Environment

Interdepartmental committee on used-tire management in Nova Scotia

Report to the Minister of Environment

Sept. 26, 2008

Executive Summary

The committee recommends that the Resource Recovery Fund Board issue a Request for Proposals for collecting used tires in Nova Scotia and processing them into tire-derived aggregate (TDA).

The committee also recommends that before the RFP is issued there be a significant effort to educate potential operators about TDA. This would include bringing them together with one or more experts in used-tire management.

TDA is made by shredding tires into pieces from 25mm to 300mm (1 to 12 inches). It has many uses, but the greatest potential in Nova Scotia is for lightweight engineering fill. This product is a cost-effective alternative in engineering applications where the ground is unable to support the weight of gravel. It is also useful as construction backfill, and in landfill cells, where it enhances leachate and gas collection.

TDA is well-understood and there is an international standard for its application. Used properly, it does not present a hazard to the environment.

An economic analysis shows that a TDA operation could earn a good return on investment.

Background

In December 2006, the Resource Recovery Fund Board awarded a contract to Lafarge Canada in Brookfield for processing the equivalent of 900,000 used passenger tires Nova Scotians dispose of each year. Lafarge intended to use the bulk of the tires as tire-derived fuel, or TDF, for its cement kilns in Brookfield and Quebec.

The TDF proposal was conditional on approval by the Department of Environment and Labour (now Nova Scotia Environment). In response to significant public concerns, the minister commissioned two reports on TDF.

The first, by a group of engineers at Dalhousie University, was an assessment of TDF. It reported that emissions were difficult to predict. It recommended that comprehensive baseline testing and pilot testing be conducted at Brookfield.

The second report was prepared by an advisory committee headed by Dr. Louis LaPierre. That panel evaluated 13 options for used tire management, rating them from a high of one to a low of four.

The TDF option received a four, and in public statements the minister said that he did not anticipate the use of TDF in Nova Scotia in the “foreseeable future”.

The minister asked that this committee be struck to develop a used-tire management strategy based on the LaPierre report, with a focus on options that received ratings of one or two.

The members of this committee are:

Bill Turpin, Nova Scotia Environment;
Christine Penney, NSE;
Don MacQueen, NSE;
Bill Ring, CEO, Resource Recovery Fund Board;
Stuart MacDonald, Department of Economic Development;
Paul Reynolds, Transportation and Infrastructure Renewal;
Wayne MacAskill, Transportation and Infrastructure Renewal.

Analysis

LaPierre committee

Chair: Dr. Louis LaPierre is Professor Emeritus, Université de Moncton. He held the K.C Irving Chair in Sustainable Development for eight years and is a former director of the Master in Environmental Studies program at the Université de Moncton. He has served on numerous committees, panels and councils for environmental and sustainability issues, nationally and internationally.

The other members of the committee, Mrs. Judy McMullen, Dr. Mark Gibson, and Dr. Wilbert Langley, have a wide range of experience in the fields of environmental management, human health, engineering, and community management.

The LaPierre committee gave high ratings (one or two) to six options. Two of these required shipping the tires out of province. The four “made in Nova Scotia” options were retreading, lightweight engineering fill, domestic waste system fill, and landscaping mulch.

The LaPierre committee noted that 125,000 industrial tires are retreaded in NS each year and that about 100,000 passenger tires are retreaded for export. Tires can be retreaded three or four times. This is environmentally sound, but while re-use delays the need for the disposal of tires, ultimately it cannot remove it.

Barring the development of a very successful export operation, retreading tires cannot have a significant impact on the province’s requirement to dispose of 900,000

passenger tire equivalents (PTEs) per year in an environmentally sustainable way. Developing such a market would be unpredictable and risky.

The remaining options -- lightweight engineering fill, domestic waste system fill, and landscaping mulch -- all use mechanical processing of whole tires. They involve grinding or chopping the tires into pieces ranging from 25mm to 300mm (1 to 12 inches). Landscaping mulch requires more processing, but a single operation could manufacture more than one type of material.

The LaPierre committee's report pointed to lightweight engineering fill -- also known as tire-derived aggregate or TDA -- as holding promise for Nova Scotia. A preliminary analysis by this committee seemed to confirm TDA's promise. Further, TDA is effectively a raw material for the other mechanical processes. Therefore, rather than repeat LaPierre's work, the committee decided to explore TDA first and move on to other options only if it encountered serious obstacles to its use in Nova Scotia.

Tire-derived aggregate (TDA)

The committee met with Dr. Dana Humphrey, the dean of engineering at the University of Maine and an expert on TDA.

Dr. Humphrey reported that TDA has been used successfully in Maine and at least 12 other U.S. states as lightweight fill without environmental problems.

Tire-Derived Aggregate

Alberta, Saskatchewan and Quebec use substantial quantities of TDA, and New Brunswick is using it on the approaches to the international bridge near St. Stephen, NB.

It's important to note that TDA replaces costlier alternatives. The material is not simply being "buried".

One of the most common applications of TDA is building roads in areas where the ground cannot support the weight of the gravel normally used to prepare the roadbed. TDA is an ideal substitute because it is half the weight and provides excellent drainage. When supported by recycling fees such as Nova Scotia's, it can be delivered to the job site for less than other lightweight fills.

TDA's low density and high permeability also give it an advantage as a "backfill" for retaining walls and bridge abutments.

Because TDA is a relatively poor conductor of heat, it reduces road maintenance by limiting frost penetration.

In certain applications, TDA can consume a surprisingly large number of tires in a short distance. In St. Stephen, where it is being used to improve “slope stability”, engineers are using 1.3 million PTEs over a total of approximately 120 metres. This is close to 1.5 years’ of Nova Scotia’s annual used tire production.

An embankment in California used the equivalent of two-thirds of Nova Scotia’s annual production in just over 200 metres.

TDA is also useful in landfill cells, where it enhances leachate and gas collection.

The manufacture of TDA is a straightforward mechanical process with no extraordinary technical or energy requirements.

Environmental impacts of TDA

Just over 19% of used tires in the U.S. are processed into TDA. In some states, such as New York at almost 33%, the rate is much higher. An extensive literature review by Dr. Humphrey found no significant environmental problems with TDA, nor did a review by Nova Scotia Environment’s Solid Waste Management Branch. There is evidence of leaching of manganese and iron where TDA is used in road construction, but the migration is short and the levels return to background in about two years. It is not a threat to drinking water.

There is a detailed international standard (American Society for Testing and Materials or ASTM) for the use of TDA that includes environmental management. We expect that adherence to the ASTM will prevent adverse environmental effects.

As noted by LaPierre, the energy requirement for producing TDA is low – comparable to that for stone aggregate.

The production and use of TDA do not create any of the potentially harmful emissions associated with the use of tires as fuel or other processes involving chemical change.

The provincial fire marshal states that TDA can be stockpiled under the same guidelines as whole tires. Unlike whole tires, TDA does not create the pools of standing water known to provide breeding grounds for mosquitoes.

Business case for TDA

Most of the demand for TDA in Nova Scotia rests with the municipal and provincial governments. The interdepartmental committee has had difficulty obtaining estimates of the demand because the decision-makers at these levels have been unfamiliar with the product and have had little opportunity to explore it.

The committee therefore arranged for Dr. Humphrey to brief representatives of the Department of Transportation and Infrastructure Renewal, Halifax Regional Municipality, Cape Breton Regional Municipality, and three waste management districts on May 7. The result was encouraging.

[As per the *Freedom of Information and Protection of Privacy Act* information has been severed under sections 14 and 17 of the *Act*]

The committee believes that a good TDA operator will find markets for all of its product.

Terry Gray, an expert in used tires with TAG Resource Recovery in Houston, provided a detailed outline of the capital requirements for a tire-shredding facility. Based on that, the Department of Economic Development and the RRFB prepared an analysis of how such a business might fare in Nova Scotia.

This is a conservative analysis. [As per the *Freedom of Information and Protection of Privacy Act* information has been severed under sections 21 and 17 of the *Act]* It is possible that at some point the market may allow a producer to charge for TDA, but used-tires continue to have a negative market value. This means recovery of this resource will continue to rely on tire recycling fees managed by the RRFB.

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The LaPierre report noted numerous other markets for reprocessed tires, including animal mats, roofing shingles, landscaping mulch, etc. A business based on TDA could be a starting point for developing those markets. TDA sales could provide cashflow during development and TDA itself is the raw material these products.
Lastly, should the need arise, TDA can be shipped to other manufacturers more economically – and using less energy – than whole tires.

This committee therefore believes TDA is a good opportunity for a well-managed company. Established aggregate companies may be interested because they are already familiar with the technology, they have readily available land, they have the means to deliver the product, and they already have relationships with potential customers.

The business case analysis should serve as a benchmark for assessing proposals submitted to government, but it is not definitive. The committee feels that a request for

proposals is the best way to find a successful operator and get the best value for the tire recycling fees collected by the RRFB.

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Issues

- Although TDA is promising, some people feel there are better options. One firm believes it has a technology for pyrolysis (breaking down the tires with heat in the absence of oxygen) that is environmentally and economically sound, and another believes there is great potential for retreading tires. One firm wants to use high-pressure streams of water to produce crumb rubber. Three others have contacted the committee or NSE simply looking for business opportunities in this area.

- NSE has been contacted several times by the firm advocating pyrolysis, and it is possible the company will continue to promote it. Pyrolysis received the lowest rating from the LaPierre committee (four).

- It is likely the private sector will be interested in processing Nova Scotia's used tires and it appears there is potential here for a good business. The RRFB's business model relies heavily on the private sector for the collection and processing of waste resources. Consequently, there will be an expectation that the private sector will continue to be involved in used-tire management.

- The establishment of a sustainable "used tire" business can be challenging. The first contractor, Atlantic Recycled Rubber (ARR), used cryogenic technology (freezing) to manufacture crumb rubber, but could not meet its obligations to the RRFB. The Board needed six months to clear the backlog of tires left behind. A similar failure now would be a significant setback for used-tire recycling in Nova Scotia. Feasibility must therefore be a key element in the province's strategy. The committee believes TDA has the best chance of meeting this requirement because it involves a simple, well-understood technology, good market prospects, and requires relatively little capital.

- TDA may encounter opposition from people who believe it is the equivalent of landfilling tires. Obviously, the use of TDA in landfills presents the same problem, and Solid Waste-Resource Management Regulations ban "used tires" from landfills. However, the committee has a legal opinion that TDA has been processed to a point where it cannot be considered "used tires".

- The public and private sectors, and Nova Scotians in general, know little about TDA. However, the committee believes that with good communication it will be regarded as environmentally and socially acceptable.

- Private firms may believe a tire processing contract from the RRFB comes with a guarantee of success. It will be important for them to understand that they are subject to risk just as any other business. They are responsible for obtaining any government commitments they need in order to make their proposals succeed.

Pyrolysis

The committee and NSE have been contacted several times by a company interested in pyrolyzing tires. Because the firm has also promoted the concept publicly, the committee felt the topic should be addressed in detail.

The process uses heat in the absence of oxygen to break down tires into oil, steel, combustible gas and a product used in rubber manufacturing known as carbon black or carbon char. To differing extents, these products can be sold, used to supply energy to the plant itself, provide district heating and/or generate electricity.

The LaPierre committee said that any consideration of pyrolysis should include a technical and economic feasibility review.

There are good reasons for that caution. Technical issues aside, tire pyrolysis enterprises have a high risk of business failure.

Although the technology has existed for 60 years, there is not one successful commercial tire pyrolysis plant in North America, Europe or Japan. The Rubber Manufacturers Association in the U.S. notes that “since 1985, 75 pyrolysis projects have been announced, patented, licensed and promoted. While at least four pyrolytic facilities have been built, there are no commercial facilities operating in the United States … Canada, Japan or Europe.”

Terry Gray, the Houston consultant mentioned above, says: “Extensive technical and economic resources (an estimated $300 million) have been invested in (tire pyrolysis) projects developed by major companies such as Goodyear/Tosco (The Oil Shale Co.), Firestone, Occidental, Uniroyal, Nippon and Foster-Wheeler. In addition, many pilot or ‘demonstration’ projects have been developed by smaller companies and entrepreneurs. One major project developed by Foster-Wheeler in England (Tyrolysis) failed technically and economically after expenditures exceeding $30 million.”

There are two tire pyrolysis plants operating in the world -- one in Taiwan and another in Shanghai, China. However, the committee does not believe their existence supports a recommendation for the process in Nova Scotia.

Nonetheless, the committee's recommendation (below) need not be a barrier to an entrepreneur who believes the pyrolysis is technically and economically feasible and has the means to finance it.

Conclusion/Recommendations

The committee believes tire-derived aggregate is the best option for the province. Properly managed, it fills a genuine demand, is environmentally sound, and offers a solid economic opportunity.

Although a TDA operation could do quite well in itself, it could also provide cashflow should an operator want to explore other markets. As noted, TDA is the raw material for the production of many other used-tire products.

The committee therefore recommends that the RRFB issue a Request for Proposals requiring, at a minimum, a sound business plan for processing Nova Scotia's used tires into TDA and marketing it. Additionally, a credible marketing plan should be required for proposals with a substantial reliance on further processing of TDA.

The committee believes this requirement minimizes the possibility of the province's used-tire management being again affected by a business failure.

It should be noted that this recommendation is not a barrier to pyrolysis. The Shanghai pyrolysis plant, for example, shreds whole tires before processing them. If a Nova Scotia company established the infrastructure for the production of TDA, it would be able to pyrolize the material rather than market it as TDA or other mechanically-manufactured product. However, the project would be subject to obtaining environmental approvals establishing limits on air and water emissions, including organic compounds and particulates. It may also require an environmental assessment, depending on the details of the proposal.

There is a possibility a request for proposals may not generate a high level of interest because TDA is relatively unknown in Nova Scotia.

The committee therefore recommends that before the RFP is issued there be a significant effort to educate potential operators about TDA. This would include bringing them together with one or more experts in used-tire management. This should include contacting potential out-of-province bidders.

Rollout

1) The rollout should emphasize:

- transparency, to ensure that everyone feels the process is fair;
- publicity, to ensure that potential operators aren't left behind;
- strong communications, to ensure the public understands what is being proposed and why;

2) Knowledge day: The RFP should be preceded by a knowledge day offering potential bidders a chance to talk with one or more used-tire experts and potential TDA buyers.

3) Draft RFP: Because TDA is new to Nova Scotia, the RFP process should include an opportunity for potential bidders to comment on a draft version of the document.

Appendix A

[As per the *Freedom of Information and Protection of Privacy Act* information has been severed under sections 21 and 17 of the *Act*]