Environmental Screening Report

Commercial Upgrade of Existing Pilot Plant
Used Tire Processing Facility
155 Yates Avenue
Sault Ste. Marie, Ontario

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MARCH 2018

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Please note that due to confidentiality, to view the appendices you must contact Environmental Waste International Inc. at (905)686-8689 or by email: steve.kantor@ewi.ca

1.0 Introduction

Every year millions of scrap tires are generated in Ontario. Some of these tires are recycled, but others make their way into landfills, are burned in cement kilns or are stockpiled throughout the province. These stockpiles can become a breeding ground for disease-carrying mosquitoes if they fill with water. These tires also pose a risk to the environment as they break down in uncontrolled locations. Environmental Waste International (EWI) and its wholly owned subsidiary Ellsin Environmental have developed a patented process that it believes will add value to used tires.

With regulatory approval the commercial upgrade of the existing pilot facility located in Sault Ste. Marie, Ontario to a fully operating facility will increase the throughput of the facility to 20 tonnes of used tires per day, producing useable products consisting of 14.8 tonnes of black plastic masterbatch, 3.6 tonnes of steel, 6.4 tonnes of oil and 2.6 tonnes of synthetic gas (Syngas).

1.1 Background

Ellsin Environmental operated a pilot facility to treat used tires at its 155 Yates Avenue location from June 2011 until the expiration of the Ontario Ministry of Environment and Climate Change (MOECC) Pilot permits in June 2016. The permits were: Air/Noise Environmental Compliance Approval (ECA) No. 0755-8ETPNW and Waste ECA No. 1180-7XRKUW.

The purpose of the Pilot Plant was to test the innovative process developed by EWI to convert waste tires into usable, saleable products. The technology is EWI's patented Reverse Polymerization™ process, which uses high efficiency microwaves in a low temperature (<350^{o} Celsius) nitrogen environment to prevent oxidation. EWI has successfully applied this technology elsewhere for several different scenarios such as medical waste management and wastewater sterilization. The intent of the Pilot Plant was to translate this success into commercial facility to convert waste tires into useful by-products.

The Pilot Plant was originally approved to operate on a 24-hour basis, seven days a week, for a 12-month period from the "Commencement Date of Operation", defined as "the date when approved waste is first received at the Site", which was June 20, 2011.

During the five years of operation the facility was inspected by the local MOECC office and had quarterly reports completed on the operation of the facility. Attached in Appendix A is the summary of the non-compliant issues that were noted in the Inspection Reports and the Quarterly Reports.

Based on the experience gained in operating the Pilot Plant, Ellsin is currently seeking to commercialize the facility and is completing a Screening level Environmental Assessment (EA) and applying for permanent ECAs for Air/Noise and Waste.

In August 2008, the then Ministry of the Environment (MOE) required Waste Diversion Ontario (WDO) to work in cooperation with Industry Funding Ontario (IFO) to develop a waste diversion program for scrap tires as defined under Ontario Regulation 84/07, made under the *Waste Diversion Act*. In accordance with the MOE's direction, the program's focus was to divert waste tires into higher end uses. As a result, the Used Tires Stewardship Program was launched on September 1st, 2009. The program promoted tire recycling as a way to drive investment in green industries and markets.

Ellsin originally worked in cooperation with the Ontario Tire Stewardship Program (OTS) to acquire tires for processing. However, due to limited availability of tires through that program, Ellsin has moved on to source tires from other suppliers. As such, once in operation Ellsin will play an important role in Ontario's economy and environment by diverting used tires into usable/salable products. In addition, Ellsin's project will provide a valuable source of raw materials that can be used to manufacture other products.

The function of the Commercial Plant is to continue to use EWI's innovative, patented process using microwaves to convert waste tires into usable/saleable products (reclaimed carbon black (rCB), hydrocarbon oil, hydrocarbon gas (Syngas), and scrap metal) at the same site and with primarily the existing equipment. Modifications of the equipment will include: infeed and out feed material handling; processing shredded tires; infeed and out feed heaters; Syngas utilized as fuel for the process heaters; reclaimed carbon pulverizer and a plastic extruder to manufacture plastic black concentrate called Masterbatch. The Site, as is, incorporates extensive engineering development work in all aspects of an operating plant including but not limited to: an operating logic control system; infeed system; tunnel design; microwave power supplies; individual control; material recovery system; and software development for intrinsically safe logic and control.

1.2 Project Description

Ellsin will upgrade the existing Pilot Plant to a commercial facility operating at a rate of 20 Tonnes per day utilizing the information gained throughout the Pilot Plant phase. The upgrades include: modifications to the infeed and outlet to accept shredded tires; preheating of the shredded rubber; post heating of the recovered tire carbon; Syngas utilized as fuel for the heaters and additional processing of the rCB to produce a black Masterbatch product. The process will rely on the patented Reverse Polymerization process to breakdown tire shred into useable products. A process diagram and a process description are presented in Appendix B

The majority of the rCB will be mixed with plastic and extruded as black Masterbatch to be utilized in the plastics industry. To continually develop the market for the rCB, some rCB will be sold to companies who manufacture plastic master batch, rubber products and coatings. The steel will be recycled by the metal recycling company located next door to the facility, while the oil will be sold to petroleum companies as a raw feedstock. All Syngas will be utilized as a fuel for the gas heaters to preheat the tire shred and to post heat the recovered carbon black. The gas engine that is currently on-site will no longer be utilized.

Based on discussions with the current OTS, the facility will have to be operating commercially before Ellsin will receive any OTS tires. Ellsin is working with Triple M and other local companies in an effort to have a local supply of shredded tires. In the short term Ellsin has sourced tire shred from Windsor Rubber Processing located in Windsor, Ontario and Silver Lining Tire Recycling located in Wyandotte, Michigan. It is the intention of Ellsin to process Ontario tire shred but due to market uncertainties Ellsin will request a service area of North America. The shredded tires will be shipped to site on as needed basis, the tire shred will be stored onsite in the transport trucks they are delivered in until needed and then unloaded directly from the truck into the facility. There will be no piles of used tires or shred located outside the facility.

Transportation

The transport of materials will be limited to deliveries between 6am and 6pm Monday to Friday. The facility will operate 7 days per week 24 hours per day; unloading and loading of trucks may occur at any time during the day. Based on operating at full capacity (20 tonnes of tire shred) below is a chart showing the estimated number of shipments/deliveries.

Material	Weekly	Monthly	Total/Year
Tire Shred (In)	7	28	336
Plastic Resin (In)	3	12	48
Finished Master Batch (Out)	6	24	288
Scrubber Chemicals (In)	1	4	48
Recovered Steel (Out)	1	4	48

Recovered Oil (Out)	1	5	60

A complete project description is in the Design and Operations Report presented in Appendix C.

1.3 Projected Project Financials

Ellsin Environmental Inc. - Subsidiary of Environmental Waste International Inc.			
Master Batch Production and Phased upgrade of Sault Ste. Marie Plant			
Tire Shred Producing Master Batch			
Imperial Measurement			
EWS SSM Upgrade Operating Projections			
Recycled Products Tire Shred	Average Selling Price	Recovery Per Ton of feed	Dollars per Ton of feed, Phase 2
Carbon Black, pound	$0.00	902.4	
Steel, pound	$0.05	200	$10.00
Refined Oil, US gallon	$0.95	79.5	$75.37
Light Oil, US gallon	$0.76	26.8	$20.29
Master Batch per lb	$0.77	1,805	$1,395

EWI MODEL	
	TR System Upgrade
Tire Throughput per day	**2,000**
CAPITAL COST for the Upgrade at SSM	**$8,756,001**
Annual By-Product Production	
Operational Days Per Year	**330**
Tons(US) of Tires Processed	6,600
Pounds of Carbon Black	5,956,098
Pounds of Steel	1,320,000
Refined Oil in USG	524,976
Light Oil in USG	176,691
Pounds of Masterbatch	11,912,195
Revenues from Sale of Products per Year	
Master Batch Sales	$9,204,878
Carbon Black Sales	$ -
Steel Sales	$ 66,000
Refined Oil Sales	$ 497,415
Light Oil Sales	$ 133,932
Gross Income	**$ 9,902,224**
Gross Income Per Ton	**$ 1,500.34**
Estimated Expenses	
General Maintenance (Including Labor)	$ 486,000
Chemicals	$ 356,590
Natural Gas	$ 140,500
Electricity Cost	$ 278,182
Water	$ 29,454
Labor / Eng /Benefits	$ 572,000
Building Lease	$ 194,088
Carbon Pulverizing	$ 253,968
Waste Disposal	$ 66,000
Business Insurance	$ 85,140
Packaging	$ 119,122
Sales commission	$ 238,244
Tire Shred Costs	$ 396,000
Engineering, Compliance and Management Costs	$ 170,135
Sub Total	$ 3,385,423
Material Cost	
Carbon Purchase	
Recycled Resin	$ 1,786,829
Sub Total	
Total Estimated Expenses:	**$ 5,172,252**
Projected Operating Income:	**$ 4,729,972**
Return on Investment	**54.02%**

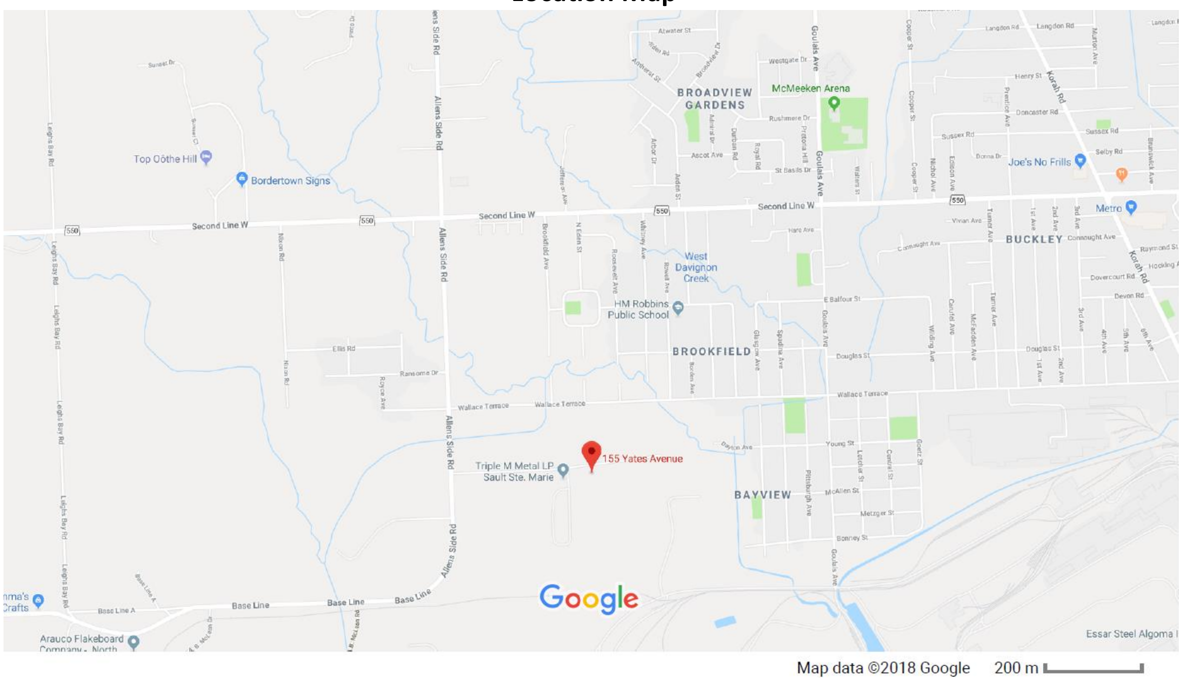
ASSUMPTIONS

- EWI Projections are estimates of market value based on time sensitive data at time of writing and are for guideline purposes only.
- EWI makes no guarantee, implied or otherwise, that these values will be achievable.
- Price includes the estimated average costs associated with installation and commissioning.

1.4 Project Location

The Commercial Plant is located in a heavily industrialized area. The neighbouring companies include: Essar Steel, Triple M (Auto Recycling), Algoma Industrial and Municipal Waste Recycling Consultants.

Location Map



Google Maps 155 Yates Ave

Imagery ©2017 Google, Map data ©2017 Google 500 m

Google Maps 155 Yates Ave

Imagery ©2017 Google, Map data ©2017 Google 50 m

1.5 Contingency and Emergency Response Plan

The complete Contingency and Emergency Response Plan (CERP) has been completed and is included in Design and Operations Appendix C.

1.6 Closure Plan

In the event that the facility has to be closed and will no longer be processing waste we have prepared a Closure Plan that is included in Design and Operations Appendix C.

2.0 Environmental Screening

To reopen the facility requires a new ECA Air/Noise and ECA Waste. The ECA Waste triggers the requirement for an Environmental Assessment (EA) and due to the nature of the facility it qualifies for a self-assessment Environmental Screening Process (ESP). One of the initial steps in the ESP is to fill out a Screening Criterion Checklist.

The completed Screening Criterion Checklist for this project is included in Appendix D which shows very limited negative impacts to the local environment. Testing completed for the previous Pilot Plant ECAs has shown that the process has very little environmental impacts. Using the synthetic gas as a fuel for the heaters will result in even less impact than the previous use of the synthetic gas in the gas engine. The Emissions Summary and Dispersion Modelling is presented in Appendix F and is discussed in Section 4.3.

The only expected waste generated at the facility will be office waste, small amounts of off spec materials such as oil and carbon, and spent activated carbon filters from the scrubber.

3.0 Public and Government Agency Consultation

Communicating with Indigenous Peoples, the Public and Government Agencies is an essential part of the ESP.

3.1 Pre Commencement

Ellsin has and will continue to work very closely with the local MOECC office. The local office was consulted prior to initializing the ESP. Subsequently Ellsin initiated a conference call meeting regarding the commencement of the ESP. The Pre Commencement conference call, on January 20, 2017, had the following participants from the MOECC offices: Gillianne Marshall – EA Coordinator Northern Region;

Kevin Belsito – Acting Supervisor; Kira Fry – Senior Environmental Officer, Sault Ste. Marie; Margaret Wojcik – Senior Review Engineer; Bijal Shah – Senior Review Engineer. As well Ellsin representatives on the call were: Steve Kantor – Chief Technology Officer and Paul Weinwurm – Engineer, Independent Environment Consultants: Don Gorber and Christine Cinnamon. The meeting minutes are included in Appendix E.

3.2 Notice of Commencement

Consultation continued with the MOECC regarding the Notice of Commencement, after review by the MOECC , Ellsin published the Notice of Commencement (NoC) in the two local papers. The email correspondence with the MOECC can be found in Appendix F. The NoC was published twice in the Sault This Week and the Sault Star, a copy of the NoC is included in Appendix G.

Ellsin received two responses to the NoC:

1. John Bobiwash, a local businessman and member of Thessalon First Nation, contacted both Clint Wardlaw and Steve Kantor to explore how he could work with Ellsin to create a business.
2. Fred Post, Environmental Engineer from Essar Steel was glad to hear we were moving forward with the project. He offered Essar's support on the project.

3.3 Indigenous, Public and Government Consultation

Following the publication of the NoC, Ellsin was provided a list of local agencies and Indigenous Communities to consult with from the MOECC, see emails in Appendix H. Ellsin sent letters or emails to all groups indicated by the MOECC and arranged meetings with all the Indigenous communities at the Ellsin facility. The agencies contacted did not indicate any concerns with the project.

3.3.1 Indigenous Meetings

Ellsin met separately with four local Indigenous Communities: Garden River First Nation, Metis Nation of Ontario, Batchewana First Nation and Thessalon First Nations. The meetings all took place at the Ellsin facility where a presentation of the project was shown to the groups and an electronic version was provided to each group. Also a tour of the facility was completed. Each group was enthusiastic and very supportive.

After consultations with the MOECC Ellsin updated its original Screening report and has sent each group the updated report for their comments.

The Indigenous groups did ask to have a follow up meeting once the project was operating. The summary of the Indigenous consultations is included in Appendix H.

3.2.2 Public Meetings

A Public Open House was held at the Ellsin facility where tours of the facility were completed and any concerns were answered. The Notice of Public Open House was published in the two local papers prior to the open house on June 1, 2017. The Open House Notices are included in Appendix I. Also a copy of the Open House notice was delivered personally to each neighbour.

A total of 7 people attended the Open House. All were local people who wanted to see what Ellsin was doing or local people who wanted to show their support for the project. There were no concerns brought forward by the attendees. The list of attendees is included in Appendix I.

Ellsin also went in person to each of the Site's neighbours and provided them with a copy of the NoC. A summary of all consultations can be found in Appendix H.

4.0 Environmental Advantages and Disadvantages

The major environmental advantage this process has over existing technologies is the greenhouse gas reductions. As shown in the table below the carbon footprint for the facility is less than from burning tires, producing virgin carbon black and creating crumb rubber.

Another environmental advantage is the plan to make black Masterbatch at the facility with the carbon black and **recycled** plastic. This will create the first 100% **recycled** black masterbatch, will limit transportation of raw materials to outside locations and provide a means to **recycle** plastic material in northern Ontario. This Masterbatch is then used in the manufacture of black plastic products; anything from garbage bags, to cell phone covers to car dashboards. This is far better than the traditional taking used tires and creating ground rubber to put into low value products.

The small negative effects from the facility are: greenhouse gas emissions; the office and off spec wastes; and the air emissions from use of Syngas and the carbon pulverizer. These effects are mitigated by the controls put in place by Ellsin. These mitigation controls are explained in the Environmental Summary and Dispersion Modelling Report included in Appendix F.

The facility has a potential negative effect based on the greenhouse gases (GHG) produced to transport tire shred to the facility and to ship the products created to consumers. We have taken these effects into consideration and are working with local groups to set up a local tire shredding operation that will process all the tires from northern Ontario. This will actually lower the GHGs currently produced to ship all the used tires to southern Ontario for processing. Producing black Masterbatch onsite will also limit the GHGs produced by removing the shipping of the rCB to Masterbatch producers in southern Ontario or elsewhere in North America. Instead we will be shipping a densely packed material directly to the end user, similar to the existing Masterbatch producers. Also in the manufacture of black Masterbatch we will require used plastic, we are hopeful that we will be able to work with northern blue box collection companies to have them supply us with the required material, again saving in the shipping and lowering the GHGs. The estimated potential Green House Gas reductions are shown below.

4.1 GHG Reduction

GHG from Tire Processing

		EWI RP Process	Virgin Manufactured Materials		
Processing Rate:	10000 kg/day	% Recovered	GHG Production	GHG Production	GHG Production
	416.7 kg/hr	kg /kg tire	kgCO2e/kg tire	kgCO2e/day	kgCO2e/year
Oil production		37%	0.43	434.58	143,412.08
Carbon production		43%	1.13	1,126.60	371,778.00
Steel production		4%	0.01	5.20	1,716.00
Syngas production		16%	0.13	131.29	43,326.62
Total per processed rubber (CO2e/kg)			**1.70**	**1,697.67**	**560,232.70**

GHG Resulting from the EWI RP Process		GHG Production kgCO2e/kg tire	GHG Production kgCO2e/day	GHG Production kgCO2e/year
Electricity consumed per rubber (kWh/kg)	0.83			
CO2 for Electricity per rubber (kgCO2e/kg)		0.08	83.28	27,482.40
Syngas use for burners per rubber (Mj/kg)	7.38			
Syngas use for burners per rubber (kgCO2e/kg)		0.58	578.06	190,758.85
Total released per EWI RP Process (kgCO2e/kg)		**0.66**	**661.34**	**218,241.25**
EWI RP Process GHG Emission Reduction		**1.04**	**1,036.34**	**341,991.45**
			% Reduction =	**61%**

Emission Source	Note: Data on this section of the chart from various EPA sources			
TDF Emissions compared to Coal Emissions in Utilities	**Combustion of Tires (tCO2e/t)**	**Combustion of Coal (tCO2e/t)**	**Increased Emissions (tCO2e/t)**	**Percentage Increase**
	2.45	1.87	0.58	31%
TDF Emissions compared to EWI RP Process	**Combustion of Tires (tCO2e/t)**	**Commodities Produced using EWI Process (tCO2e/t)**	**Reduced Emissions (tCO2e/t)**	**Percentage Reduction**
	2.45	0.66	1.79	73%
Crumbing Products compared to producing Virgin Material	**Manufactured Virgin Material (tCO2e/t)**	**Manufactured from Recycled Tires (tCO2e/t)**	**Reduced Emissions (tCO2e/t)**	**Percentage Reduction**
	0.61	0.43	0.18	30%
EWI overall process compared to producing Virgin Materials (see above chart for details)	**Commodities Produced from Virgin Mtl. (tCO2e/t)**	**Commodities Produced using EWI Process**	**Reduced Emissions (tCO2e/t)**	**Percentage Reduction**
	1.7	0.66	1.04	61%
EWI Carbon Black Production Emissions Compared to Virgin Carbon Black Production	**Virgin Carbon Black Production (tCO2e/t)**	**EWI RP Carbon Black (tCO2e/t)**	**EWI RP Emission Reduction (tCO2e/t)**	**Percentage Reduction**
	2.62	0.28	2.34	89%

Notes:

347	kWh EWI electricity consumption consist of magnetrons, auxiliary equipment and post processing (carbon pulverising)
2.62	Embedded Carbon Dioxide – Carbon Black Manufacture t CO2 / t Carbon Black per IPCC 2006. Assumes furnace black process is used.
0.13	Embedded Carbon Dioxide – Steel Manufacture tCO2e/T steel per EPA WARM v12
33.7	Oil Production kg CO2e/GJ per CRS 2013 (assumes refined Canadian Oil Sands)
38.3	Energy Content – Fuel Oil MJ/L per EC 2013
0.91	Specific Gravity of Oil kg/L
34.9	Energy Content – Fuel Oil MJ/kg per EC 2013
1.17	eCO2 kg/kg of oil
17.8	LPG/Syngas Production kg CO2/GJ per Greenhouse Gas Emissions Inventory Summary for Canada EC (2002)
78.37	LPG/Syngas Combustion kg CO2/GJ per EC 2002
46.1	Energy LPG MJ/kg
0.82	LPG/Syngas Production kg CO2/kg
	EWI process syngas was assumed to generate equivalent CO2e emissions when compared to marketable LPG
0.1	Electricity kgCO2/kWl Ontario Electricity Source: Canada - National Inventory Report 1990-2009, Greenhouse Gas Sources and Sinks in Canada, Part 3
2.58	Required Energy for pre/post heating of rubber (Mj/kg)
330	Days of operation per year
2.6477	www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf

4.2 Air Emissions Mitigation and Controls

In the microwave process as the tires breakdown hydrocarbon vapours are extracted from the process tunnel while carbon and steel remain in the process chamber to be extracted at the rear of the tunnel.

4.2.1 Hydrocarbon Vapours

As the hydrocarbon vapours are drawn out of the processing tunnel the condensable hydrocarbons are collected by cooling in the condensing system.

The non-condensable gas or Syngas exiting the condenser is further scrubbed with a sodium hydroxide solution in a large counter-current vertical scrubber. Sodium hydroxide is used to remove hydrogen sulphide from the syngas, which has a concentration of approximately 0.5% to less than 10 ppm. An activated carbon unit continuously removes hydrocarbons from sodium hydroxide solution recirculating in the scrubber unit while fresh sodium hydroxide solution is continuously added to the scrubber to maintain the set pH levels. As the level increases some of the spent sodium hydroxide solution is removed into the conditioning unit were sodium sulphide is oxidized by the addition of sodium hypochlorite into a harmless solution of sodium sulphate and sodium chloride salts. Before this solution is discharged into the sewer system it is polished by a secondary activated carbon unit. The quality of water is below the levels of the city sewer bylaw limits.

After the scrubbing system a demister is used to remove any very small liquid droplets before the Syngas is compressed in a gas compressor. The gas compressor operates with recirculation of oil and separation of oil from gas. The filtration of gas and oil is used to eliminate any residue. Due to compression, oil contact and coalescing further cleaning of gas is happening.

The Syngas is stored in a large pressure vessel where it is used as a fuel for the burners to indirectly preheat and post-heat the system with radiant heat. Temperatures of flames in the burners will be above 900 deg C. Due to the long retention time of the gas (more than 1 second) in hot heating tube environment and oxygen levels above 7%, the hydrocarbons are changed to CO_2. Carbon monoxide (CO) will be present below 35 ppmv. At the start-up of process natural gas is used to preheat the system. After few hours, once Syngas is created, the natural gas is replaced with Syngas.

Previously the pilot plant operated utilizing a natural gas engine which incorporated Syngas as 20% of the fuel. The exhaust from the gas engine were treated with a catalytic reducing unit and the injection of propane to lower NOx levels following the catalytic oxidiser to minimize total hydrocarbon (THC) and CO. Results from the source testing showed that all measured parameters were below MOECC in stack and point-of-impingement (POI) criteria.

The proposed use of Syngas in pre/post heating system will utilize similar principles of oxidization as used previously in the gas engine. In comparison to previously run pilot plant we expect lower emission results due to longer retention times at the same temperature, better control of the process and a large improvement in lowering greenhouse gas emissions due to replacement of natural gas with 100% Syngas.

4.2.2 Carbon and Steel

Carbon and steel remain on the processing tunnel conveyor and are extracted at the discharge through an airlock. The steel is separated magnetically from the raw tire carbon and placed into an airtight container until there is sufficient cooled for removal. A metal recycling company located beside our facility takes all the recovered metals.

Material conveying

Raw tire carbon produced by the process is in a lumpy form. This material is transferred by a conveying system into a raw carbon silo, located in the pulverizing room. This silo is equipped with a bin vent dust collector. The unit will be designed to meet dust emission targets set for the facility.

Pulverising

Raw tire carbon from the silo is fed into a pulverizing unit where it is reduced in size to below 10micron. Pulverizing the carbon to micron size particles requires some air movement mainly for classifying purpose. As a result this air carries some fine particles. This air will be filtered by a dust collector before being discharged to atmosphere. The filter media for this purpose can remove 99.98% for particles above 0.5 micron and 99.994% for particles above 0.7 micron. The unit will be designed to meet dust emission targets set for the facility. After size reduction the rCB is pneumatically conveyed to another silo where it is held until it is required in the production of Masterbatch.

Masterbatch Process

Production of black Masterbatch concentrate is accomplished in the extruder which is main part of the system. The polyethylene plastic pellets are fed at the beginning of the extruder and are melted at 140^{o}C. Pulverized rCB from the silo is added in second part of extruder to be mixed with warm and melted plastic. At the end of the extruder plastic black concentrate exits through the small holes. It is cooled and chopped into black plastic concentrate pellets. Production of black Masterbatch requires some movement of carbon dust in the area; the feeder and hopper are the main areas requiring carbon dust control. Although all delivery points are sealed some air pick up points will be incorporated to the system to avoid any chance for rCB to become airborne. A dedicated dust collector is assigned for this area to collect all air from the pickup points and clean it before being discharged to atmosphere. The filter media can remove 99.97% of dust above 2.0 micron. The unit will be designed to meet dust emission targets set for the facility.

4.3 Emission Summary and Dispersion Modelling

An Emission Summary and Dispersion Modelling (ESDM) Report was prepared in support of the Environmental Screening to cover full-scale operations at the Ellsin Tire Recycling Facility (the Facility). The Facility previously operated at the same location as a pilot Facility under Amended ECA No. 2455-9JHFLE, which has now expired. The ESDM Report was prepared in accordance with s.26 of O.Reg. 419/05. In addition, guidance in the MOECC publication "Procedure for Preparing an Emission Summary and Dispersion Modelling Report, Version 4.1" [1] dated March 2018 (ESDM Procedure Document) was followed as appropriate.

The purpose of this ESDM Report is to support an application for an ECA covering the Facility's commercial scale operations at a throughput of 20 tonnes of scrap tire material per day (i.e., approximately 834 kg of scrap tire material per hour). The site address of the Facility is 155 Yates Avenue, Sault Ste. Marie, Ontario. The area surrounding the Facility is zoned for medium and heavy industrial use, with some nearby open space and low-density residential.

The Facility is a tire recycling Facility that utilizes a proprietary microwave technology to "reverse polymerize" and breakdown scrap tire material. The North American Industry Classification System (NAICS) Code that applies to the Facility is 562210 - Waste Treatment. Since this NAICS Code is listed in Schedule 5 of O.Reg. 419/05, the air standards specified in Schedule 3 of O.Reg. 419/05 apply to the Facility. Therefore, this ESDM Report assesses the modelled impact of contaminant emissions using the MOECC-approved version of the U.S. EPA's AERMOD model (version 14134).

The Facility operates continuously and the process involves scrap tire material of various kinds (i.e., used tires, off-spec tires, tire shred, and tire crumb) being placed on a continuous conveyer belt which feeds into a processing chamber where the scrap tire material on the belt is exposed to microwave energy. The volatile components of the scrap tire material are evolved in the microwave chamber and form hydrocarbon vapour. Hydrogen sulphide (H_2S) gas is also formed from the sulphur contained in the scrap tire material. The process gas passes through a condenser, where a portion of the vapour condenses. The oil condensate is collected and stored in an outdoor storage tank.

The remaining gas (Syngas) is treated in a caustic scrubber to remove sulphur compounds, such as H_2S, to prevent the formation of sulphur dioxide (SO_2) in the combustion exhaust when Syngas is fired in the pre-heating and post heating burners. Syngas leaving the scrubber is transferred to the gas receiver tank before used for the operation of pre-heater and post heater.

The raw tire carbon reclaimed from the tunnel process, is further processed in the carbon finishing creating Reclaimed Carbon Black (rCB) which is further used in Masterbatch processing areas. Raw tire carbon from the out-feed of process tunnel is transported to the Raw Carbon Silo located in the Carbon Finishing area. From there, the rCB is pulverized and collected by the product dust collector. The pulverized rCB from the product dust collector is discharged into the finished product silo while the exhaust from the product dust collector is discharged into the atmosphere via a dedicated stack.

The pulverized rCB from the finished product silo is then fed into the extruder at the Masterbatch area. In the extruder, the plastic is heated and mixed with the pulverized rCB (mix ratio 1:1). The hot pellets produced from the extrusion process are then cooled and screened to obtain black pellets, which are stored in the product bin or bulk bags. Off-specification pellets from screening process are transported back to the finished product silo for further extrusion.

The principle contaminants of concern from the Facility include particulates, carbon black, metals, Nitrogen Oxides (NOx), Carbon Monoxide (CO), and volatile organic compounds (VOCs). Some of the sources and contaminants were considered negligible in accordance with s.8 of O.Reg. 419/05.

The maximum emission rates for each significant contaminant emitted from the significant sources were calculated in accordance with s.11 of O.Reg. 419/05 and the data quality assessed following the process outlined in the requirements of the ESDM Procedure Document.

A Point-of-Impingement (POI) concentration for each significant contaminant emitted from the Facility was calculated for each operating scenario based on the calculated emission rates and the output from the approved dispersion model; the results are presented in the following Emission Summary Table in accordance with s. 26 of O.Reg. 419/05.

The POI concentrations listed in the Emission Summary Table were compared against criteria listed in the MOECC publication "Air Contaminants Benchmarks List: standards, guidelines and screening levels for assessing the point of impingement concentrations of air contaminants" Version 1.0, dated December 2016 [ACB List].

All contaminants are assessed with their POI limits in the ACB List. Calcium and Sodium are assessed against the POI limits for Calcium oxide and Sodium oxide. All predicted POI concentrations are below the corresponding limits. The highest POI concentration relative to MOE POI Limits is Carbon Black at 89.88% of the 24-hour POI Limit.

Contaminant Name	CAS No.	Total Facility Emission Rate [g/s]	Air Dispersion Model Used	Max. POI Concentration [µg/m³]	Averaging Period [hr]	Ministry POI Limit [µg/m³]	Limiting Effect	Regulation Schedule #	Percentage of MOECC POI Limit (%)
TSP	N/A	1.04E-01	AERMOD v14134	12.02	24	120	Visibility	3	10.02%
Nitrogen oxides	10102-44-0	1.22E-01	AERMOD v14134	97.97	1	400	Health	3	24.49%
Nitrogen oxides	10102-44-0	1.22E-01	AERMOD v14134	59.8	24	200	Health	3	29.90%
Magnesium (Mg)	7439-95-4	5.38E-05	AERMOD v14134	0.0061	24	0.2	Health	3	3.07%
Carbon black	1333-86-4	7.89E-02	AERMOD v14134	8.99	24	10	Soiling	3	89.88%

The complete ESDM Report is included in Appendix F

5.0 Next Steps

During the Environmental Screening process Ellsin has found no environmental issues with the project and there have been no environmental concerns identified from Indigenous peoples, the Public or Agencies. Ellsin is now prepared to submit our Notice of Completion of Environmental Screening Report and is completing the required Air and Waste Environmental Compliance Approval applications.

To complete the upgrade EWI/Ellsin will invest just over $8 million into the existing plant, over a 6-12 month period. This will require local tradespeople and suppliers. When the facility is fully commercialized it will directly employ 20-25 full time positions and indirectly create numerous local opportunities.