St. Lawrence TECHNOLOGIES

ABSTRACT

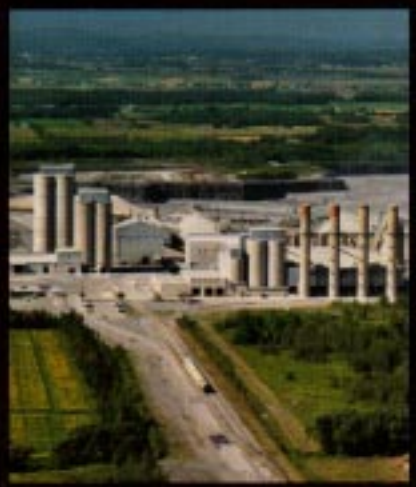
The 3Rs/ER* of waste management are a critical issue for the treated wood industry. As part of a global waste management plan, St. Lawrence Cement, in partnership with LPB Poles Inc., Bell Canada, Hydro-Quebec, Canadian National, Canadian Pacific Railway and STEPPE-UQAM, recycled utility poles treated with pentachlorophenol (PCP) and used PCP-treated wood wastes as well as creosoted railroad ties for energy reclamation in a cement plant.

The second phase of this technology demonstration project, conducted at the Joliette facilities of St. Lawrence Cement, confirmed the technical and environmental feasibility of reclaiming PCP-and creosote-treated wood waste as a fuel supplement in cement making.

* See definition on page 2.

RESIDUAL MATERIALS

RECLAIMING TREATED WOOD WASTE AS FUEL IN CEMENT MAKING



MAIN FEATURES

- **Technology**
  - Substitution of a fossil fuel with treated wood waste
  - Maintenance of clinker quality
  - Diversification of fuel sources
- **Environment**
  - Reduction in waste sent to landfills for disposal
  - Wood preserving agents disposed of more safely than by landfilling
  - Use of a renewable energy source
- **Cost**
  - Potential reduction in costs of managing treated wood waste
  - Improvement in industrial competitiveness

Saint-Laurent Vision 2000

Environment Canada Protection Québec Region

Environnement Canada Protection Région du Québec

LPB

ST.LAWRENCE CEMENT

Federal Office of Regional Development (Québec)

Bureau fédéral de Développement régional (Québec)

STUDY OBJECTIVES

The objective of the project was to validate the industrial-scale technical and environmental feasibility of the partial substitution of coal for pentachlorophenol and creosote-treated wood waste. Tests were conducted under extreme operating conditions in order to:

1. Validate the substitution rate.

2. Compare compliance of inputs (kiln dust, atmospheric emissions) with environmental standards.

3. Verify how changes in fuel affect clinker quality.

4. Verify the removal and destruction efficiency of the cement kiln.

5. Estimate economic viability of the project.

* In this document, 3Rs/ER stands for : Reduce at source, Reuse (waste used again in the same form and for the same purpose), Recycle (waste transformed for new use) and Energy Reclamation (waste transformed into energy).

BACKGROUND

Electrical, telecommunications and railway companies are the biggest users of treated wood. At present, the most common disposal method for utility poles and railroad ties is disposal at a secure landfill site. Under the principle of sustainable development, however, landfilling should be the last resort. Reclamation of treated wood waste for fuel in cement making is an alternative that is compatible with the concept of 3Rs/ER. Scientific information on the attendant environmental impacts of incinerating such waste is scanty, however, and varies according to cement plant facilities. Treated wood waste contains harmful substances such as PCP from utility poles along with polycyclic aromatic hydrocarbons (PAHs), which are the main components in creosote-treated railroad ties.

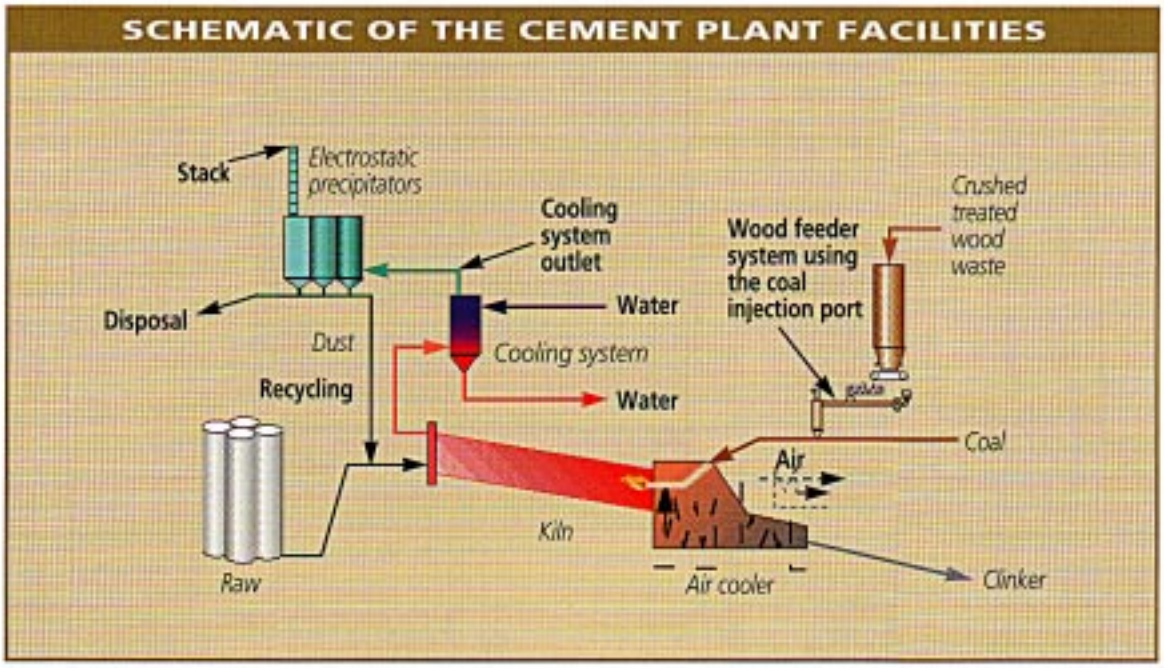
TECHNOLOGY

Testing was carried out at the Joliette, Quebec, plant of St. Lawrence Cement, which is authorized to burn tires and waste oils. Plant facilities include a kiln 122 m long and 3.66 m in diameter that is equipped with a flame burner capable of reaching 2000°C. Kiln temperature can thus be maintained at approximately 1450°C , the temperature at which clinker is formed.

Combustion gases are controlled by two variable-speed fans, while dust is recovered by means of multicyclones and electrostatic precipitators. A clinker cooling system is located at the opposite end. Hot air is recovered at the clinker outlet and returned to the kiln, where it serves as secondary combustion air.

After being stripped and crushed into fine particles, the wood waste is introduced into the cement kiln via the coal injection system.

SCHEMATIC OF THE CEMENT PLANT FACILITIES



RESULTS

A total of 400 tonnes of wood treated with PCP, creosote and chromated copper arsenate (CCA) was tested under two extreme operating conditions relative to secondary air temperature and oxygen content: 1029°C with 1.5 % of O_2 and 946°C with 2.3% O_2. Tests were conducted on a mixture of 68% PCP-treated wood, 29% creosote-treated, and 3% wood treated with CCA. This mixture provided 35% of the kiln's energy requirements, which corresponds to an average feed rate of 3 t/h.

A comparison of the results indicated that neither operating condition has a significant influence on the atmospheric emissions.

Atmospheric emissions were analysed and concentrations of the chemical compounds under study were found to have increased slightly compared to the pilot tests, for which only the usual cement-making fuels were used. Nonetheless, concentrations remain, for the most part, below the guidelines of the Canadian Council of Ministers of the Environment (CCME) and the Quebec Regulation respecting air quality (Q-2, r.20). Moreover, removal and destruction efficiency for dichlorobenzene (a reference compound) was 99.9981%, while the rate for other pollutants varied from 99.9547% to 99.9993%. These results confirm that cement kilns have the capacity to remove the toxic organic compounds contained in treated wood.

No organic pollutants were detected in the clinker during testing (i.e. below detection limit). On the other hand, the levels of some metals were found to increase when treated-wood waste is employed as fuel. This rise is probably due to the presence of residual CCA-treated wood, but has no impact on cement quality. The clinker was found to respect the quality criteria of the cement-making industry.

RESULTS OF ATMOSPHERIC EMISSIONS MEASURED

Parameters	Unit	Pilot	Treated wood	Standard / Criteria
PCP	mg / Nm³	ND	0.55	—
Dioxins and furans	g-TEF / Nm³	0.13	0.24	0.5 **
Particles	g / t clinker	37	47	500 *
HCL	mg / Nm³	5.4	9.4	50 **
Sum of Sb, Cu, Mn, V, Zn	mg / Nm³	0.097	0.117	1.5 **
Sum of As, Cr, Co, Ni, Se, Te	mg / Nm³	0.064	0.072	0.5 **
Sum of Cd, Hg, Tl	mg / Nm³	0.052	0.053	0.15 **

ND: not detected. * : *Regulation respecting air quality* (Q-2, r.20). ** : Criterion recommended by the CCME.
TEF: Toxicity Equivalency Factor applies to 2,3,7,8-tetrachlorodibenzo-p-dioxin.

POTENTIAL AND LIMITATIONS

This project demonstrated the technical and environmental viability of using PCP and creosote-treated wood waste as a fuel supplement in cement production. Its biggest advantage is the maximal use of a natural resource while reducing the amount of waste destined for the landfill.

Furthermore, emissions from this process respect CCME criteria relative to atmospheric emissions.

Nonetheless, the use of this type of residue in cement making is only an option where the plant is equipped with efficient treatment systems.

Moreover, the Environmental Monitoring Committee for industrial activities in Greater Joliette kept nearby residents informed throughout the energy-recovery test period.

This process offers a technological alternative within an integrated waste management approach based on the philosophy of the 3Rs/ER.

Finally, an economic evaluation has determined that such a venture can indeed be profitable, depending on local economic conditions, competing technologies, and regulation.

INFORMATION

This technology data sheet was prepared by the STEPPE-UQAM, and based on the results of a demonstration project on the integrated management of treated wood waste. The present project was a joint initiative of St. Lawrence Cement, LPB Poles Inc., Bell Canada, Hydro-Quebec, Canadian National, Canadian Pacific Railway, in cooperation with the Ministère de l'Environnement et de la Faune du Québec and with the technical and financial assistance of Environment Canada and the Federal Office of Regional Development (Quebec). Refer to the data sheet entitled, "Recycling utility poles treated with pentachlorophenol" for more information on the first phase of this demonstration project.

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St. Lawrence TECHNOLOGIES

St. Lawrence Technologies data sheets are intended for all companies, industries, organizations and individuals interested in new environmental technologies. They are produced by the Eco-Technology Innovation Section, Environment Canada, as part of the St.Lawrence Vision 2000. They serve to disseminate the results of technology development and demonstration projects conducted in the following five sectors: industrial wastewater; contaminated soil; hazardous wastes; contaminated sediment and innovative tool.

Data sheets may be obtained from:
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