process is provided below that is intended to illustrate points a), d), e), g), and h) from Subsection 2.5.2.

Company A will endeavour to produce polyethylene (with the XC catalyst) using CFB gas-phase technology by toll manufacturing at a manufacturing site at Company B. All of Company A's production experience to date for the production of polyethylene has been with gas-phase bubbling bed technology using the patented XC catalyst (Examples 4.6 and 4.7). Company B has process experience with the operation of CFB technology for gas-oil catalytic cracking (with Fluid Catalytic Cracking catalyst), but does not have any relevant experience with polyethylene production using the XC catalyst.

1. Project Code: 4.8

   Project Name: Toll Manufacturing Trials of Polyethylene using Circulating Fluidized Bed Reactor and XC Catalyst
   Start Date: dd/mm/yyyy Completion Date: dd/mm/yyyy

   Total Labour Cost: $150k (for current tax year)
   Material Consumed or Transformed: $300k (for current tax year)

2. Capital Expenditures

Capital Item	Cost	Project Code
	nil	4.8

3. Personnel

Name	Role	Project Code	Areas of Work
J. Doe	Plant Manager	4.8	Operations Supervisor
J. A. Doe	Lead engineer	4.8	Trial production plan
J. B. Doe	Lead chemist	4.8	Chemistry support/assistance
J.C. Doe	QC Technologist	4.8	Process operations/assistance
J.D. Doe	Operator 1	4.8	Process operations/assistance
J.E. Doe	Operator 2	4.8	Process operations/assistance
J.F. Doe	Technologist	4.8	Health and Safety support
J.G. Doe	Engineer	4.8	Regulatory approvals

4. Detailed Project Description

   The new bubbling fluidized bed plant discussed in Examples 4.6 and 4.7 (using the new XC catalyst process) has been successful based on plant trials to date for the production of certain grades of polyethylene. However, scientists have determined from related lab-scale studies that other grades of polyethylene could be more efficiently produced with a high velocity fluidization process, like circulating fluidized bed (CFB) reactor technology, where the relative yields of these grades could be 2 – 4 % higher. There was also no spare capacity in the existing bubbling bed system to accommodate the production of other polyethylene grades for which there was clearly a customer demand.

Company A, the developer of patented XC catalyst at the XXYY R&D Center (see Examples 4.1-4.5), did not have any pilot or plant-scale CFB reactors available for this production. In addition, senior management was unwilling to invest significant resources (capital, materials, and personnel expenses) to develop the XC catalyst process for the CFB technology, before it could be successfully demonstrated on a customer's commercial-scale process equipment.

Company B had spare process capacity available with both their pilot-scale and plant-scale CFB reactors. These reactors were normally employed for their FCC gas-oil catalytic cracking process, but had significant downtimes at the present time. There was clearly a market niche for certain grades of polyethylene that could be produced more efficiently and with higher yields using the CFB technology. Senior executives at Company A subsequently made a business decision to contract the R&D and production work out to Company B as a toll manufacturing process using the CFB technology with the XC catalyst.

Company A provided the XC catalyst to Company B, and set up a toll-manufacturing contract to:

a) investigate the potential for polyethylene production with the XC catalyst in the Company B's CFB pilot-scale reactor;
b) carry out limited plant trials (using parameters identified from pilot-scale runs), to demonstrate the potential to produce commercial grade polyethylene using Company B's full-scale CFB production facilities.

All the raw materials (catalyst, process gases etc.) for the project were supplied by Company A. SR&ED labour was pooled from both Company A and Company B, and included qualified scientific and engineering technical personnel and operations labour. All process equipment (pilot and production) was supplied by Company B. Company A made a claim for the SR&ED project work by identifying relevant costs (labour, materials, overhead and other directly related and incremental costs). Company A's *SR&ED claim (for material costs) was made for only those materials that were either consumed or transformed (reference 9) during the pilot-scale experiments or plant experimental production test trials. If some of the products from either of these sets of test trials are sold in the future, the recapture rules will apply (see Section 2.5.1). Company B could make a claim for its own labour costs for its own SR&ED project.*

5. Scientific/Technological Objective

   The objective of this work was to determine if CFB technology could be successfully used to produce certain grades of polyethylene using the XC catalyst. This would be achieved by identifying operating parameters from the pilot-scale runs (such as gas velocity, solids flux, recirculation flow rates, temperature, pressure), and extrapolating where possible for a limited number of trial runs on the production-scale CFB facilities.

6. Scientific/Technological Advancement

   Engineers have found that the CFB process is capable of producing polyethylene more cost effectively than the bubbling bed system, and that there is much more flexibility in terms of the operating range. This permits for a wider spectrum of polyethylene grades to be produced with gross yields of up to 4% higher than the comparable bubbling bed process.

   The heat and mass transfer coefficients for the CFB are several times higher than the bubbling bed process due to the greater turbulence in the reactor, which allows for a much faster reaction time. It is clear that the reaction has shifted from one that is diffusion-limited (in the bubbling bed) to one that is kinetics-limited in the CFB, based upon chemical analysis data from product samples. However, more experimental work is required to determine the optimal solids to gas mass loading in order to reduce the extensive solids refluxing at the reactor walls.

7. Scientific/Technological Uncertainty

   There were several technological uncertainties encountered. Firstly, it was not clear if the CFB reactors that were previously employed for gas-oil cracking with FCC catalyst could be successfully employed for the XC-catalyst polyethylene process.

   It was also technically uncertain what the best operating parameters would be with the pilot-scale system, which needed to be determined through a planned systematic experimental investigation. Finally, it was technically unclear if the parameters identified from pilot-scale runs could be successfully used to predict rough operating parameters for the production CFB system. This is because the wall effects of the pilot-scale system play a much larger role in the two-phase flow hydrodynamics (because of smaller pipe diameter), in comparison with the full-scale production system. Extensive solids (catalyst) refluxing at the pipe walls in the pilot-scale system can have a major effect on the degree of back mixing, and hence the ultimate reaction rate that can be attained.

8. Supporting Information Available for Review

   Manufacturing operating procedures
   Test methods
   Detailed logs of start-up operations
   HAZOP reports
   Process operators' Logbooks
   Detailed mechanical drawings of toll manufacturing process equipment
   e-mail correspondence
   QC testing results
   Process Control testing results
   Experimental results (lab books)
   Shipping reports
   Video of toll manufacturing equipment process operation

Table 4.8
Process or Product Development Toll Manufacturing Example (Company A SR&ED Claim) [1]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[2]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES				
A	Toll manufacturing of experimental material	Y	SR&ED contracting costs for development work. Taxable supplier rules apply. **[Reference 2]**	Y	SR&ED contracting costs for development work. Taxable supplier rules apply. **[Reference 2]**
B	Equipment [3]	N	Owned by Company B	N	Owned by Company B
C	Equipment [4]	N	Owned by Company B	N	Owned by Company B
D	Equipment [5]	N	Owned by Company B	N	Owned by Company B
E	Scientists, Engineers, Technologists, Technicians directly involved in SR&ED project	Y	Company A labour	Y	Company A labour.
F	Raw materials consumed or transformed	Y	Transformed materials could be subject to recapture	Y	Transformed materials could be subject to recapture **See Note 1.**
G	Lab operations for SR&ED project	Y	Company A work Personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"	Y	Company A work Personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"
H	Technical support operations for SR&ED project	Y	Company A work Personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"	Y	Company A work Personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"

Note 1:
On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

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[1] Some project work meets definition of SR&ED
[2] Prescribed Proxy Amount
[3] ASA equipment
[4] Intended for commercial use (50% or less for SR&ED use).
[5] Shared use equipment (>50% SR&ED use over first two years).

Table 4.8
Process or Product Development Toll Manufacturing Example (Company A SR&ED Claim) (Cont.) [1]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[2]	Proxy Notes on Allowability
	OTHER AREAS OF WORK/EXPENDITURES				
I	Quality control testing of test material [6]	Y	Part of contracting costs or Company A personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"	Y	Part of contracting costs or Company A personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"
J	Process control testing of test material [6]	Y	Part of contracting costs or Company A personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"	Y	Part of contracting costs or Company A personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"
K	Technical support operations[6]	Y	Part of contracting costs or Company A personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"	Y	Part of contracting costs or Company A personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Testing"
L	Data collection [6]	Y	Part of contracting costs or Company A personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Data Collection"	Y	Part of contracting costs or Company A personnel carrying out 248(1)(d)(**See Appendix A.2**) – "Data Collection"

[1] Some project work meets definition of SR&ED
[2] Prescribed Proxy Amount
[6] Commensurate with needs of SR&ED project. Taxable supplier rules apply. **[Reference 2]**

4.9 Example 4.9: Process or Product Development Post-Production Improvement

This is an example of a fully operational commercial process for which a new technological problem has been identified that requires experimental development to resolve the problem. A number of areas of work are included; some of these could be considered as stand-alone SR&ED projects.

1. Project Code: 4.9

   Project Name: Post-Production Improvement for Gas-phase Bubbling Fluidized Bed Polyethylene Process
   Start Date: dd/mm/yyyy Completion Date: dd/mm/yyyy

   Total Labour Cost: 50k (for current tax year)
   Material Consumed or Transformed: 5k (for current tax year)

2. Capital Expenditures

Capital Item	Cost	Project Code
Membrane Elements	60k	4.9

3. Personnel

Name	Role	Project Code	Areas of Work
J. Doe	Project Lead	4.9	In charge of overall project
J. A. Doe	Lead Scientist	4.9	In charge of specific trial
J. B. Doe	Lead Engineer	4.9	Development of trial/assistance
J. C. Doe	Lead Chemist	4.9	Chemistry support/assistance
J. D. Doe	Technologist	4.9	Product evaluation/testing
J. E. Doe	Technologist	4.9	Trial assistance

4. Detailed Project Description

   In this project a new wastewater treatment facility was evaluated for the treatment of liquid effluents arising from the gas-phase fluidized bed polyethylene plant (see Examples 4.6, 4.7). A series of 10 experiments were carried out on a pilot-scale membrane facility (200 L/min clean water throughput) to determine the effects of applied pressure, cross flow velocities and process temperature on clean water permeation and contaminant removal efficiencies from the membrane plant. If the series of trials were successful, a full-scale membrane plant would be designed to operate in conjunction with the process XC-catalyst fluidized bed production equipment.

5. Scientific/Technological Objective

   The objective was to investigate the application of membrane technologies for the treatment of effluents arising from the XC-catalyst bubbling fluidized bed process.

6. Scientific/Technological Advancement

   The use of membranes for this type of waste is a new and untested application of the technology, and represents a technological advancement in the company's business environment. It was found that the combined membrane treatment removed 99.3% of hazardous contaminants; all other Canadian discharge guidelines were achieved. Appropriate cleaning and anti-bacterial agents were identified that would prevent downtime due to fouling and deposition of the membranes with colloidal and other organic substances. Methods to minimize the onset of fouling were identified, and optimal process parameters were found.

7. Scientific/Technological Uncertainty

   There are technical risks associated with the plant emissions and environmental impacts from the XC catalyst fluidized bed process that require significant modifications to existing plant equipment and processing methodologies.

   In particular, it was technologically unclear if the envisioned liquid waste treatment technology could produce an effluent quality that met all required Canadian discharge guidelines for hazardous substances in the effluent. There were also technological uncertainties associated with the processing of this liquid waste with each membrane system (microfiltration and reverse osmosis). Finally, there was also the system uncertainty associated with treating the waste with the multi-stage integrated treatment scheme.

8. Supporting Information Available for Review

   Selected internal company reports
   ISO 9000 report
   MSDS sheets
   Experimental procedures
   Application testing results
   Analytical lab results and methods
   Blueprints for water treatment plant
   Video of experimental operation of plant
   Used membrane elements
   Experimental results (lab books)

Table 4.9
Process or Product Development Post Production Improvement [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES				
A	Technical work to qualify new suppliers of new raw materials for SR&ED project	Y		Y	
B	ISO 9000 qualification	N		N	
C	Obtaining data for Material safety data sheets (MSDS)	Y	Carrying out 248(1)(d)(**See Appendix A.2**) – "Data collection"	Y	Carrying out 248(1)(d)(**See Appendix A.2**) – "Data collection"
D	Responsible Care	N		N	
E	Optimization of process to improve yield and/or productivity	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met
F	Changes in process to reduce waste or emissions	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met
G	Development of product application for specific customer applications	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met
H	Remediation of contaminated environment	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met

[1] Some project work meets definition of SR&ED.
[2] Some elements of work within the project could be stand alone SR&ED projects.
[3] Prescribed Proxy Amount

Table 4.9
Process or Product Development Post Production Improvement (Cont.) [1,2]

	Area of Work/Expenditure	Allowability for Tax Credit (Yes/No) "Traditional"	Traditional Notes on Allowability	Allowability for Tax Credit (Yes/No) PPA[3]	Proxy Notes on Allowability
	MAJOR AREAS OF WORK/EXPENDITURES (CONT.)				
I	Effluent treatment	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met
J	Equipment for application development testing	Y	If all or substantially all for SR&ED or shared use equipment	Y	If all or substantially all for SR&ED or shared use equipment
K	New analytical & test methods development	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met	Y	Carrying out 248(1)(d)(**See Appendix A.2**) or as separate SR&ED project if 3 criteria are independently met
L	Developing Experimental operations procedure	Y		Y	
M	Training for specific SR&ED project	Y	If directly related and incremental	N	Covered by PPA.
N	Employee health testing related to SR&ED project	Y	If directly related and incremental	N	Covered by PPA.
O	New equipment for SR&ED	Y	If ASA equipment or SUE. Recapture rules could apply.	Y	If ASA equipment or SUE. Recapture rules could apply.
P	Modifications to existing SR&ED equipment	Y		Y	

[1] Some project work meets definition of SR&ED.
[2] Some elements of work within the project could be stand alone SR&ED projects.
[3] Prescribed Proxy Amount

5. GLOSSARY OF TERMS USED IN THIS GUIDANCE DOCUMENT

Analysis
Analysis is a method used to determine or describe the nature of a thing by separating it into its component parts.

Business environment
Business environment characteristics include business size, competition, area of industry, and access to technical resources. For example, an enterprise may not have practical access to information proprietary to a competitor, or known in specialist or academic circles.

Commercial production
Commercial production is the set of areas of work associated with the production of products, and it is expected that a profit will be made.

Commonly available sources of knowledge or experience
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 scientific research and experimental development. They also include knowledge that is available in the business context of the firm. See also the Glossary entry on "Business environment."

Custom Product/Commercial Asset
Assets resulting from SR&ED projects that could, at the onset of the project, reasonably be expected to be sold, i.e. a custom product, or used in the claimant's business, i.e. a commercial asset.

Directly engaged
Whether an employee is directly engaged in SR&ED is a question of fact based on the duties performed and not on the job title. Directly engaged refers to "hands-on" work which would be included in paragraphs 248 (1)(a) to (d) of the *Income Tax Act*. "Hands-on" work performed by an employee includes:

1. preparing equipment and materials for experiments and analysis, but not maintaining equipment;
2. experimentation and analysis;
3. recording measurements, making calculations, and preparing charts and graphs; and
4. performing work with respect to engineering or design, operations research, mathematical analysis, computer programming, data collection, testing or psychological research that is commensurate with the needs and directly in support of eligible SR&ED work.

Directly in support
An activity is considered to be directly in support of scientific research and experimental development when it is reasonable to believe that the activity is required to carry out the scientific research and experimental development. That is, it has been shown to be an integral part of the systematic investigation of a problem, and is required in the search for a theoretical or practical solution.

Envelope of SR&ED
The "envelope of SR&ED" contains basic research work, applied research work, experimental development work, and other areas of work (i.e. 248(1)(d), Appendix A.2), that are necessary to resolving technological uncertainties, as defined in subsection 248(1) of the Act [Reference 7].

Experimentation
Experimentation is an act or operation designed to discover, test, or illustrate a technical truth, principle, or effect – to make a test or trial.

Experimental Production:
Experimental production means "the output that is required to verify whether or not the technological objectives are met and/or if a technological advance is achievable."

Feasibility Studies
In general, feasibility studies are not normally standalone SR&ED projects. There is usually a period of experimental work for the feasibility study to be eligible.

Once an eligible project is established, the feasibility study that was done in preparation for that project qualifies. In some cases, technical feasibility studies, can meet the SR&ED criteria on their own. In such cases the technical work will be eligible. The technical aspects of the work should be distinguished from all other types of studies (marketing, commercial or financial) that are often carried out at the same time, but which are not eligible as SR&ED.

GPOEF
General Purpose Office Equipment & Furniture
GPOEF includes all furniture, such as desks, chairs, lamps, filing cabinets and bookshelves. It also includes photocopiers, fax machines, telephones, pagers, typewriters, word processors, teletypes and calculators. Computers, including hardware, software and ancillary equipment, are not considered to be GPOEF.

Increment
An increment is the level of small improvement or "continuous improvement" by which a machine or piece of equipment can be improved (as opposed to radical improvement).

Offsite Testing
Frequently, the machinery and equipment produced by members of this industry are destined to be installed in the customer's production or process facilities. The development work is not complete until the machinery or equipment achieves its technological objectives. This is demonstrated through testing in the real production environment. Most often, the claimant cannot simulate a typical production environment. Offsite testing is therefore essential.

Offsite testing may take place after legal ownership of the machinery or equipment has been transferred to the customer. The change of ownership issue, and the location of testing should not affect whether the activities qualify as SR&ED. However, in such a situation, the right to claim may be questionable. The determination has to be made on a case-by-case basis.

Pilot Plant
A pilot plant is a non-commercial scale plant in which processing steps are systematically investigated under conditions simulating a full production unit. The purpose of a pilot plant is to obtain engineering and other data needed to evaluate hypotheses, write product or process formulae, establish finished product technical specifications, or design special equipment and structures required by a new or improved fabrication process.

Project
A SR&ED project consists of a set of interrelated areas of work that meet the three criteria of SR&ED. Assessment of eligibility for ITC purposes is made at the *"project"* level, not at the *"activity"* level.

Prototype
A prototype is an original model on which something new is patterned, and of which all things of the same type are representations or copies. It is a basic experimental model possessing the essential characteristics of the intended product.

Routine engineering
"Routine engineering" is the practice of designing, composing, evaluating, advising, reporting, directing, or supervising the construction or manufacturing of tangible products, assemblies, systems, or processes that require in-depth knowledge of engineering science, and the proper, safe, and economic application of engineering principles. By definition, and according to sound professional practice, routine engineering practice does not involve appreciable scientific or technological uncertainty.

SUE
Shared Use Equipment
Equipment used primarily (50% or more during its operating time) for the prosecution of SR&ED in Canada may qualify for a partial ITC. This shared-use treatment could apply to equipment used for dual purposes during the first or second period, or equipment whose use changes during the first or second period, for example, when a company performs SR&ED in a shop-floor setting and uses equipment for both SR&ED and production activities.

First term shared-use-equipment means depreciable property acquired after December 2, 1992, that is used by the claimant, during its operating time in the "first period," primarily (more than 50%) for the prosecution of SR&ED in Canada. The "first period" is the period that starts at the time the property was acquired, and available for use, by the claimant, and ends at the end of the claimant's first taxation year that occurs at least 12 months after that time. Second term shared-use-equipment of a claimant means property of the claimant that was first term shared-use- equipment and that is used by the claimant, during its operating time in the "second period," primarily (more than 50%) for the prosecution of SR&ED in Canada. The "second period" is the period that starts at the time the property was acquired, and available for use by the claimant, and ends at the end of the claimant's first taxation year that occurs at least 24 months after that time. See also paragraph 62 of IT-151 R5 (CONSOLIDATED) for further details on SUE.

Shop floor SR&ED
Work taking place in a manufacturing environment that meets the 3-criteria for SR&ED.

Style change
Style change means changing the physical appearance or arrangement of an article without altering its utility, efficiency, function, or operating characteristics.

System uncertainty
System uncertainty is recognizing that combinations of technologies, the components of which are generally well known, frequently carry a risk of failing to perform to acceptable standards. Thus, while each individual technology is known, the results of interactions among them as a whole may not be known, and must be determined by a program of systematic investigation to determine the results of such interactions.

Technical Scale Reactor
A technical-scale reactor is a scaled-up version of a bench-scale reactor, which is required to carry out experimental trials with more materials and of longer duration. The next step in the scale-up process would be the "pilot-scale" reactor.

Toll Manufacturing
Toll manufacturing refers to a practice that frequently occurs in the chemical sector, where a company 'A' chooses to outsource its experimental production and/or its existing commercial production to a potential customer (Company B) or an unrelated third party (Company C).

Trouble-shooting
Trouble-shooting is routinely correcting equipment or processes by identifying problems. The goals may be to optimize a process in both the technical or economic sense, to adjust equipment performance or to evaluate it during breakdowns, improve working conditions, minimize production losses, or to control the generation and disposal of wastes.

Trouble-shooting occasionally brings out the need for further scientific research and experimental development, but more frequently it involves detecting faults in equipment or processes, and results in minor modifications of standard equipment and processes. Such detection and modification is not scientific research and experimental development.

6. REFERENCES

[1] Chemicals Guidance Document 1 - Shop Floor SR&ED
http://www.cra-arc.gc.ca/taxcredit/sred/publications/chemdoc-e.pdf

[2] IT-151R5 (Consolidated): **"**Scientific Research and Experimental Development Expenditures"
http://www.cra-arc.gc.ca/E/pub/tp/it151r5-consolid/it151r5-consolid-e.pdf

[3] Information Circular IC86-4R3: Experimental Development and Scientific Research
http://www.cra-arc.gc.ca/E/pub/tp/ic86-4r3/ic86-4r3-e.html

[4] Application Policy SRED 95-02: Science Eligibility Guidelines for the Oil & Gas and Mining Industries
http://www.cra-arc.gc.ca/taxcredit/sred/publications/ap9502-e.html

[5] Application Policy SR&ED 96-07: Prototypes, Custom products /Commercial Assets, Pilot Plants and Experimental Production
http://www.cra-arc.gc.ca/taxcredit/sred/publications/ap9607-e.html

[6] Application Policy SR&ED 2000-04R2: "Recapture of Investment Tax Credit"
http://www.cra-arc.gc.ca/taxcredit/sred/publications/sr0618-e.html

[7] Information Circular 94-2**:** Machinery and Equipment Industry Application Paper
http://www.cra-arc.gc.ca/E/pub/tp/ic94-2/ic94-2-e.html

[8] Application Policy SR&ED 96-06: Directly undertaking, supervising or supporting directly engaged SR&ED Salary and Wages.
http://www.cra-arc.gc.ca/taxcredit/sred/publications/sr9606-e.html

[9] Recognizing Experimental Development;
http://www.cra-arc.gc.ca/taxcredit/sred/publications/recognizing-e.html

[10] T4088: Claiming SR&ED Expenditures – Guide to Form T661.
http://www.cra-arc.gc.ca/taxcredit/sred/publications/formshelp-e.html

[11] Application Policy SR&ED 2002-02R: Experimental Production and Commercial production with experimental development work – Allowable SR&ED Expenditures.
http://www.cra-arc.gc.ca/taxcredit/sred/publications/ap2002-02R-e.html

7. APPENDICES

Appendix A.1 Qualifying SR&ED Expenditures Under the Proxy Method
Appendix A.2: Subsection 248(1) of the *Income Tax Act*
Appendix B Chemical Industry and CRA Joint Committee Membership

APPENDIX A.1: BACKGROUND OF THE TWO METHODS

Section 37 of the *Income Tax Act* (the Act) provides two methods for calculating Scientific Research and Experimental Development (SR&ED) expenditures: the traditional method and the proxy method. The amount of expenditures added to the SR&ED expenditure pool under subsection 37(1) of the Act and the amount of qualified expenditures calculated under subsection 127(9) of the Act to determine the investment tax credit (ITC) earned will depend upon which of these two methods a claimant chooses.

The expenditures qualifying for an ITC are summarized in Appendix A.1.1. The main differences between the two methods are as follows:

Expenditure	Traditional Method	Proxy Method
Salaries	Salaries related to the time an employee spent directly engaged in SR&ED in Canada. Directly engaged refers to hands-on work which would be included in paragraphs (a) to (d) of the definition of SR&ED in subsection 248(1) of the Act.	Salaries related to the time an employee spent directly engaged in SR&ED in Canada. Directly engaged refers to hands-on work which would be included in paragraphs (a) to (d) of the definition of SR&ED in subsection 248(1) of the Act.
Cost of Materials	Costs of materials consumed and materials transformed in the prosecution of SR&ED in Canada.	Costs of materials consumed and materials transformed in the prosecution of SR&ED in Canada. On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

Expenditure	Traditional Method	Proxy Method
Overhead and Other Expenditures	Each overhead and other expenditure directly related and incremental to the prosecution of SR&ED must be specifically identified. Salary or wages related to clerical or administrative duties that are directly related and incremental to SR&ED in Canada can be included as overhead and other expenditures. The SR&ED portion of the costs of related benefits are claimed as overhead and other expenditures.	Overhead and other expenditures are not included in the calculation of allowable SR&ED expenditures. These costs are deducted on the financial statements as regular business expenses. Instead of identifying and making an allocation for each expenditure, a notional amount, the prescribed proxy amount (PPA), is calculated to represent an approximation of overhead and other expenditures in the determination of qualified expenditures for ITC purposes. The PPA is calculated as 65% of salaries and wages of employees who were directly engaged in SR&ED. The PPA represents the following expenditures directly related and incremental to the prosecution of SR&ED: ▪ Office supplies ▪ GPOEF ▪ Heat, water, electricity and telephones ▪ Support staff salaries and wages ▪ Travel and training ▪ Property taxes ▪ Maintenance and upkeep of SR&ED premises, facilities, or equipment ▪ Any other allowable expenditure directly related and incremental to the prosecution of SR&ED
Lease costs, capital expenditures, and shared use equipment	Costs of GPOEF are excluded.	Costs of GPOEF are excluded.

APPENDIX A.1.1: QUALIFYING EXPENDITURES UNDER THE TRADITIONAL AND THE PROXY METHODS

Traditional Method	Proxy Method
Directly engaged salaries or wages	Directly engaged salaries or wages
Materials consumed	Materials consumed
Materials transformed *	Materials transformed* See Note 1.
SR&ED contract payments	SR&ED contract payments
Lease costs of ASA equipment	Lease costs of ASA equipment (other than general purpose office equipment and furniture)
	½ lease costs of equipment primarily used for SR&ED (other than GPOEF)
Other expenditures directly related and incremental to SR&ED	Other expenditures covered by PPA
Other expenditures directly related and incremental to the provision of premises, facilities, or equipment for SR&ED	Other expenditures covered by PPA
Third party payments	Third party payments
Capital expenditures for ASA equipment *	Capital expenditures for ASA equipment (other than GPOEF –)*
	Prescribed proxy amount
Shared use equipment (other than GPOEF) *	Shared use equipment (other than GPOEF) *

Note 1:
On December 20, 2002, the Department of Finance released a package of draft technical amendments to the *Income Tax Act*. A change was proposed to allow the costs of materials transformed when using the proxy method. Although the coming into force date is February 23, 1998, the filing requirements will apply. If the proposed legislation is not passed, SR&ED claims that contain any of the proposed changes that were not passed will be reassessed accordingly.

* Materials transformed, capital expenditures, and SUE may be subject to ITC recapture.

APPENDIX A.2: SUBSECTION 248(1) OF THE *INCOME TAX ACT*

The law (subsection 248(1) of the *Income Tax Act*) defines SR&ED as:

"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 and psychological research where the work is commensurate with the needs, and directly in support, of work described in paragraph (a), (b) or (c) that is undertaken in Canada by or on behalf of the taxpayer,

but does not include work with respect to

(e) market research or sales promotion,

(f) quality control or routine testing of materials, devices, products or processes,

(g) research in the social sciences or the humanities,

(h) prospecting, exploring or drilling for, or producing, minerals, petroleum or natural gas,

(i) the commercial production of a new or improved material, device or product or the commercial use of a new or improved process,

(j) style changes, or

(k) routine data collection.

APPENDIX B: SR&ED Tax Credit Working Group

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