



ENVIRONMENT

Technological Innovation

ABSTRACT

Reclaiming inorganic industrial wastes is in keeping with the basic principles of waste management. The 4 R's of waste management are reduce (source reduction), reuse, recycle and reclaim (or recover), in that order.

Although reclaiming a residual material can be a complex undertaking, it may lead to lucrative commercial activities, since it involves taking an essentially worthless item and turning it into a product or a value-added material for which there is demand.

The approach devised by the Centre de transfert technologique en écologie industrielle (CTTÉI) and presented in this document consists of a decision-support tool that can help directors and environmental managers make informed decisions and more effectively plan, assess and carry out projects to reclaim a residual material.



WASTE MANAGEMENT

APPROACH FOR RECLAIMING INORGANIC INDUSTRIAL RESIDUAL MATERIALS



Photo: CTTÉI

HIGHLIGHTS

Overall approach

The methodology developed by CTTÉI:

- Guides and accelerates the decision-making process (analysis of environmental and economic benefits);
- Aims to put the residual material back onto a production line or create a new product;
- Aids in identifying suitable technical and scientific resources.

Characterization of industrial wastes

- Chemical composition, concentrations and structure of constituents;
- Physical characteristics (particle-size distribution, % moisture, etc.);
- Environmental suitability (leaching, toxicity, etc.).

Treatability testing

- Capacity of the residual material to undergo treatment;
- Validation at the laboratory scale and pilot scale;
- Commercial feasibility.

OBJECTIVES OF PROJECT/ PHASES

The aim of this data sheet is to provide a decision-support tool and reference guide for industrial waste generators, consultants, research facilities and universities that deal with waste management and industrial ecology issues, and, more specifically, to promote the reclamation of such materials. The first 3 R's of waste management (reduction, reuse and recycling) should always be given priority. The reclamation approach that is outlined here comes into play after reduction, reuse and recycling have all been ruled out as potential options for adding value to the residual material of interest.

This document will:

- Describe the industrial reclamation approach used by CTTÉI, setting out the key steps in informed decision making;
- List the reclamation expertise and facilities available in Quebec, at universities, research centres and government research institutes;
- Identify the legal issues arising in connection with reclamation-related activities such as transportation, storage, disposal, treatment and reclamation per se, so as to highlight the requirements and limitations associated with this type of undertaking.

BACKGROUND

Residual materials management is an area that has generated a great deal of interest in recent years.

A number of organizations and private companies are now getting involved in managing and controlling such materials or raising awareness of their reclamation potential. This includes the Quebec Department of the Environment (Ministère de l'Environnement du Québec), Recyc-Québec, Collecte sélective Québec, Environment Canada, Natural Resources Canada, the Quebec network of Centres de formation en entreprise et récupération (waste recovery training centres) and the Ressourceries du Québec network. However, there is no tool available at present

to help industries and decision-makers identify avenues for reclaiming residual materials arising in the manufacturing process, except perhaps guidelines for certain non-hazardous inorganic materials (Guide de valorisation des matières résiduelles inorganiques non dangereuses de source industrielle comme matériau de construction, ministère de l'Environnement du Québec, Service des matières résiduelles, June 2002).

Reclaiming industrial wastes (mine tailings, steel manufacturing wastes, quarry wastes, aluminium smelter wastes, chemical industry wastes, commercial and institutional wastes, municipal waste, etc.) is a complex undertaking that involves

studying many different facets, such as technical and scientific feasibility, management and treatment costs and financing, environmental protection, regulations, transportation, labour force, work organization, hygiene, health and marketing. It may be difficult for companies and stakeholders concerned with the reclamation of industrial by-products to identify and compile the necessary information. This document will provide a better grasp of the different issues involved in such projects and assist all those interested in locating the necessary expertise. A table listing various research facilities specializing in industrial by-product reclamation is appended.



Photos: CTTÉI, Melri, RECMIX and Suzanne Lachance

METHODOLOGY

Reclaiming an industrial residual material requires an evaluation protocol that addresses all of the aspects covered in this data sheet. The different stages in the fact-finding and decision-making process are illustrated in Figure 1.

Knowledge of the process in which the residual material arises, the associated monitoring efforts, the management methods applied and accurate characterization are key components of an effective reflection approach. After this stage is completed, a preliminary analysis can be made of problems that are likely to be encountered in the course of reclamation. Summarizing the data that have been compiled aids in identifying information gaps. A literature search can be carried out, as needed, and consulting the network of experts listed in the appendix may be essential for success.

Complementary characterization of the material destined for reclamation may be recommended after the data compilation stage. However, before it can be determined

whether the potential exists for reclamation, it is important to characterize the solid material. A re-evaluation of the situation may make it necessary to modify the initial hypotheses or even the reclamation options selected at the outset.

This characterization will aid in determining the regulatory status of the residual material. Depending on whether the material is deemed to be hazardous or non-hazardous (within the meaning of the provincial Regulation respecting hazardous materials), various tools are available to support decision making. There are four existing reclamation guides that deal with non-hazardous materials. Table 1 lists the acts and regulations governing activities such as the transportation, storage, disposal, reclamation, management, treatment and recovery of residual materials, all of which may influence the feasibility of a reclamation operation.

Upon completion of this stage, it should be known whether the residual material can be used as is and whether reclamation is a feasi-

ble option. What remains to be determined is the treatment process or processes (treatment line) that will allow the material to be reclaimed in whole or in part. The treatment options will be tested in the laboratory. Laboratory testing is done to test the hypotheses and reduce the scientific and technical uncertainty surrounding the targeted results or the methods that will be used during the pilot phase. The results of these tests will provide enough information to decide whether to make adjustments during the project development stage or whether to halt the undertaking. The financial situation of the project is crucial at this stage.

During the pilot phase, concrete data are obtained that can be used to scale up the process for the treatment line.

The last phase consists in transferring the technology to clients who will use it. Knowledge transfer can be achieved through various approaches, such as providing a theoretical and practical course.

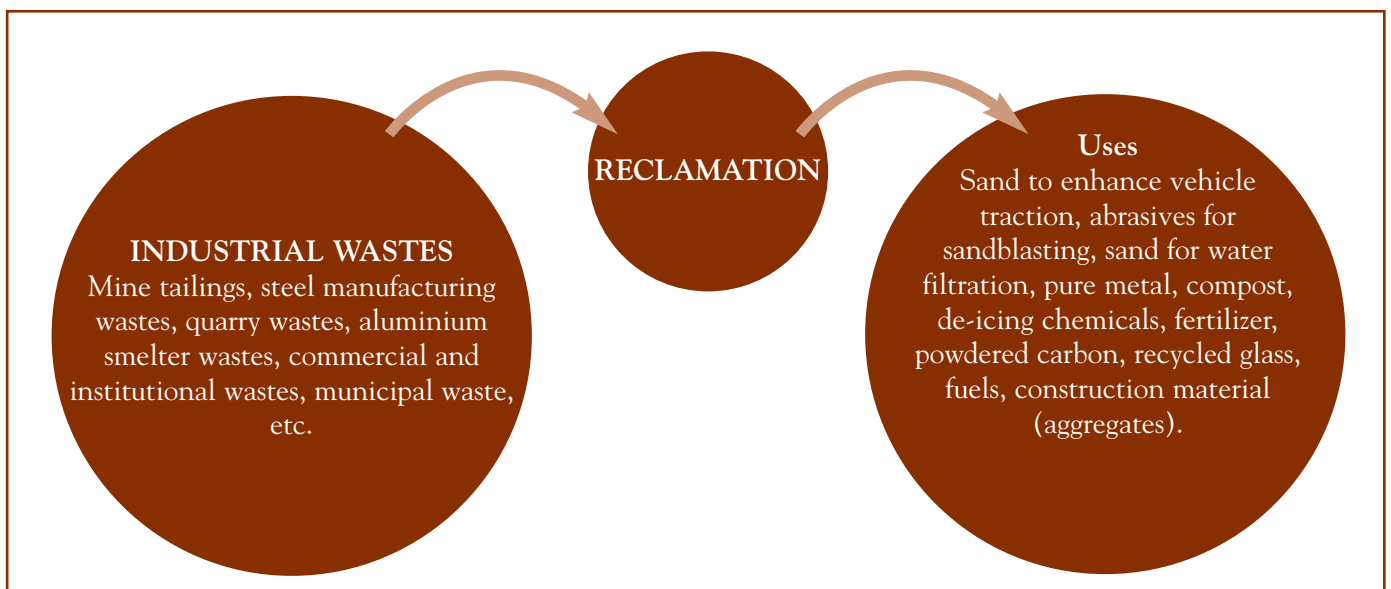
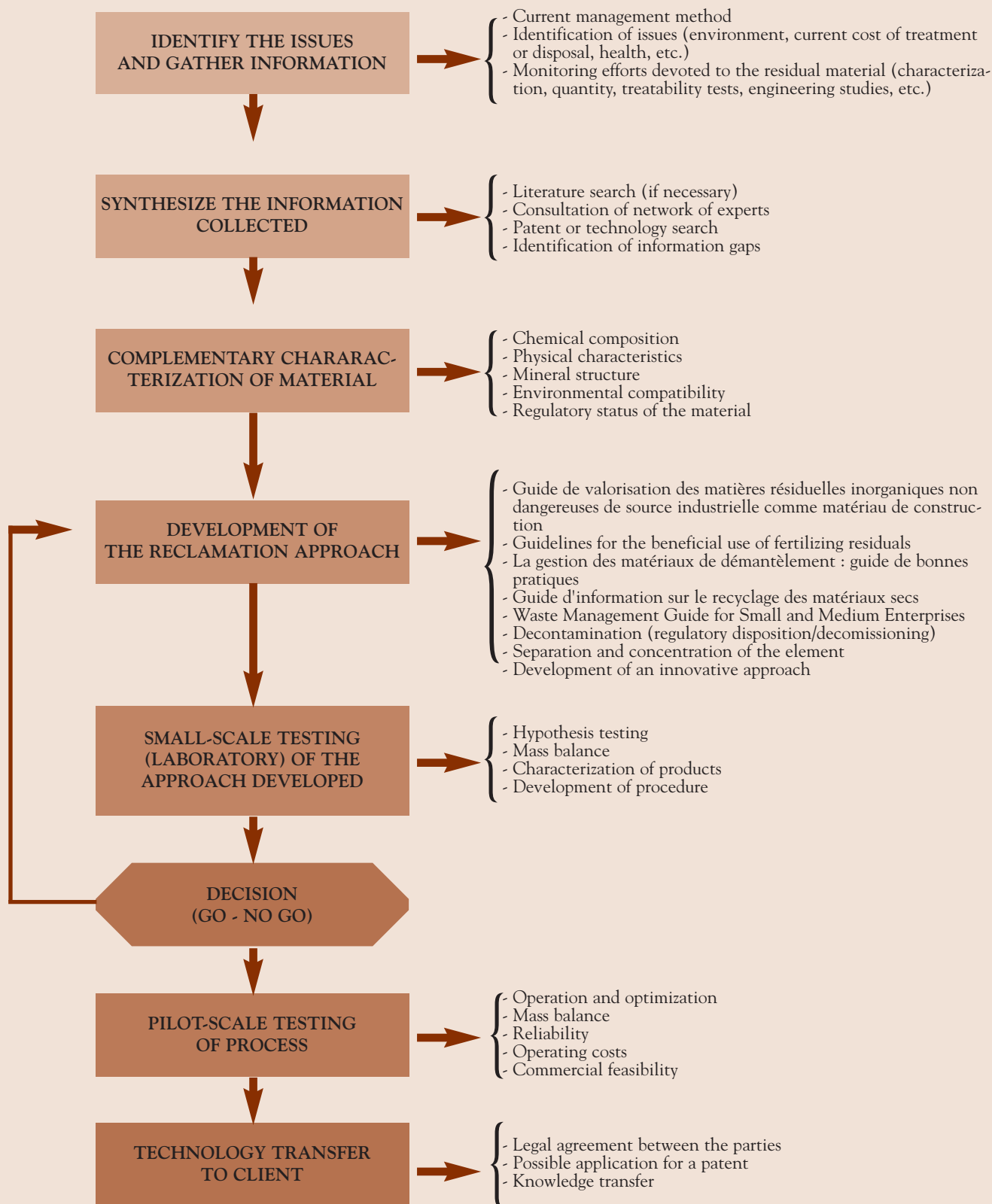


FIGURE 1: RECLAMATION APPROACH OF A RESIDUAL MATERIAL AT THE CTTÉI



REGULATORY FRAMEWORK

Residual material*

Any residue resulting from a production, treatment or utilization process and any substance, material or product or, more generally, any object that is discarded or that the holder intends to discard.

*Source: Quebec's Environment Quality Act

Hazardous material*

A material which, by reason of its properties, is a hazard to health or to the environment and which is explosive, gaseous, flammable, poisonous, radioactive, corrosive, oxidizing or leachable.

TABLE 1: ACTS, REGULATIONS AND GOVERNMENT GUIDES DEALING WITH INORGANIC RESIDUAL MATERIALS

Activities	Acts, regulations and Guides	General Description
TRANSPORT	Transportation of Dangerous Goods Act, 1992	Deals with signage, safety requirements, means of containment and emergency response plans.
	Regulation respecting hazardous materials (provincial)	Requirement to entrust the shipment of hazardous materials to a carrier holding a permit.
	Transportation of Dangerous Substances Regulation (provincial)	Covers most aspects of transportation.
STORAGE	Environment Quality Act (section 70.9) (Quebec)	A permit is required to store hazardous materials received from a third party.
	Regulation respecting hazardous materials. (Chapter IV) (provincial)	Deals specifically with the storage of residual hazardous materials.
DISPOSAL	Environment Quality Act (Quebec)	Division VII covers aspects related to the disposal of residual materials (management plan, site operating standards).
	Regulation respecting solid waste (Quebec)	Deals specifically with the management and operation of disposal sites (definitions, recovery, composting, certificate of authorization, financial guarantees).
	Regulation respecting hazardous materials (provincial)	Section 5 defines "hazardous materials disposal site". Chapter V sets out the provisions governing final disposal sites.
RECLAMATION	Environment Quality Act (Quebec)	In section 53.1, the term "reclamation" is defined. Division VII focuses on reclamation of residual materials.
	Regulation respecting hazardous materials (provincial)	Chapter 3 sets out the provisions related to the use of hazardous materials as an energy source.
	Guide de valorisation des matières résiduelles inorganiques non dangereuses de source industrielle comme matériau de construction (provincial)	Based on an exhaustive characterization of residual materials, this guide is designed to promote and facilitate the reclamation of residual materials.
	Guidelines for the beneficial use of fertilizing residuals (FR) (provincial)	Used to determine whether an FR reclamation activity is subject to a certificate of authorization, and sets out the applicable criteria and standards.
MANAGEMENT OF RESIDUE MATERIALS	Environment Quality Act (Quebec)	A register must be kept of hazardous materials. Requirement to submit an annual management plan for hazardous materials.
	Regulation respecting hazardous materials (provincial)	Defines the contents of the annual report.
	Environment Quality Act (section 53.4) (Quebec)	Introduction of the Quebec policy on residual materials management.
	Québec Residual Materials Management Policy	Sets out the government's policy on the management of residual materials.
	La gestion des matériaux de démantèlement : guide de bonnes pratiques (best practices guide) (provincial)	The aim of this guide is to promote appropriate management of these materials so as to minimize associated environmental effects.
TREATMENT	Waste Management Guide for Small and Medium Enterprises (federal and provincial)	Designed to assist managers of SMEs in developing and implementing a customized waste management program.
	Environment Quality Act (Quebec)	A permit or certificate of authorization is required to treat hazardous materials, pursuant to section 70.9(2).
RECOVERY	Regulation respecting solid waste (provincial)	Governs most of the aspects related to the recovery of mixed wastes.

POTENTIAL AND LIMITATIONS

Potential

- Substitution for raw materials;
- Optimal use of non-renewable materials;
- Value added to resources;
- Reduction of environmental impacts;
- Possible start-up of a company specializing in waste treatment and reclamation;
- Savings for the waste generator;
- Energy savings;
- Reduction in greenhouse gas emissions.

Limitations

Most residual materials or wastes have some valuable constituents, but these constituents are often contaminated with undesirable elements, constraining their use. The feasibility of reclamation depends on how difficult it is to separate out the valuable constituents.

Reclamation of an industrial residual material can be envisaged where:

- A financial advantage exists in relation to the current management situation;
- There are problems associated with current management of the material;
- The reclamation technology is available and affordable;
- The product derived from the reclamation process complies with the applicable regulations;
- There is an economically viable market for the product.

INFORMATION

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