Lafarge Canada Inc. – Brookfield Cement Plant

Environmental Assessment Registration Document Lower Carbon Fuel: Tire Derived Fuel (TDF System)

LAFARGE

Lafarge Canada Inc. – Brookfield Cement Plant
87 Cement Plant Rd.
Brookfield, Nova Scotia
B0N 1C0

TABLE OF CONTENTS

FIGURES AND TABLES

APPENDICES

1.0 INTRODUCTION

1.1 Proponent Information

About Lafarge Canada Inc

Lafarge Canada Inc. (hereinafter referred to as “Lafarge”) is Canada's largest provider of solutions to the construction and development industry. With more than 6,000 employees across Canada, our mission is to provide construction solutions that build better cities and communities. The cities where Canadians live, work, and raise their families along with the infrastructure that supports their communities such as roads, bridges, transportation links, water, and waste management benefit from the solutions provided by Lafarge.

Through our 2030 Plan, Lafarge is committed to providing aggregate, cement, and concrete product solutions using sustainable manufacturing practices and improving the environment in and around its operations. At locations across Canada, we have reduced carbon dioxide emissions, restored wetlands for native plants and animals, and recycled waste materials in our operations. More information is available on Lafarge Canada's website: www.buildingbettercities.ca or www.lafarge-na.com.

We note that there is more concrete sold than all other building materials combined. Our product is resilient, proven, and ubiquitous in the construction of our cities and towns and the roads that connect them. Lafarge has committed to a 40% reduction in carbon intensity by 2030 over 1990 levels and has already achieved a 20% reduction. Our company is best in the sector for carbon intensity and we are committed to our projects and in support of our customers.

Lafarge owns and operates the Brookfield Cement Manufacturing Plant in Nova Scotia. The plant recently celebrated 50 years of continuous operation in Nova Scotia. The Brookfield plant supplies cement that is used to make roads, schools, and hospitals across the province and is proud to be a part of local organizations and events including the Brookfield Homecoming and the Brookfield Athletic Association.

Lafarge is a corporation formed under the laws of Canada and has been in existence since October 22, 1927. It is registered to do business in Nova Scotia under the Nova Scotia Corporations Registration Act as Registry ID 3304554. The Nova Scotia Registry of Joint Stock Companies information for Lafarge is located in **Appendix A**.

The existing Brookfield Cement Plant operates under “Approval to Operate – Cement Plant and Limestone Surface Mine Approval No. 2005-049646-R02” dated June 20, 2016 and is attached in **Appendix B. Appendix C** shows the signature of Lafarge’s CEO Bruno Roux as a part of this proposal.

Address:

87 Cement Plant Road
Pleasant Valley, Nova Scotia, B0N 1C0
Phone: 902-673-3709

Proponent Contact:

Robert Cumming, Environment Director
6509 Airport Road
Mississauga, Ontario, L4V 1S7
Phone: 613-484-7714

Chief Executive Officer:

Bruno Roux
6509 Airport Road
Mississauga, Ontario L4V 1S7
Phone: 905-738-7773

Consultant Contact:

Peter Oram, P. Geo
45 Akerley Blvd.
Dartmouth, Nova Scotia, B3B 1J7
Phone: 902-468-1248

1.2 Project Information

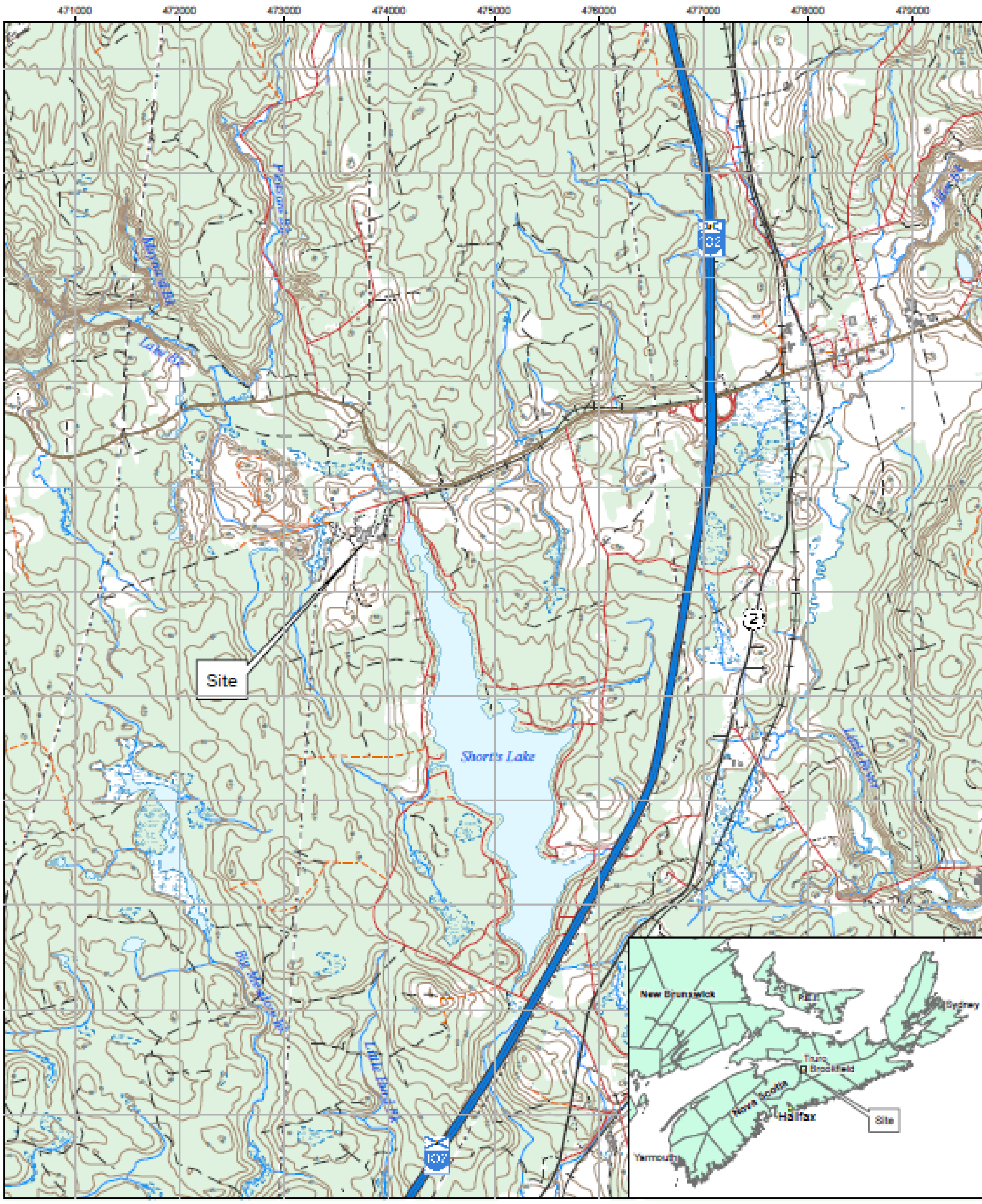
1.2.1 Name of the Undertaking

Lafarge is proposing to operate a new Lower Carbon Fuel: Tire Derived Fuel (TDF) System to use scrap tires, as a means to reduce coal and petroleum coke use, as a low carbon fuel. Lafarge is committed to reducing its carbon footprint and the use of scrap tires has the potential of lowering CO_2 emissions compared to traditional fossil fuels as well as other environmental benefits. The proposed undertaking is on kiln #2 at the Brookfield Cement Plant.

1.2.2 Project Location

The Brookfield Cement Plant is located at 87 Cement Plant Road, Pleasant Valley, Colchester County, Nova Scotia, B0N 1C0 (PID 20015319). The coordinates for the approximate centre point of the project are UTM Zone 20 E4733775 N5009620 (NAD83 (CSRS)) or Geographic 63° 20’ 2.8”W / 45° 14’ 22.6”N (NAD83 (CSRS)). **Figures 1** shows a map with the site in regional context and **Figures 2 and 3 (below)** show the site location, site boundary, and the proposed project location.

Figure 1 Site Location in Brookfield



Source: Service Nova Scotia

0 500 1,000 1,500
Metres
Coordinate System:
NAD 1983 CSRS UTM Zone 20N

N

GHD

LAFARGE CANADA INC.
PLEASANT VALLEY, NOVA SCOTIA
BROOKFIELD CEMENT PLANT: TDF SYSTEM

11139570
Feb 21, 2017

SITE LOCATION

FIGURE 1

GIS File: I:\GIS_DATA\Projects\8-chars\1113----\1113xxxx\11139570 Lafarge\11139570-GIS-DA001.mxd

Figure 2 Site Boundary and PID in Brookfield

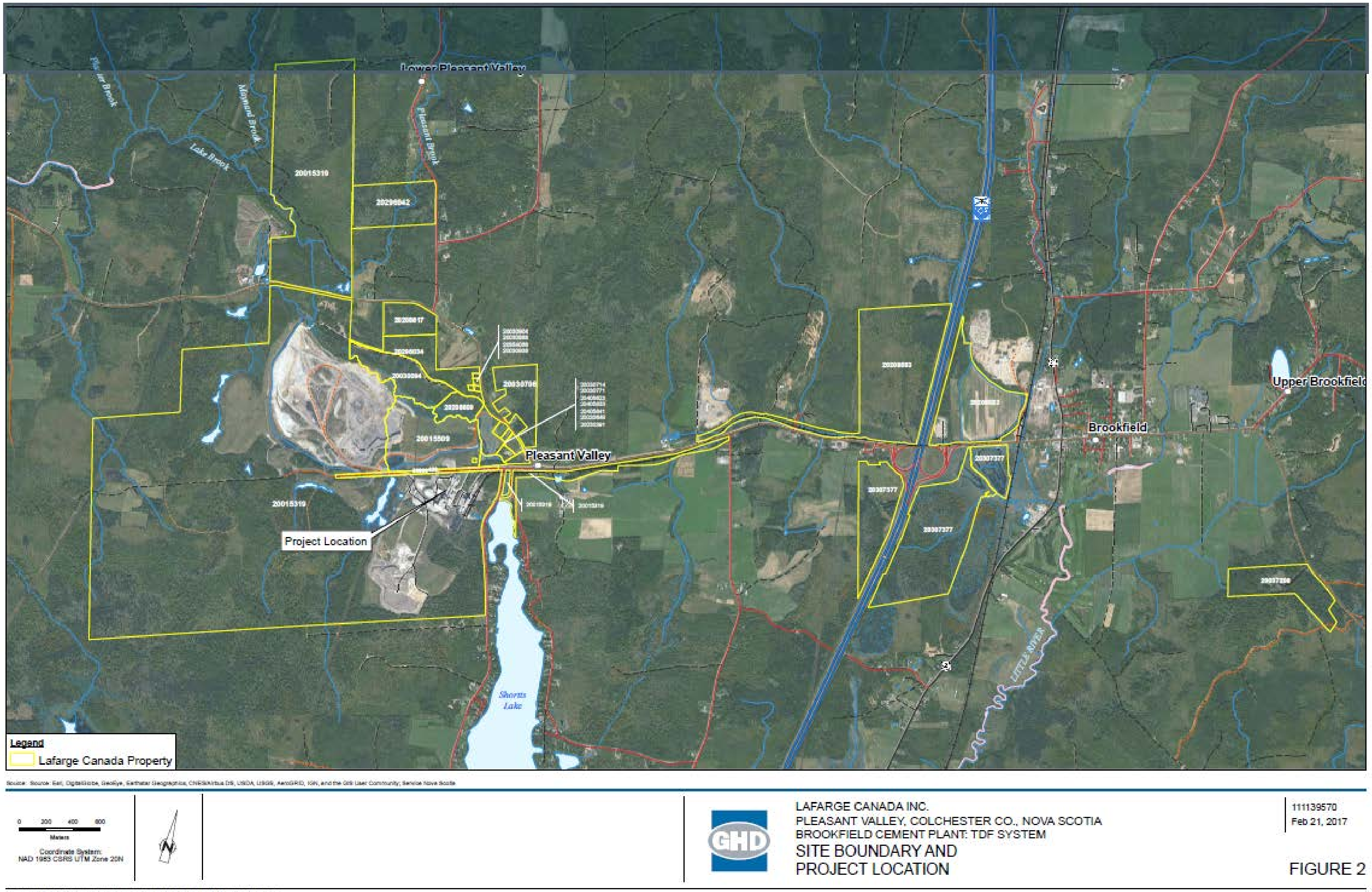


Figure 3 Proposed Undertaking Location at Plant

1.2.3 Purpose and Need for the Undertaking

This project is to demonstrate and, based on positive results, permanently replace a portion of the fossil fuels used at the Brookfield cement plant in partnership with researchers based at Dalhousie University. The project builds on previous, independent research that includes international literature reviews, fuel chemistry evaluations, and lab scale combustion trials. The reports arising from this work, which also included assessments of the use of other lower carbon fuels, is available on the plant's website at http://www.lafargebrookfield.ca/news.html

Based on this research, it is expected that locally sourced, lower carbon fuels will bring enormous environmental, societal, and economic benefits to cement making when handled in an environmentally sound manner. Scrap tires used for thermal energy in a cement kiln can reduce greenhouse gas emissions by roughly 30%, for every tonne of coal replaced (to be confirmed during the demonstration period), along with an expected

10-15% reduction in NO_x emissions. No significant adverse effects, other than a slight increase in truck traffic, are expected. Emissions from fossil fuel mining and processing are also conserved. Scrap and used tires will be put to a high value use in the manufacture of cement and so contribute to a circular economy.

The silica and iron present in scrap tires can act as raw material during cement manufacturing, adding a second re-use attribute for the scrap tires as they are completely combusted at temperatures over 1,600 degrees C and all non-combustible components are incorporated into the cement, partially replacing virgin raw materials.

Using scrap tires in a local cement plant also yields economic benefits as it will create and preserve local manufacturing jobs along with producing cement for Nova Scotia infrastructure projects. Sourcing local fuel supplies and associated transportation, hauling, material handling, and other activities will create new jobs. Using lower carbon fuels also prepares the Brookfield plant to meet emerging carbon pricing challenges while remaining competitive in a fast changing global market.

2.0 SCOPE OF THE UNDERTAKING

2.1 Scope of the Undertaking

As previously noted, Lafarge proposes to use scrap tires as a lower carbon fuel at the existing Brookfield Cement Plant's kiln #2 to partly replace the use of traditional fossil fuels. The proposed undertaking will be located in the existing cement facilities. Lafarge will construct and design the TDF Injection System to receive and feed the tires into kiln #2 which will be equipped with a mid-kiln feed system.

It is proposed that the tires will be delivered to the Brookfield site in tractor trailers. Two docking stations will be used for the trailers to park. The tires will be put on a belt conveyor and spaced apart to allow a photo sensor at the discharge of the belt conveyor to index one piece at a time. The tires will be conveyed to a hook elevator or belt conveyor which will take the tire from the ground level to above the kiln.

The tires will be dropped on a weight feeder and the system will weigh each tire prior to being dropped in the injector. This weight will be used by the central control system to meter the feed rate to the kiln. The tire will drop in the injector device chute installed on the rotary kiln. A cam actuator opens the valve and allows the scrap tire to fall into the kiln. **Appendix D** shows preliminary engineering plans for the plant layout and delivery of the scrap tires to the kiln that may be subject to change.

We propose to use up to 20 tonnes per day or up to 6,000 tonnes per year of scrap tires in kiln #2. This corresponds roughly to 15% of the total fuel input to the kiln.

2.2 Consideration of Alternatives

Option 1: Do Nothing

With the advent of emerging carbon regulations to mitigate rapid climate change, the continued use of fossil fuels will contribute to an existing problem. Failure of the plant to pursue lower carbon fuels could ultimately put the plant at risk of closure – and subsequently necessitate the importation of cement from outside of the Atlantic region, and thus increasing the cost of buildings, bridges, and other infrastructure for the region.

Option 2: Use other lower carbon fuels.

Lafarge is leading research efforts across Canada to demonstrate and validate the use of a wide variety of lower carbon fuels. Based on current research findings and global experience, the maximum amount of fuel replacement in front end burner systems is around 30-35% and the Brookfield cement plant has already achieved this usage rate with shredded non-recyclable plastics and asphalt shingles. In order to move from 35% to 50% fossil fuel replacement with lower carbon fuels, the goal of this project, the only proven technology for this kiln design is to use mid-kiln injection scrap tire systems which are in use throughout North America.

Further, each plant must work within the context of locally available fuels. Some fuel supplies are not available in economical quantities in Nova Scotia – however, there are enough scrap tires available in Nova Scotia to meet the 15% target for the mid-kiln system. The use of other fuel types will continue to be evaluated in terms of their environmental benefits, economics, and availability.

2.3 Scope of the Environmental Assessment

2.3.1 Boundaries

The scope of the environmental assessment takes into consideration that the cement plant has been in operation for over 50 years and is subject to an existing Industrial Approval. It also recognizes that the project consists of a partial replacement of one fuel with another and that environmental changes will thus be limited to kiln emissions and traffic. The environmental assessment will be evaluating the cement operating area including on-site roads.

2.3.2 VEC Selection

The Valued Environmental Components considered for assessment and interactions with project components are primarily air quality and transportation around and in the site. The use of TDF in the cement kiln affects only potential air emissions from the main kiln stack. All existing air emissions downstream of the kiln, associated with independent process operations (clinker processing, cement grinding etc) will not be affected with the use of TDF as a fuel. Further, the use of TDF is not expected to create any new or additional particulate emissions compared to the existing emissions. Air dispersion modeling can be used to predict what changes may occur to the atmospheric environment. A model was created for kiln #2 using TDF with the results discussed in **Section 5.1** and details provided in a report as **Appendix F**.

TDF will be delivered to the site via trailer trucks and may potentially affect the existing traffic volumes on Highway 102 and local streets around the area. A desktop analysis was carried out to assess how traffic may change with the delivery of TDF to the plant and is provided in **Section 5.2.**The environmental effects and potential impacts of the project along with their significance and suggested mitigations are outlined in the various subsections in **Section 5.0.**

2.4 Regulatory Framework

The Brookfield cement plant is governed by an Industrial Approval No. 2005-049646-R02as well as multiple Federal and Provincial Regulations and Municipal bylaws. Additionally, the plant must meet industry standards such as ASTM and CSA for the cement it produces. **Table 1** outlines applicable legislations to the plant.

Table 1 Applicable Legislation to the Plant

Legislation	Agency	Context
• *Canadian Environmental Protection Act* • Ozone-depleting substances regulation • NPRI Notice 2014/2015 • GHG Emissions Reporting • National Fire Code • Migratory Birds Convention Act • Species at Risk Act • Fisheries Act • Environmental Emergencies Regulation	Environment Canada	Control of toxic substances, environmental emergencies, and conservation of natural habitats
• Hazardous Products Act • Transportation of Dangerous Goods Regulation • Navigable Waters Regulation	Transport Canada	Promotes and controls public safety during handling and transports of dangerous goods
• *Environment Act* • Air Quality Regulations • Environmental Assessment Regulations • Used Oil Regulations, Dangerous Goods Management Regulations	Nova Scotia Environment	Supports and promotes protection, enhancement and prudent use of natural resources by regulating designated activities and establishing environmental requirements
• Building Code By-law	Municipality of the County of Colchester	To administer and enforce building regulations for new construction, alternations to buildings

When establishing Industrial Approvals, Nova Scotia Environment evaluates the air emissions and other environmental effects of the site and compares it to environmental regulations designed to be protective of human health and the environment. The use of scrap tires must perform within these limitations.

It is important to note that previous work has been carried out by Dalhousie University researchers to evaluate options both to manage scrap tires and to consider the environmental aspects of doing so in a cement kiln process. This work consisted of literature reviews, fuel chemistry analysis, and lab scale combustion trials. The work has pointed to a number of potential environmental benefits, with no significant detrimental effects, to be obtained by replacing fossil fuels with scrap tires. The primary benefits are the reduction of CO_2 and NO_x emissions from the plant and other life cycle based benefits.

3.0 DESCRIPTION OF THE UNDERTAKING

3.1 Project Background

3.1.1 Site History

The Brookfield cement plant was constructed by the Canada Cement Company and officially opened on September 29, 1965. The Plant's operating capacity was 250,000 tonne per year. The Brookfield Cement plant adequately supplied the Atlantic Canadian market until 1973-1974 when it was determined cement demand would soon outstrip production capacity.

A project was started in 1975 to double the facility's cement production capacity to 500,000 tonnes per year. Construction began in 1976 and was completed in the Fall of 1977. The new kiln was started in March 1978 and continues to operate as the main clinker production unit with the original Kiln 1 currently dormant, but available if required.

The Brookfield cement plant is the only operating cement plant in Atlantic Canada. The cement plant currently employs 70 people; with a high percentage of those being Colchester County residents.

3.1.2 Operational Regime

Normal operating hours for the cement plant office are 7:30 AM to 4:00 PM Monday to Friday but the plant can run 24 hours per day, 365 days per year. The plant has a total of 70 full time employees. The operational production days can typically range from 250-330 depending on cement production demand.

The plant has 24 hour rotating shifts which also provide continuous security for the site. The cement plant is enclosed by a wire mesh fence with controlled access gates. On evenings and weekends, access is controlled to the site through a remotely controlled gate monitored by a closed circuit camera from the Control Room. Any areas that are assessed to be high risk have an additional 10 inch high barbed topped chain linked border which faces areas such as trails and dwellings.

The plant also has a water based firefighting system of hydrants throughout the industrial facility, both inside and out. Water is provided by pumps connected to the plant electrical grid and backed up with an emergency generator.

3.1.3 Existing Cement Manufacturing Process

The Lafarge Brookfield Cement Plant manufactures Portland cement, a fine powder that is the primary ingredient in concrete. Portland cement consists primarily of calcium silicates, aluminates, and alumino-ferrites, and is produced at the Brookfield Plant with a production capacity of approximately 500,000 tonnes of cement per year. Portland cement is manufactured using four (4) main categories of raw materials that include calcareous, siliceous, argillaceous, and ferriferous (calcium carbonate, silica, alumina, and iron) materials.

<u>Raw Materials</u>

Raw materials acquisition and handling includes quarrying, transportation and stockpiling of limestone from the on Site quarry prior to further processing. Additional raw materials rich in oxides of iron may be required and are transported and stockpiled in the Raw Material Storage areas at the Site.

<u>Kiln Feed Preparation</u>

Kiln feed preparation is completed in the Raw Mill located in the Milling area and includes blending and sizing operations that are designed to provide a dry feed (raw mix) with appropriate chemical and physical properties. The raw mix is dried/heated by recycling heat taken from the pyroprocessing line. The raw mix is mechanically blended and homogenized and stored in specially constructed silos until it is fed to the pyroprocessing system.

<u>Traditional and non-Traditional Kiln and Milling Fuel</u>

The primary solid combustion fuel that is used is either coal or petroleum coke ("petcoke" or "coke") and is stockpiled outdoors in the solid fuel storage area. The use of alternative lower carbon fuels has been approved under the NSE Industrial Approval 2005-049646-R02 and includes used waste oil, glycerine, and solid shredded wastes (SSW). The SSW consists of shredded plastics and chipped roofing shingles. The used waste oil and glycerine are stored in waste oil tanks and the SSW is stored in large bins.

All fuels are transported to the Brookfield Plant by truck. A mixture of petcoke, used waste oil, glycerine, and SSW is presently used as fuel in the kiln. Heat is scavenged for the Raw Mill and light oil and bunker is used for the kiln during start-up and other periods where the solid fuel system is not available.

Kiln

The rotary kiln constitutes the pyroprocessing system and is a cylindrical inclined long dry process kiln furnace. The kiln is lined with refractory brick to protect the steel shell and retain heat within the kiln. The raw mix enters the kiln at the elevated end of the kiln and combustion fuels are introduced into the lower end of the kiln in a counter current manner.

The energy for pyroprocessing is provided by the combustion of fossil based and lower carbon based fuels. The main burner including the external port, located at the lower end of the kiln, combusts ground petcoke, used oil, glycerine, and SSW through dedicated channels.

The kiln burner pipe is a multi-circuit burner. The kiln burner pipe is rated for the 4 fuels of 143,309,948 BTU/hr (3,628,000 MJ/d). The flow rate of fuel is adjusted to obtain the necessary operating temperatures for cement manufacturing. These temperatures, of necessity for cement manufacturing, are well in excess of the temperatures required for complete combustion.

Primary air is provided by ambient air blowers. A separate blower provides the solid combustion fuel transport and waste oil and glycerine is pumped into the kiln. Secondary air is pre-heated through the cooler.

During start-up and shut-down stages of the combustion fuel system, or when the petcoke feed systems are unavailable (e.g. during maintenance), light oil and bunker is used to heat the kiln.

The raw mix is continuously and slowly moved to the lower end by rotation of the kiln. As the raw mix moves down the kiln, it is changed to a cementitious material (referred to as “clinker”) as a result of the increasing temperature in the kiln. Clinker consists of grey, spherically shaped nodules that typically range from 0.3 to 5.0 centimeters in diameter. The sequence of raw mix processing may be subdivided into four (4) stages, as a function of location and temperature of the materials in the rotary kiln:

i) Evaporation zone between 100°C and 400°C: removal of water from raw mix;

ii) Dehydration zone between 350°C and 650°C: clay starts to lose water of crystallization;

iii) Decarbonation zone between 900°C and 1250°C: limestone begins to decompose to form CaO and CO_2. CaO begins to react with other raw materials (SiO_2, Al_2O_3, Fe_2O_3, SO_3); and

iv) Clinkerization zone between 1250°C and 1450°C: the reaction becomes exothermic as clinker minerals are formed.

The last step of the pyroprocessing system is clinker cooling. This step recovers up to 60% - 75% of the heat input to the kiln, locks in desirable product qualities by freezing mineralogy, and reduces the clinker temperature for handling with conventional conveying equipment. The temperature of the materials is reduced from approximately 1100°C to usually <100°C by ambient air passing through the clinker and into the rotary kiln for use as secondary combustion air.

Finished Product Processing, Storage, and Transportation

The final step in the manufacturing of Portland cement involves a sequence of blending and grinding operations that transforms clinker to various finished products. This final step takes place in the Finish Milling area and final products are stored in the Cement Storage Dome and storage silos. Baghouses are used to control particulate emissions during these operations. Other materials such as gypsum are added to the clinker during grinding to control the cement setting time or to impart specific product properties. Portland cement and other products are loaded onto transport trucks and railcars – shipping by trucks typically represents the largest transportation volume.

3.2 Project Description

3.2.1 Geographic Setting

The Plant is located in a rural area in southern Colchester County, NS approximately four kilometers from the village of Brookfield, fifty minutes driving time from the provincial capital of Halifax, thirty minutes from the Stanfield International Airport and fifteen minutes from the Town of Truro. Surrounded by farming areas, the Cement Plant is located along Route 289 adjacent to Shortts Lake. The lake's shoreline area is occupied by permanent residential &seasonal cottage dwellings.

3.2.2 Construction and New Technology

All proposed facilities will be located at the Brookfield Cement Plant. Scrap tires will be collected and shipped to the site by others. The primary site objective will be to create a new injection point from which the scrap tires can be added. Lafarge will design and commission the tire handling and injection system according to the robust existing protocols. The Lafarge staff at Brookfield is committed to operate the cement plant in accordance with the strictest environmental and safety standards.

Lower carbon fuel injection through the main burner is limited by the combustion requirements of the flame. To reach the temperatures needed for clinkerization, the average energy density of the fuel must be above a threshold. Due to the middle range heating value of lower carbon fuels, this limits potential fuel substitution through the main burner.

Mid-kiln injection has the effect of preheating the material in the kiln before reaching the burning zone and allows for the additional replacement of approximately 15% of the plant's fuel's needs with mid-kiln injection of low carbon fuels (scrap tires).

The injection point will be a gate mechanism approximately 20 inches wide by 48 inches long that is mounted on and rotates with the turning cement kiln. When the gate is at the correct point in the rotation cycle of the kiln, the gate opens and (a) used tire(s) is dropped or injected into the kiln. The gate closes until the kiln rotates again to the appropriate point. In this manner, whole and partially whole tires are automatically delivered as fuel to the kiln. **Figure 4 (below)** shows a cross-section of the proposed engineering for the system.

To construct the new TDF Injection System, Lafarge estimates to create 4 new jobs for the planning and engineering phase, 11 new jobs during the construction and installation, and 2-3jobs during the operation of the TDF system. All these jobs created within Nova Scotia will increase the positive economic impact of managing the scrap tire resource within the province.

3.2.4 Operation, Maintenance, and Management

The owner of the mid-kiln fuel system will be Lafarge and the lower carbon fuel supply will be operated by both Lafarge Canada Inc and Geocycle Inc.

Geocycle, a wholly owned subsidiary of Lafarge, will generally manage the collection, pre-processing (if necessary), acceptance, sorting, coordination with 3rd party collectors and haulers, and transportation functions of lower carbon fuel supply. Lafarge will generally manage the operation and maintenance of storage systems and fuel delivery systems associated with the kiln operation. However, as needed, Lafarge Canada and Geocycle Inc. may undertake duties normally carried out by the other.

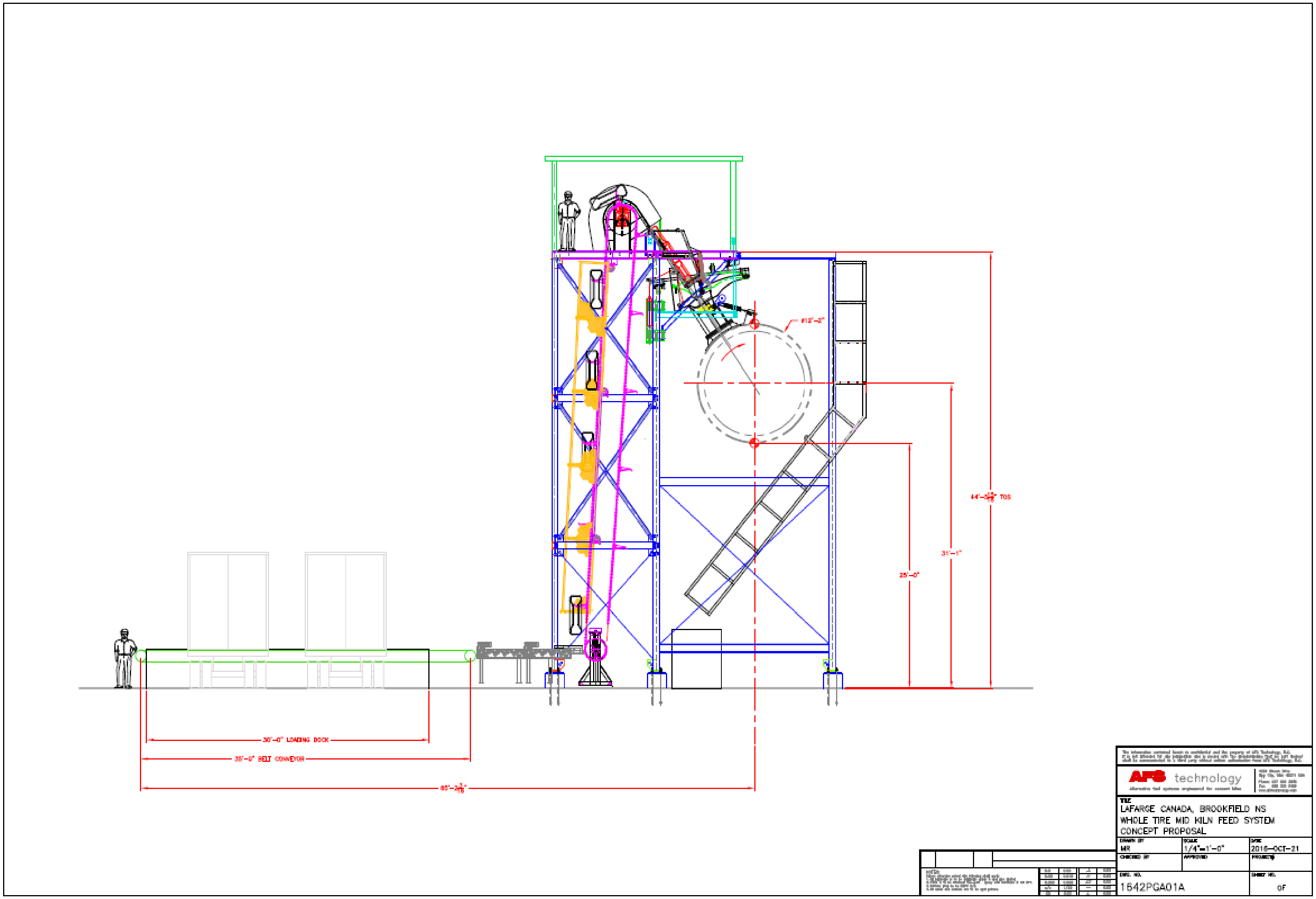
Once the TDF Injection System is designed, the number of employees and maintenance frequency will depend on how automated the injection system is. Maintenance will occur when the plant is shut down during the winter months. Used tire types include, but are not limited to, the following:

1. All passenger car tires (regardless of rim size)
2. All on-road motorcycle tires (regardless of rim size)

3. All camper recreational vehicle (RV), camper trailer and utility tires (regardless of rim size)
4. All light truck tires (regardless of rim size)
5. All medium truck tires, highway truck and tractor/trailer tires, including super singles, up to a rim size not exceeding 24.5”
6. Non-vulcanized or off-spec tires from tire manufacturers
7. Tires accepted under the Nova Scotia Used Tire Management Program, as determined by Nova Scotia Environment from time to time.

Note: Tires may be whole or partial (but suitable for conveyance by the plant’s system)

Figure 4 Cross Section of Proposed TDF Injection System for Kiln #2 (subject to change)



3.2.5 Tire Processing

Used tires received at the site will be inspected, weighed and temporarily stored as necessary in the designated tire storage area as detailed in **Section 3.2.7.** The used tires that are received will be used for fuels for kiln #2 and no other purposes. If there are any unusable tires received, they will be handled as per **Section 3.2.6.**

3.2.6 Waste Handling/Reduction

Unusable tires, their residues, and by-products will be disposed of in an environmentally friendly manner. Tires that are less than 60% whole will not be large enough to be delivered into the kiln with the proposed system and will also be disposed of. Other potential contaminants include rims, auto parts, gravel, and mud received during the used tire delivery and will be disposed of using appropriate means. Any waste as described here will be disposed of according to applicable legislation and at approved sites.

3.2.7 Tire Storage

There will be a dedicated vacant lot for the storage of used tires to manage supply or fuel consumption fluctuations. The specific location will be determined following the mining plan. For active use, it is proposed that there will be adequate storage space on-site at all times for used tires received. It is proposed that this will be two trailers that dock at all times where the tires will feed into the kiln. Based on typical truck weights, it is expected that storage in trailers at the dock will be a maximum of 33 tonnes. There will also be storage established for used tires during periods where the facility and equipment undergo repairs or maintenance and during temporary scale-back or shutdown of processing activities, whether planned or unplanned. It is anticipated that tires will be stored to a maximum of seven (7) days supply (which is 140 tonnes) in trailers and/or on-ground storage piles. Storage will ensure a constant supply of fuel in case of increased cement production or decline in steady volumes of tires supplied thus avoiding fuel interruptions.

3.2.8 Decommissioning

The TDF Injection System will be decommissioned as required, alternative uses will be sought for each part of the equipment or otherwise sent for scrap metal recycling where feasible. All alternative fuels stored on site will be fully used or removed to an approved location prior to the decommissioning of the alternative fuel systems. A rehabilitation plan will be submitted to NSE at least 60 days prior to abandoning the site. The decommissioning of the TDF system is expected to occur when the cement manufacturing plant is decommissioned or if the system.

3.3 Environmental Management

3.3.1 Emission Controls

The particulates entrained in the kiln flue gases are cooled by water spray before entering a three compartment electrostatic precipitator (ESP) to collect the dust prior to discharge through the kiln stack.

Water Sprays

There is a water spray that uses evaporative cooling to reduce the flue gas temperature to a range suitable for the ESP. This temperature is monitored and recorded in the control room.

Electrostatic Precipitator

The ESP has three fields which are used to create a static charge (corona effect) on particulate such that it is collected on the plates and returned to the kiln, conveyed to the cement kiln dust (CKD) storage cell, or added to the cement grinding mill. A controlled series of rapping events (power-on or power-off) is used to remove accumulated material from the plates for re-insertion into the process or an on-Site landfill.

Stack and CEM System

The kiln stack is equipped with an opacity continuous emissions monitoring system (CEM) and CEMS for Oxides of Nitrogen (NOx) and Sulphur Dioxide are being installed in 2017 in addition to existing Oxygen and Carbon Monoxide process analyzers. The flue gas flow from the exit of the kiln is directed through the duct and ultimately exhausts into the kiln stack through two induced draft fans. The kiln stack is 60.9 meters high with an internal discharge diameter of 1.5 meters.

The opacity monitor is installed on the discharge side of the induced draft fan that services the duct. The CEMs will be controlled through a system that controls sequencing values and transmits data and control signals to and from the analyzers to the plant's Distributed Control System. The system is supplied with a data acquisition system to display, report, and record raw data, analytical data, and calibration records.

Details of the CEM system are provided in a Quality Assurance Plan, which is maintained at the Site.

3.3.2 Cement Kiln Dust

Cement kiln dust (CKD) is a by-product of many cement making processes. Where CKD is withdrawn, it is due to the accumulation of alkalis, such as sulphur and chlorine, in the kiln. It is necessary to remove some of the raw materials collected by the ESPs to prevent excessive accumulations of alkalis. Alkalis are found in both the raw materials (both quarried and recycled) and fuels (both traditional and fossil fuel alternatives). The quarried limestone is the most significant source.

CKD constituents are representative of the raw materials present in the kiln and are therefore non-hazardous.

When it is necessary to withdraw CKD from the kiln process, the CKD is transferred via truck to the Site landfill. CKD is also stored in smaller silos and loaded into trucks for sale to specialized markets. Water is added to control dusting when the material is transferred and added into the landfill. The design and operation of the landfill follows the guidelines set for industrial landfills by Nova Scotia Environment and the Industrial Approval No. 2005-049646-R02.

No changes to quantity or quality of CKD are expected with the use of scrap tires. This will be confirmed through the demonstration program.

3.3.3 Environmental Management Plan

The Brookfield Cement Plan has an Environmental Management System (EMS) and Environmental Management Plan (EMP) on site in the event of an environmental incident and emergency. The plant has an Emergency Response Manual that is reviewed on a regular basis and includes information on the plant location, lay-out of facilities and installations, assessment of environmental risks, and responsible personnel. With the new undertaking, the EMP will be revised accordingly to include the assessment of any new environmental risks and their prevention and mitigation.

Operational experience within Lafarge has demonstrated that storage of scrap tires in trailers – or small monitored stockpiles – has successfully controlled the possibility of fires. Security on site is used to monitor site access and controlled to prevent arson, vandalism, and other unwanted activities. Responsible personnel are trained in developing emergency response procedures, overseeing the program, and leading the plant response to emergencies.

The EMP will be revised to include a response procedure in the event of a fire from tires in the trailers. On-site staff would remove the trailers located next (or as near to) the burning trailer(s) as is reasonably feasible in order to minimize any impacts from a fire. This action will also minimize the spread of the fire. As noted previously the plant site has personnel 24 hours a day, 365 days per year.

Portable fire extinguishers will be strategically located in the parking and storage areas for the on-site personnel to use if the fire is small enough to be controlled by such use. Regardless, on-site personnel will contact the emergency response coordinator who, if necessary, will call the local fire department for assistance. The on-site personnel will be trained in the use of such portable firefighting equipment.

3.4 Project Schedule

The TDF Injection System is estimated to take approximately 6 months to complete engineering and installation of the mid-kiln injection system from commencement. Lafarge with researchers from Dalhousie University have already started consultation sessions with local stakeholders starting in August, 2016.

The proposed schedule once the undertaking has been approved is shown in **Table 2** considering a start date in May 2017.

Table 2 Proposed Construction Schedule for TDF Injection System

Months in 2017	Proposed Activity
Previous work	Preliminary concept engineering and estimates
1-3 months	Kiln Shell Preparation
1-3 months	Equipment Finalization and Order
4-6 months	Installation
6-8 Months	Commissioning

4.0 PUBLIC CONSULTATION

4.1 Objectives and Background

The objective of the public consultation report is to ensure that a science based, transparent, and staged implementation strategy is followed – one that encourages public and stakeholder involvement in the study and use of TDF at the Brookfield Cement Plant. Significant consultation and dialogue has already taken place and will continue during the EA consultation period and throughout the demonstration period – results will be shared in a public meeting and through other ongoing means. The purpose of this public consultation is to identify and consider issues that are important to the public to aid researchers in their work and to provide stakeholders with an opportunity to receive information about, and provide meaningful input to the application process and demonstration program.

Appendix E provides a detailed description of extensive consultations and meetings with the local residents, the broader community, and other stakeholders. All concerns and comments are documented and addressed, as applicable in the attached report. **Table 3** shows a summary of the consultation and meetings.

Table 3 Summary of Public Consultations

Consultation Group	Date	Summary
Ecology Action Nova Scotia	Aug/18/2016	• Introduced TDF Project • Invited participation in consultation meetings
Shortts Lake Residents Meeting #1	Sep/28/2016	• Introduced TDF Project • Invited members to participate in consultations • The community asked questions on emissions testing and monitoring at the plant • Lafarge scheduled a follow up meeting to address their concerns in detail
Shortts Lake Residents Meeting #2	Oct/20/2016	• Introduced Dalhousie University's research and data with TDF in the laboratory • Answered questions from Meeting #1 • Presented Dr. Gibson's research on using TDF and expected emissions from kiln #2 • The community was interested in seeing baseline testing, an air dispersion model, a test plan, and if there would be any adverse effects to Shortts Lake • Lafarge planned a follow up meeting to present data from consultants
Public Meeting #1	Oct/20/2016	• Open house with display boards to introduce TDF Project in Truro • 66 attendees signed in for the meeting • Questions from the Public Meeting are grouped into concerns relating to environmental testing at the plant, contaminants in TDFs, odors, water quality, and the new system on site • These questions are documented and Lafarge responses to questions were prepared for the next community meeting
Shortts Lake Residents Meeting #3	Jan/26/2017	• Provided an update in the TDF Project status • Discussed Shortts Lake water quality and the levels of metals in fish and Nova Scotia • Dr. Gibson presented information on how air dispersion modeling will predict emissions and what to expect from the TDF modeling • Answered commonly asked questions from Public Meeting #1
Sipekne'katik First Nation Tour	Feb/7/2017	• Held informal site tour to introduce TDF Project and Brookfield Plant • Discussed environmental emissions testing

		and assessment to be done • Lafarge will provide results and reports as soon as they are available for their review
Colchester County Meeting	Feb/7/2017	• Introduced TDF Project to council • Discussed environmental concerns and proposed that liaison committee should be organized for the community

5.0 VALUED ENVIRONMENTAL/SOCIO-ECONOMIC COMPONENTS AND EFFECTS MANAGEMENT

5.1 Air Quality

5.1.1 Existing Environment

5.1.1.1 Ambient Conditions

Ambient air quality in Nova Scotia is monitored using a network of 13 sites operated by NSE and Environment Canada through the National Air Pollution Surveillance (NAPS) Network. Common air pollutants monitored at these stations include the following:

- Sulphur Dioxide (SO_2);
- total particulate matter (TPM);
- Coarse particulate matter (PM_{10});
- Fine particulate matter ($PM_{2.5}$);
- carbon monoxide (CO);
- Ozone (O_3);and
- Oxides of Nitrogen (NO_x).

Data collected at these stations is used by NSE to report the Air Quality Index (AQI) and by Environment Canada to report the Air Quality Health Index (AQHI).The closest NAPS monitoring stations are located in Dartmouth and Pictou, Nova Scotia. **Table 4** outlines the data for these two stations.

Table 4 Regional Ambient Air Quality at Nearest Monitoring Stations

Contaminant	Cherrybrook, Dartmouth, Nova Scotia			Beaches Road, Pictou, Nova Scotia		
	1 Hour Max	24 Hour Max	Annual Mean	1 Hour Max	24 Hour Max	Annual Mean
Sulphur Dioxide (ppb)	23.5	3.0	0.3	NR	NR	NR
Nitrogen Dioxide (ppb)	14	5	1	19	7	1

Contaminant	Cherrybrook, Dartmouth, Nova Scotia			Beaches Road, Pictou, Nova Scotia		
	1 Hour Max	24 Hour Max	Annual Mean	1 Hour Max	24 Hour Max	Annual Mean
Ozone (ppb)	58	51	30	61	46	25
Nitrous Oxide (ppb)	13	2	0	9	1	0
Oxides of Nitrogen (ppb)	26	6	2	21	8	2
Fine Particulate Matter (PM2.5) (µg/m3)	27	16	5	171	50	7

Source: Concentration: Environment Canada-Climate Data online-2015 Annual Summary; NR- Not reported

There were no exceedances of the NSAQS at the nearest stations for all contaminates. One exceedance of the CAAQS for PM2.5 was reported for the Pictou Station. The Brookfield site is located in a relatively undeveloped rural region of Nova Scotia with infrequent industrial operations that would affect air quality. As the NAPS monitoring stations are located in areas with more local industry, measured concentrations of contaminants presented would likely be lower for the Brookfield site.

5.1.1.2 Climate and Weather

Nova Scotia is considered to have a moderate climate, rarely extremely hot or cold. The climate within Nova Scotia is quite variable, depending on the location. Local microclimates can provide differences based on elevation, slope and/or vegetation. Nova Scotia does experience ample and reliable precipitation, a fairly wide but not extreme temperature range, a late and short summer, skies that are often cloudy or overcast, frequent coastal fog and marked changeability of weather from day to day fueled by prevailing westerly winds, the modifying influence of the sea, and the convergence of three main air masses over Atlantic Canada. (Davis, Browne 1998)

The Brookfield Cement Plant is located within the Eastern Nova Scotia climatic region, which is generally characterized by high rainfall and generally cool temperatures, but has also has the strong coastal influence from the Bay of Fundy region which produces a long, cool summer and mild winters. The nearest climate station with historical data is at Truro (ID# 8205990) operated by the Meteorological Service of Canada (MSC). The station is located approximately 15 km northeast of the project site, near Truro (45° 22’N, 63° 16’N).

The summary of average climate conditions at the Truro station is based on climate normals published by Environment Canada (ECCC 2016) for the period from 1981 to 2010.

Mean annual total precipitation is 1183.1 mm, which includes 214.7 cm of average snowfall per year (214.7 mm water equivalent) and 979.5 mm of rain. Highest precipitation in the form of rain generally occurs in the months of September, October and November (average range 103.2 – 104.5 mm / month); however, November, December and January have the highest combined precipitation (114.0 – 115.0 mm). The lowest average precipitation rate is in August (79.6 mm). Measurable (>= 0.2 mm eq.) precipitation occurs on an average of 175.2 days per year, with 140.4 days of measurable rainfall and 45.1 days of measurable snowfall.

The extreme one day rainfall for the station is 100.8 mm on August 15, 1971 and extreme one day snowfall is 42.2 cm on February 16, 1996.

Average temperature is 6.0°C, with an average range from -6.9°C (January) to 18.4°C (July). Temperature extremes can range from -34.4°C to 33.5 °C. There is an average of 307.3 days per year with an average temperature above 0 °C. Wind chill factors make the temperatures feel like -35 to -42 °C in December through March. Truro receives an average of 1668.3 hours of bright sunshine per year measured over 284.7 days.

Wind direction is variable but generally west to southeast for majority of the year. Winds in February to April tend to be more north to southeast. Maximum hourly wind speeds can range from 48 km/h in June / July to 93 km/h in January, with maximum gusts of up to 134 km/h recorded (Feb. 1976).

The national average annual temperature has increased by 1.6° C since records began in 1948, however, in Atlantic Canada, the annual average temperature has only increased by 0.5 C for the same period (1948 – 2013) (Environment Canada 2013). The Atlantic Region has experienced slight cooling in the last 50 years due in part to the melting of the ice caps in Greenland and Northern Canada. The cooler air and water temperatures associated with the melted ice that have been flowing past Atlantic Canada are causing the cooling trend.

5.1.1.3 Greenhouse Gas

Greenhouse gas emissions from the Brookfield Cement plant consist of carbon dioxide (CO_2) emissions almost entirely. There are two sources of CO_2 emissions: process emissions from the calcination of limestone to lime and CO_2 resulting from combustion of fossil fuels.

The Cement Industry has established reporting protocols for the reporting of greenhouse gases under the World Business Council for Sustainable Development's (WBCSD) Cement Sustainability Initiative (CSI). This method is in current use at the Brookfield for Provincial and Federal reporting. This protocol addresses both aspects of CO_2 emissions from fossil fuel use the CO_2 emissions from the chemistry of combustion and biogenic content present in the fuels.

The Brookfield plant has reached world class status in the percentage of its fossil fuels replaced with lower carbon fuels, in the form of front end burner injection, and has reached substitution rates as high as 30% on an energy basis in 2016. The plant is currently approved for the use of glycerin, plastics, and asphalt shingles all of which are lower carbon emitting fuels as compared to coke and coal.

The use of mid-kiln injection technology wherein scrap and green tires are delivered partway down the rotary kiln allows the replacement rate, including the 35% injected in the primary burner, to reach as high as 50%. The mid-kiln injection point is carefully selected, based on company experience, to ensure that temperatures are high enough for highly efficient combustion and to ensure the heat release matches the heat load requirements of the process at that stage in the kiln. TDF and other post-consumer rubber products can be injected into front end burners if they are ground fine enough, but the use of mid-kiln injection allows the introduction of whole tires (and related materials) into the kiln.

Scrap tires and green tires are both considered to be lower carbon fuels than coal and petroleum coke given their chemistry - and the biogenic content they contain associated with the presence of natural rubber. This is codified in some jurisdictions; for example, Quebec has determined that the carbon intensity of tire derived fuel (TDF) 80.8 kg CO_2/GJ which is 6% lower than coal – and when the 20-30% biomass content of tires is added, this results in tires being about 30% lower carbon intensive than coal without adding in additional supply chain (life cycle) savings.

5.1.2 Effects Assessment

5.1.2.1 Boundaries

The assessment of emission effects is focused on the emission changes associated with the cement kiln operation because the use of TDF, in partial replacement of other kiln fuels, in the cement kiln only affects the potential air emissions from the main kiln stack. Although there are supply chain benefits expected with avoidance of emissions from coal mining and processing and from avoidance of emissions from shredding of tires for other beneficial uses, these effects are out of scope for this environmental assessment report. They will be assessed as a separate research topic.

5.1.2.2 Project Activity Interactions and Effects

TDF is anticipated to replace only about 15% of the fuel used and, based on experience at other cement plants, will not affect the quality of the clinker produced by the kiln nor the quality or quantity of CKD produced.

It is noted that a pilot approach is being proposed wherein independent experts and stakeholders are engaged in validating the beneficial to benign effects of scrap tire use as fuel in the Brookfield plant. However, under a precautionary approach, it was helpful to first study the experience of other cement plants prior to commencement and to identify any concerns and guide research efforts.

The use of TDF in cement kilns has been very well researched and is now considered a proven technology. Typical results are that the emissions of oxides of nitrogen (NO_x) and net CO_2 are reduced by around 15-20% and 30% (for every tonne of coal and petcoke displaced) respectively. In kilns with measurable dioxin & furan emissions, the use of TDF appears to have a reducing effect based on a meta study carried out by the US based Portland Cement Association and referenced in the Dalhousie University study. We note that Brookfield's emissions are very low and near detection levels. The effects on SO_2 and CO can vary and where they may increase, they are expected remain well within regulatory limits and will be addressed should they occur.

Several reports have been completed in the Brookfield context and they too have been instrumental in informing the pilot approach. The Dalhousie University team has published a 2015 study that indicates the use of scrap tires as a cement kiln fuel is a highly suitable use for these tires. Their report considered various emission concerns and concluded that the effects are expected to be benign or beneficial.

The July 21, 2015 report entitled "Use of scrap tires as an alternative fuel source at the Lafarge cement kiln, Brookfield, Nova Scotia" can be downloaded from the http://afrg.peas.dal.ca/publishing/ website.

An air dispersion model was created by GHD to assess the potential air emissions from kiln #2 using TDF and the report is attached as **Appendix F**. Historical stack testing reports and research by Dalhousie University were used to estimate the emissions of all potential air contaminants. The USEPA AERMOD dispersion model was used to estimate the maximum off-site concentrations of the air contaminants. Nova Scotia does not have published air quality standards for most of the potential air contaminants, therefore, the health, risk-based standards published by Ontario were used. The modeled, maximum off-site concentrations of contaminants are all well below applicable health based air standards, as summarized in a table in **Appendix F**.

To ensure the air model presented by GHD is technically correct, D. Gibson from Dalhousie University reviewed the model as well. Dr. Gibson found the model was conducted correctly and concur with their conclusion that the maximum off-site concentrations of contaminants are well below applicable health based air standards. Dr. Gibson's technical memorandum is attached in **Appendix G.**

5.1.2.3 Mitigation and Monitoring

Continuous Emission Monitors (CEMs) will be installed on the main stack and certified in 2017. The new CEMs will monitor NO_x and SO_2. The kiln stack will also be tested for dioxins and furans, hydrogen chloride, ammonia, and heavy metals during baseline conditions in 2017 and after the TDF system is commissioned. Both of these tests will be conducted under the guidance of the Dalhousie University research team and in accordance with published quality control guidance and regulatory requirements for Source Emission Testing programs.

Lafarge has committed to publish the results of the emission testing program after quality control reviews are complete and a statistical science based assessment is completed. These tests are in addition to ongoing process analysis and quality control product testing. The cement plant will continue to monitor emissions as per Industrial Approval No. 2005-049646-R02 from kiln #2 including opacity, and particulate matter and adhering to Schedule A for permissible ground level concentrations.

5.1.2.4 Residual Effects and Significance

There are no expected residual effects. This project consists of a partial replacement of fossil fuels with a lower carbon fuel.

5.1.2.5 Proposed Compliance and Effects Monitoring Program

Continuous Emission Monitors (CEMs) will be installed on the main stack and certified in 2017. The new CEMs will monitor NO_x and SO_2. The kiln stack will also be monitored for dioxins and furans, hydrogen chloride, ammonia, and heavy metals during baseline conditions in 2017 and after the TDF system is commissioned. Both of these tests will be conducted under the guidance of the Dalhousie research team and in accordance with published quality control guidance and regulatory requirements.

Lafarge has committed to publish the results of the emission testing program after quality control reviews are complete and a statistical science based assessment is completed.

5.2 Transportation

5.2.1 Existing Environment

Table 5 shows the calculated 2016 average daily vehicle traffic at the cement plant.

Table 5 Daily Vehicle Traffic Entering the Site for 2016

Vehicle Type	2016 Daily Vehicle Traffic Entering Site
Cement Trucks	20
Courier/Freight Vehicles	3
Coke Trucks	3
Gypsum Trucks	1
Employee Vehicles	35

Based on calculated 2016 averages, the cement plant has on average 3 trucks delivering solid fuel daily with an average capacity of 35 tonnes. The trucks are transporting the solid fuel from Sydney Nova Scotia where it originally arrives by ship. The trucks generally travel down Highway 102 and the local roads to access the cement plant.

The Nova Scotia Transportation and Infrastructure Renewal (NSTIR) traffic volume from the Nova Scotia Traffic Volume dataset shows vehicles count that crossed Highway 289 at Sections 3 and 5. The Average Annual Daily Traffic (AADT) values were used which are adjusted for seasonal variations and show the average volume of traffic per day over an entire year. At Section 3, which is the road where the plant is located near, the AADT was 320 for May 30, 2013. The west side of Route 236, which is Section 5 of Highway 289, has an AADT was 4270 on May 29, 2013.The higher volumes on the west side would be primarily from residents and visitors travelling towards the village of Brookfield off of Highway 102.

5.2.2 Effects Assessment

5.2.2.1 Boundaries

The area assessed is the Brookfield Cement Plant where fuel trucks travel on-site to unload fuel and nearby roads that including Highway 102 which is located east of the site and local roads such as Cement Plant Road and Pleasant Valley Road.

5.2.2.2 Project Activity Interactions and Effects

There will be an increase in truck traffic due to the lower tonnage of scrap tires on a truck as compared to a truck shipment of coal or petcoke. Based on production forecasts, **Table 6** shows the expected increase of total traffic volume at the site.

Table 6 Traffic Assessment Comparing TDF with Coke

	TDF	Coke
Lower Heat Value (GJ/tonne)	29.5	32.645
Tonnes Required (tonne)	3,925	3,547
Truck Capacity (tonne)	5-14*	35
Number of Trucks	280-785	101

*Truck trailer lengths vary typically from 6 m (20 ft) up to 16 m (55 ft).

From the above calculation, there is expected to be a total increase of 179-684 trucks for the 2017 year when replacing 15% of the plant's fuel with scrap tires (from coke). Assuming the deliveries are evenly spaced out throughout a typical 280 operating days for the plant, that is an increase of 0.6-2.5 or a maximum of 3 trucks per day. The plant can receive fuel deliveries after hours but typically they are scheduled for normal business hours. With the expected maximum traffic increase of 3 trucks per day, this is not expected to have a significant impact on-site at the cement plant or on local roads. Using the AADT from May 29, 2013, the 3 truck per day increase results a 0.9% increase in Section 3 (road near the plant) and a 0.07% increase in Section 5 (road heading towards Brookfield).

5.2.2.3 Mitigation and Monitoring

Lafarge and its supplier's only deal with qualified haulers whose licensed drivers receive formal training as part of their licensure.

5.2.2.4 Residual Effects and Significance

There are no expected residual effects to the transportation change as the traffic volume is not expected to increase significantly.

5.2.2.5 Proposed Compliance and Effects Monitoring Program

Lafarge also has an active program to deal with any complaints that arise from its operations including deliveries and shipments.

5.3 Other Projects in the Area

There are no known other major projects within the cement plant area that would impact or be impacted by the undertaking.

6.0 EFFECTS OF THE PROJECT ON THE ENVIRONMENT

As noted in **Section 5.1.2.2**, emission changes from partial replacement of existing fossil fuels with used tires are expected to be beneficial or benign compared to current operations. The modeled off-site contaminant concentrations are well below the applicable health standards when using conservative assumptions. The scrap tires to be used in kiln #2 are shown to be well within air emission limits and compliance. There are no expected adverse effects to the environment from the Project.

7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The surrounding environment may contribute to adverse effects on the Project; but are predicted to be limited to climate and meteorological conditions. Climate change is more likely to affect projects with long durations that may be affected by future severe weather events if not planned for properly. Short period events, e.g. heavy rainfall, blizzards or thunder storms, may temporarily shut down operations for safety reasons. The proposed facilities will not be affected in general by weather conditions. The design of the injection system will be able to withstand high rainfall, precipitation, and the site has water management measures. The plant will conduct maintenance as necessary if the integrity of the facility is affected by the normal climate.

The national average annual temperature has increased by 1.6° C since records began in 1948, however, in Atlantic Canada, the annual average temperature has only increased by 0.5 C for the same period (1948 – 2013) (Environment Canada 2013). The Atlantic Region has experienced slight cooling in the last 50 years due in part to the melting of the ice caps in Greenland and Northern Canada. The cooler air and water temperatures associated with the melted ice that have been flowing past Atlantic Canada are causing the cooling trend. As oceans warm and water expands, the melting ice may accelerate sea-level rise in the region, however given the elevation of this Project this is not a concern here.

Earthquakes are mapped by Natural Resources Canada. Although Nova Scotia is a relatively quiet earthquake zone (moderately low), larger quakes have been reported in the historical past. The largest quake in recent history with a maximum magnitude (M) of 3.2 was recorded near Bridgewater in 2007(Natural Resources Canada 2017). No earthquakes have been recorded in the Truro area since 1985. No significant earthquakes (M>5.0) have occurred in Nova Scotia between 1600 and 2006 (Lamontange et al 2007). There is, therefore, little likelihood of earthquakes being an effect on the project.

The geology of the regional area is Early Carboniferous - Windsor Group consisting of marine limestone, mudrock and evaporites. The presence of limestone and evaporites gives potential for karst features (i.e. sinkholes) to occur in the bedrock and the area has been given a moderate risk of karst occurring. In areas of sinkhole development the primary geohazard is related to sudden catastrophic subsidence due to collapse of cavities in the bedrock created by the dissolution. No karst features have been identified on the site. Given the bedrock type at the site quarry, karst features would not been countered on the Project Site and thus is a low risk.

Wildfires are limited in Nova Scotia but there is the potential for this to affect the project by limiting when work may be conducted during such an event. Permanentstructures on the site may be lost and Lives may be in danger if they cannot be evacuated before an approaching fire. The site is stripped of tall vegetation but is surrounded by forested areas. Fire protection is available from water in on-site ponds.

8.0 OTHER APPROVALS REQUIRED

Permits (eg building permits, electrical inspections) will be obtained as required in the normal course of project construction. A Letter of Authorization as per IA Condition 12 for continued use of alternate fuel following testing will be required at the discretion of NSE. An Industrial Approval amendment may also be required or a variance issued.

9.0 FUNDING

Research funding has been secured by Dalhousie University and additional funding is planned to be sought from the National Science & Engineering Research Council (NSERC) for the planned work. Further, Lafarge has applied to receive funds from Natural Resource Canada as a part of the Natural Resources Canada (NRCan) Energy Innovation Program – Clean Energy Innovation program to assist in the research aspects of the pilot approach at the cement plant. No funding from the public is involved in the execution of this undertaking. Lafarge will fund the rest of the costs.

10.0 ADDITIONAL INFORMATION

Several research reports on the use of TDF in cement plants are available at the Lafarge Brookfield Website at http://www.lafargebrookfield.ca/news.html. Lafarge can provide additional information if requested

11.0 REFERENCES

Davis, Derek and Sue Browne. 1998. The Natural History of Nova Scotia, Volume I: Topics and Habitats. The Nova Scotia Museum and Nimbus Publishing, Halifax.

Environment and Climate Change Canada (ECCC) 2016, 1981-2010 Climate Normals& Averages, http://climate.weather.gc.ca/climate_normals/index_e.html Date modified 2016-02-24, Accessed Feb 2017.

Lamontagne, M; Halchuk, S; Cassidy, J F; Rogers, G C.2007. Significant Canadian earthquakes 1600-2006.Geological Survey of Canada, Open File 5539, 32 pages