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ST MARYS St Marys Cement

# Petroleum Coke in the Cement Industry

# Topics

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# Fuel in the Cement Industry

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## The process of making cement:

- Raw material is processed through a mill and fed counter-flow into the cement kiln which operates at 1500°C melting the rock to produce clinker. This clinker is then further ground to a fine cement powder.

# Requirements for Cement Kiln Fuel[4][5][6]

Considerations for Cement Kiln Fuel Sources

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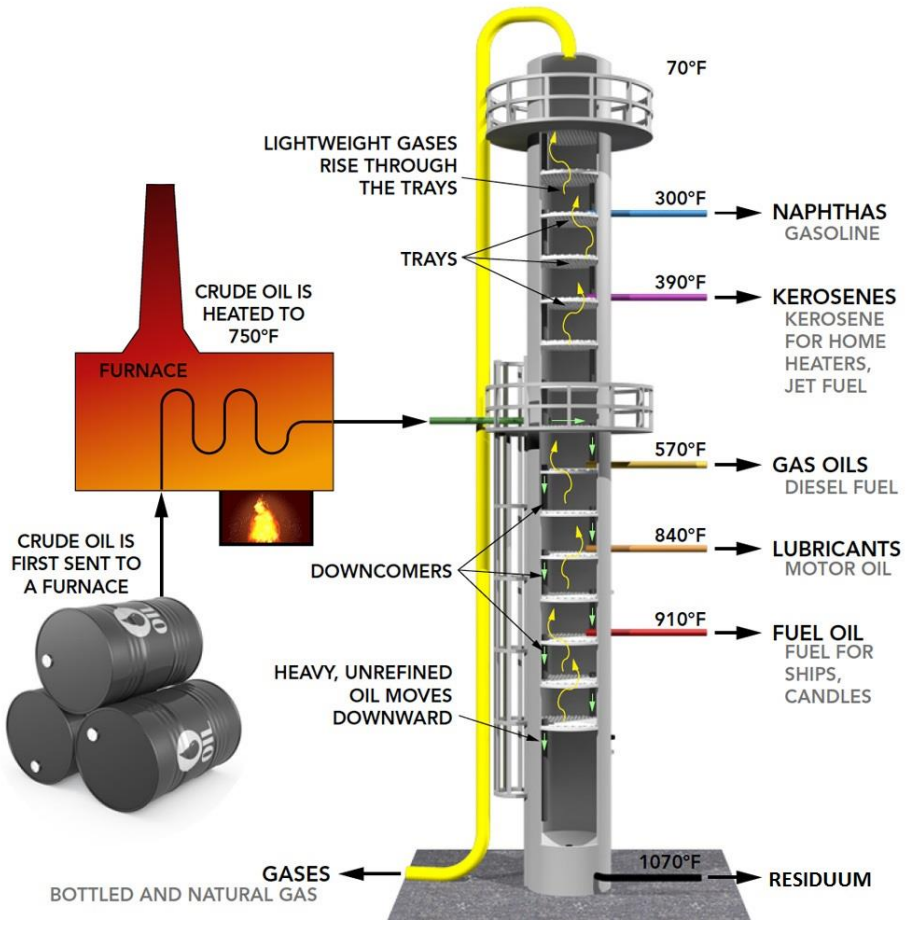
1. **Consistent composition and heat value (heat generated from combustion of fuel).**
2. **The potential emissions released.**
3. **Potential to adversely affect humans and the environment.**
4. **Resulting cement quality.**
5. **Physical state and properties of the fuel.**
6. **Economic viability.**

**Only if all of these criteria are met will the fuel be used in the cement industry.**

# What is Petcoke?

# What is Petcoke?




- **Petroleum coke (petcoke) is produced in the oil refining industry[1]**
  - Oil refining is extracting crude oil from the ground and processed in an oil refinery.
  - Products from the oil refining industry include gasoline used in vehicles, kerosene used in home heaters and jet fuels, diesel fuels used in heavy machinery, lubricants for motors, and heavy fuels such as petcoke which are used in industrial processes such as cement manufacturing).
- **Increased need for gasoline worldwide has lead to an increased production of petcoke.**
- **Canada currently has abundant petroleum coke stockpiles. [3]**

# Petcoke's Composition and Properties

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- **Petroleum Coke Composition**
  - The specific chemical composition of Petcoke depends on the composition of the petroleum feedstock used in refining.
  - Petcoke is primarily carbon based but other elements, such as nitrogen, sulphur, nickel are also captured within Petcoke's carbon matrix.

- **Petroleum Coke Properties**
  - Physical qualities exist well outside the ambient range- it does not readily melt, dissolve, or boil.
  - Petcoke is essentially inert and does not readily react. [1]
  - Petcoke is not biodegradable, nor does it bio-accumulate substances into its structure. [1]

# Potential Health Hazards of Petcoke


- **If working directly with petcoke on a daily basis you can become come in contact with PM 2.5 dust via inhalation or skin contact.**
- **“Effects were to be non-specific responses of the respiratory tract to high concentrations of dust particles rather than compound specific effects.”** [1] [2]

# Why Use Petcoke in the Cement Industry?

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1. **Consistent composition and heat value (heat generated from combustion of fuel).**
   - Petcoke has a high heat value, meaning less fuel is required to run the kiln.
2. **The potential emissions released.**
   - The flow of the raw materials counter flow to the hot kiln gases means some of the elements which would have been emitted into the air are captured in the cement.
   - Extremely high temperatures and complete combustion eliminate some of the organic materials found in fuel.
3. **Potential to adversely affect humans and the environment.**
   - Petcoke also has little to no heavy metal concentration, and meets MOECC requirements regarding trace elements and leachates.
4. **Resulting cement quality.**
   - Its extensive use in the cement industry also means that the effects of Petcoke on the cement, the plant, and the environment, are well known.
5. **Physical state and properties of the fuel.**
   - Its stable physical and chemical properties mean that the storage and handling of Petcoke is safe.
6. **Economic viability.**
   - Increased gasoline consumption worldwide means petcoke is readily available.

# Petcoke at St Marys Cement

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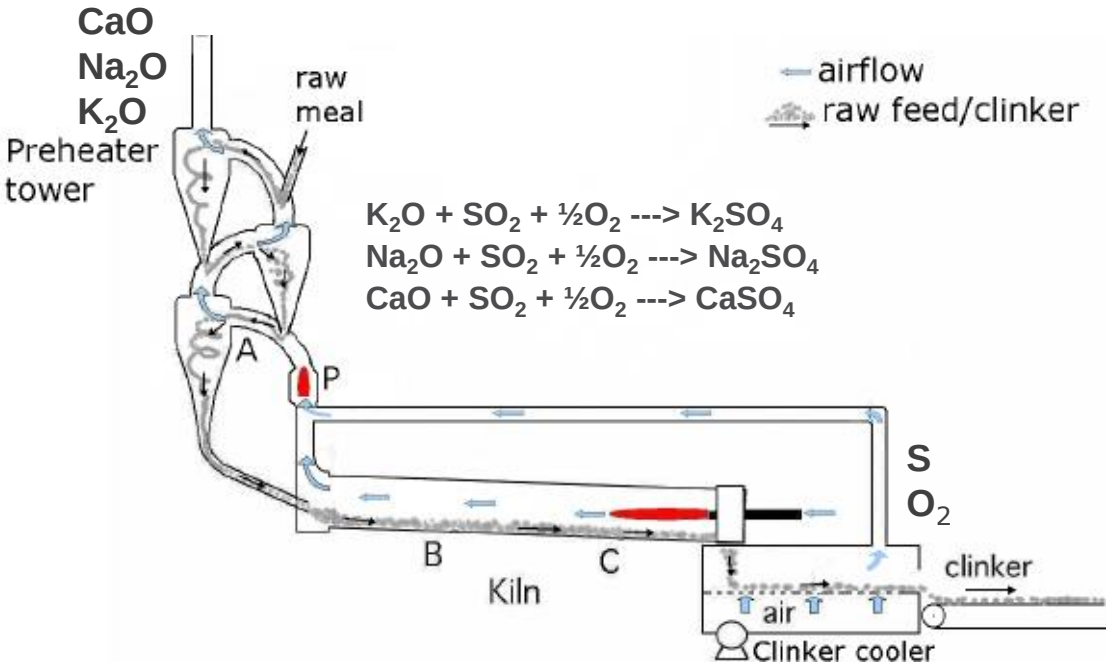
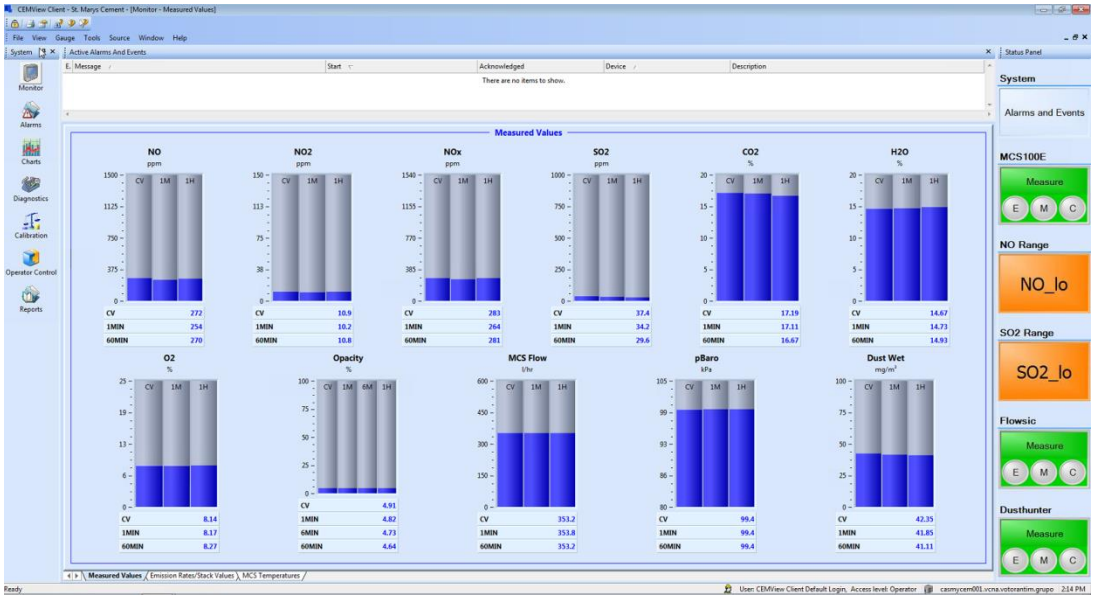
# Petcoke in a Cement Kiln

- The flow of the raw materials counter flow to the hot kiln gases means some of the elements which would have been emitted into the air are captured in the clinker. This is referred to as a `scrubbing` effect. [6]
- Sulphur dioxide reacts chemically with calcium, sodium, and potassium from the raw mix.
- Other impurities within petcoke are trapped in the clinker.[6]
- Because of this, cement kiln operations which are fueled using petcoke result in lower emissions than other operations that use petcoke. For example, industrial sized furnaces which use petcoke do not have this scrubbing effect and therefore have higher emission levels. [6]
- Ultimately it is important that at St Marys Cement, we put a focus on what leaves our stack, as this is the true emission values from our process, as opposed to potential releases.



# Petcoke at St Marys Cement

- Petcoke has been used at St Marys Cement intermittently for over 35 years.
- We do regular testing of the petcoke used on site.
- Petcoke onsite is coated with surfactant which decreases the chances of particles becoming airborne.
- The MOECC has requirements for monitoring emisisons from cement plants.
- Our Continuous Emissions Monitoring system collects close to 70,000 points of data every day to ensure we are meeting MOECC requirements for emissions.



# Petcoke at St Marys Cement

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| • **Advantage of Petcoke in Cement Kilns** | • **Why** |
|---|---|
| • Petcoke has a high heat value | • Less fuel is required to power the kiln.<br>• Less fuel means less transportation emissions.<br>• Using less fuel means less $CO_2$ emissions, less NOx emissions, and less $SO_2$ emissions. |
| • Emissions are mitigated | • $SO_2$ generated from petcoke combustion is captured in the cement product.<br>• NOx emitted from petcoke combustion is managed using an Selective Non-Catalytic Reduction System (SNCR). |
| • Physical composition | • Physical qualities exist well outside the ambient range- it does not readily melt, dissolve, or boil.<br>• Petcoke is essentially inert and does not readily react. [1]<br>• Petcoke is not biodegradable, nor does it bio-accumulate substances into its structure. [1]<br>• Storage of petcoke on site is managed by surfactant. |
| • Low ash content | • Less particulate is left after burning. |

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