



Votorantim Cimentos North America

**St Marys Cement
Shutdown**

Shutdown

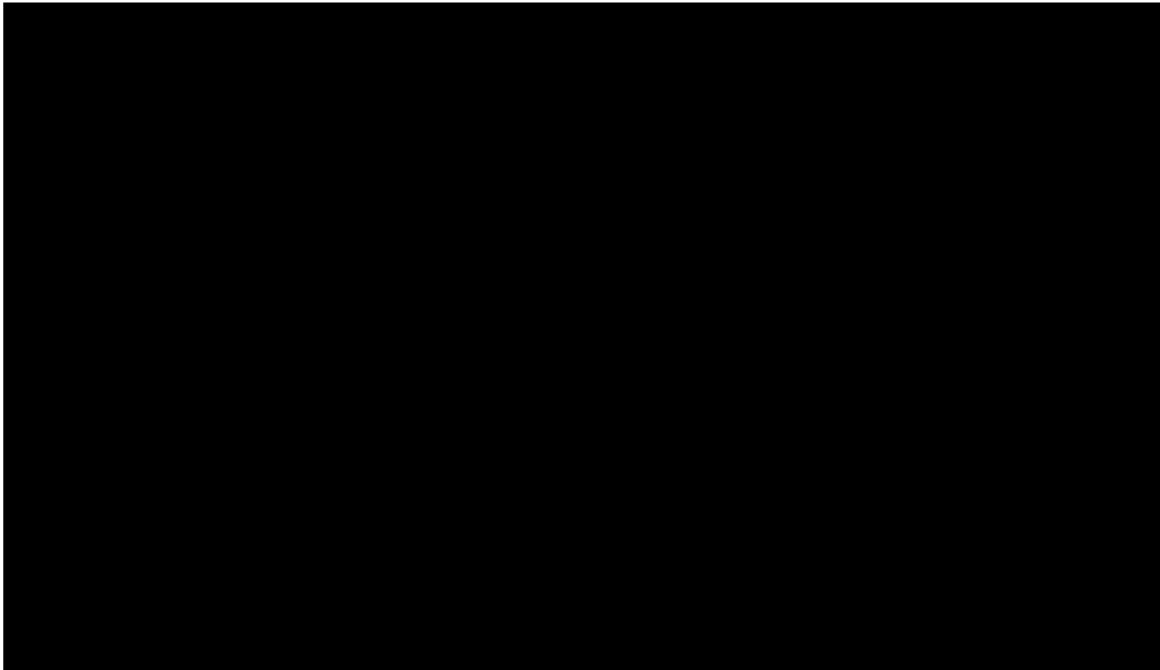
- St Marys Cement has several planned maintenance shutdowns throughout the course of a year
- Shutdowns vary in timing and length based off what maintenance is required and production needs
- Maintenance activities include preventative maintenance inspections and repairs, plant upgrades, and plant projects
- A shutdown period typically includes quarrying operations, crushing, the kiln, and the cement mill

- Note that some of these pictures have people in them, which illustrates the size of the equipment we have on site.

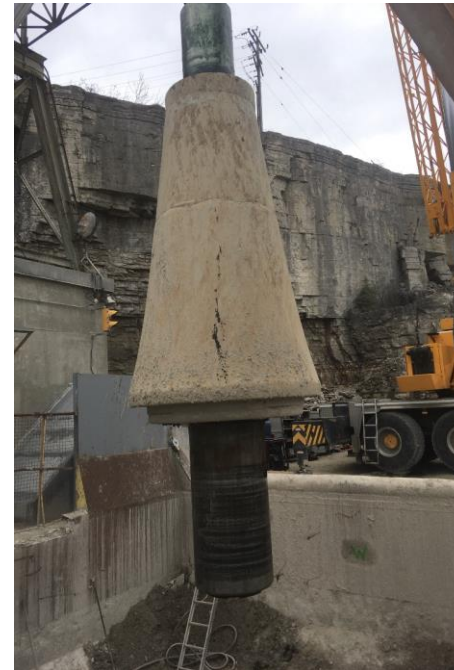
- **Kara – I want these slides to tell the story, it will be posted on the CLC website and I want people to be able to read and know what is going on**

Quarry

The Quarry is where St Marys Cement blasts limestone and crushes it in the primary crusher to be sent to the cement plant. No limestone is needed during shutdown periods, so during shutdown repairs are done to the crushing equipment.



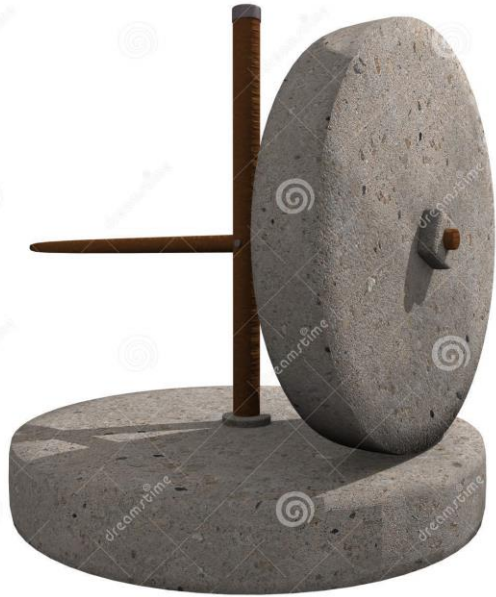
60 ton haul trucks dump the limestone into the top of the crusher, where the rotating mantle crushes the rock from 3-8ft pieces to 1-2ft pieces. From there the rock is transferred via conveyor (which passes over Water Street) to the cement plant.



During shutdown the mantle (approximately 50 tons) is removed so the bowl can be inspected and repaired as required.

Crushing; Raw Mill

During production the Raw Mill is used to grind the limestone and other raw materials into a fine powder. The crushing is done using roller stones, similar to historic methods of crushing flour using a millstone.



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Original stone mills
(~23,000 BCE)



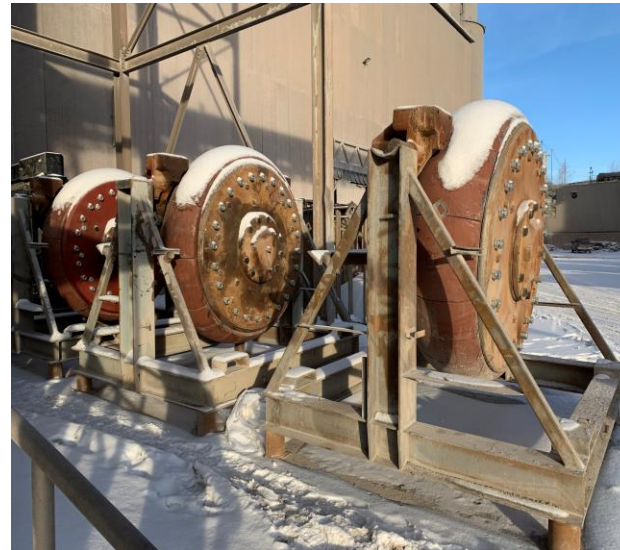
St Marys Cement Raw Mill; 2020

Crushing; Raw Mill

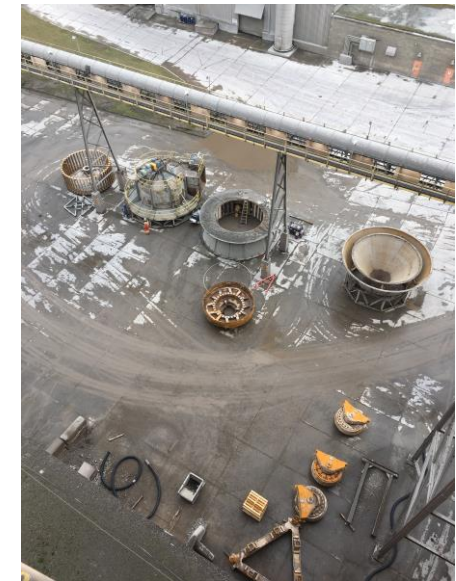
During production the Raw Mill is used to grind the limestone and other raw materials into a fine powder. The mill is about 2.5 stories tall. Inside, three large rollers crush approximately 230 tons of limestone per hour.



When the process is stopped for shutdown, the Raw Mill is opened up and all of the material is removed. This material is fed back into the system after shutdown.

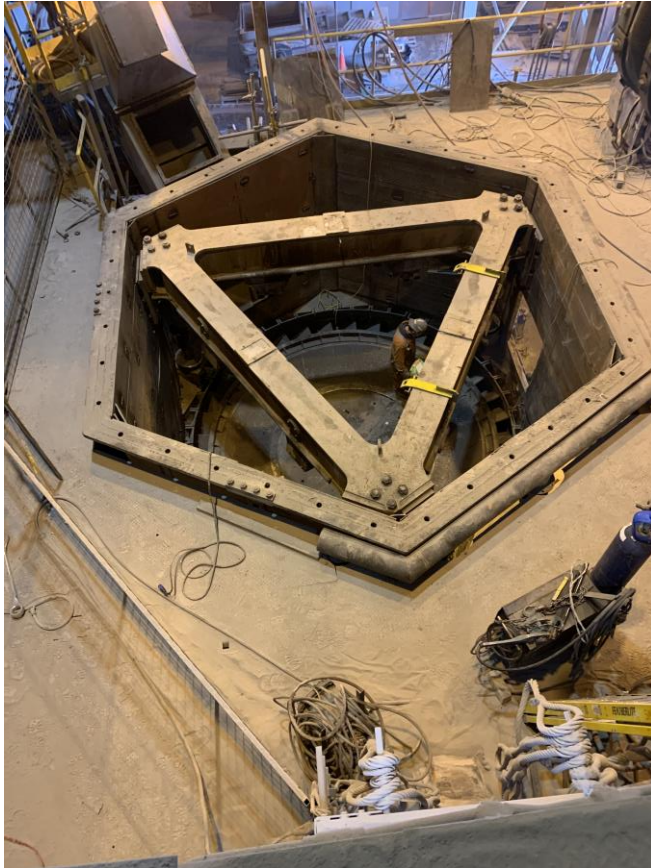


The rollers are also removed using an overhead crane. They are examined to see how much wear is on them. Each roller weighs approximately 16 ton.



The raw mill is disassembled and the pieces are brought outside for inspection and repair (human for scale).

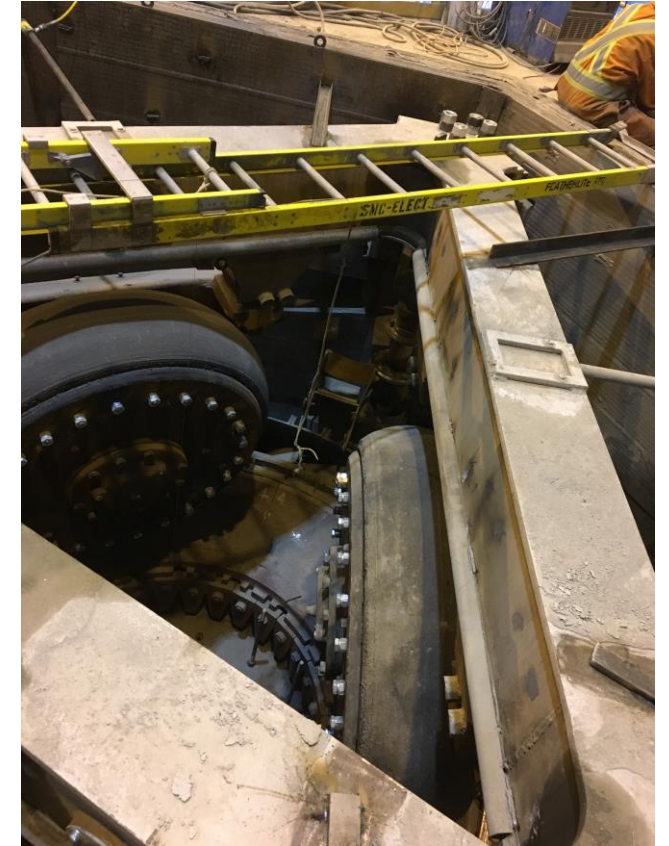
Crushing; Raw Mill



Internal parts are also inspected for wear and tear (you can see employees working inside the mill).



Employees perform internal measurements to ensure everything is aligned.



The raw mill is put back together ready for start up

Burner



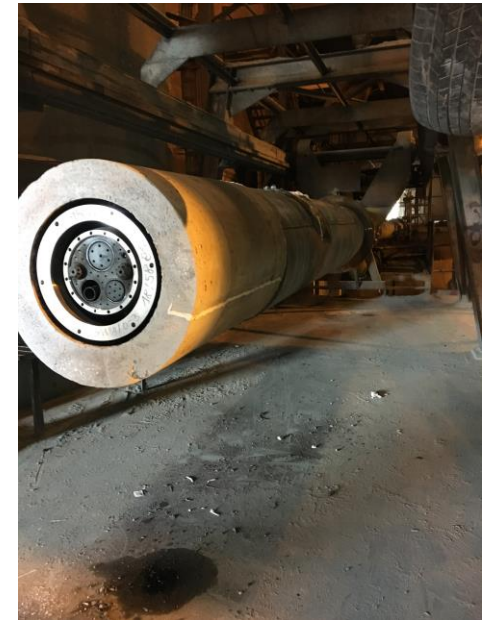
The burner is what heats the kiln to 1600C. The different holes on the burner are for the different fuel (petroleum coke and natural gas), oxygen for the flame, and a camera (which is used to monitor the flame and watch the clinker react inside the kiln).



During shutdown the burner is removed from the kiln.



The worn thermal insulation is removed by hand so that repairs can be done to the burner.



New burner casing is installed.

The kiln is where the limestone and other raw materials are heated to 1600C and chemically react to form clinker. The kiln operates 24/7 and is insulated using thermal bricks. The kiln is 80m long, 5m in diameter, and rotates about 6 times per minute.



Kiln Operation March 10 2021



After the kiln stops, it is cooled for about 2 days. Once cooled it is opened up. This picture shows the clinker coating the kiln (the kiln has a 5m internal diameter).



The coating is knocked away from the edges of the kiln using a jackhammer robot which is operated via remote control.



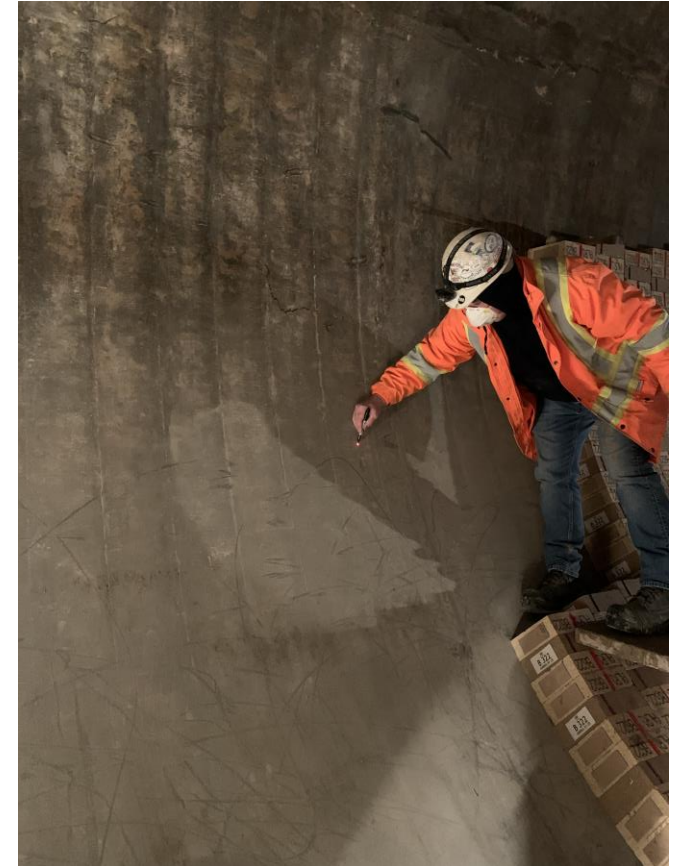
Once loose, the coating is removed so the kiln can be inspected (you can see production staff on top of the clinker). The removed material is fed back into the system after shutdown is finished.



Once all of the coating is removed the process engineer examines the kiln shell to see where the bricks are worn and need replaced.



In some spots the bricks have worn almost in half.



Areas are marked out for brick installation.

Bricking



Bricking

The worn bricks are removed where required and new bricks are installed by workers with the assistance of a bricking arch (previous photo). The arch uses hydraulic jacks to hold the bricks in place as the workers make their way around the top of the kiln. The final brick is secured in place using a hammer and shims.

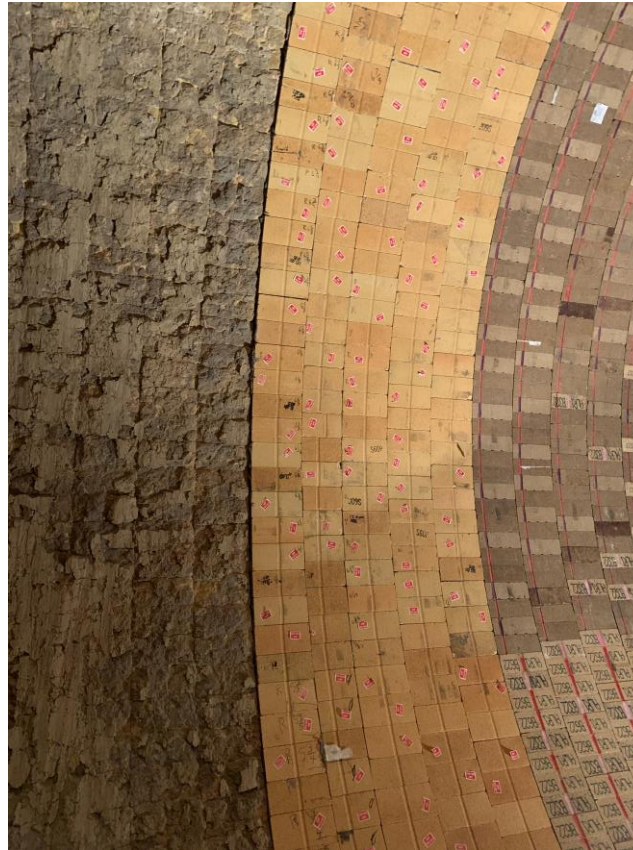


Hydraulic
jacks

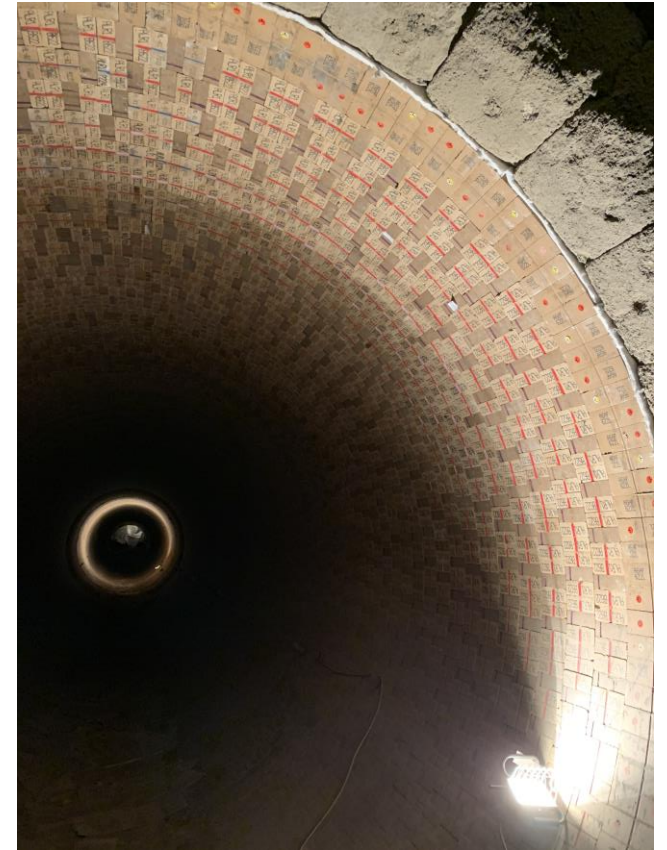
Bricking



There are several different types of bricks used in the kiln. They are made from a blend of silica, alumina, and magnesium. The composition of the different types of bricks varies based on location in the kiln relative to the burner, inlet, and discharge points.



We only replace the parts of the bricking that are worn; in this photo you can see some of the old brick and then two different types of new bricks.



The kiln is 80m long, if we were to replace the entire kiln it would be 130,000 bricks

Baghouse

The baghouse is used to control dust emissions from the main stack. It is basically a giant vacuum cleaner with 3200 tube bags installed on wire cages. Each bag is 6 inch diameter and 8 feet long. The baghouse controls the dust emissions coming out of the main stack.



Each bag has a corresponding air tube which is used to pulse the dust off of the bags.



If the bags are replaced during shutdown, all of the cages and bags are removed, the baghouse is cleaned, and then new bags and cages are installed.

Finish Mill

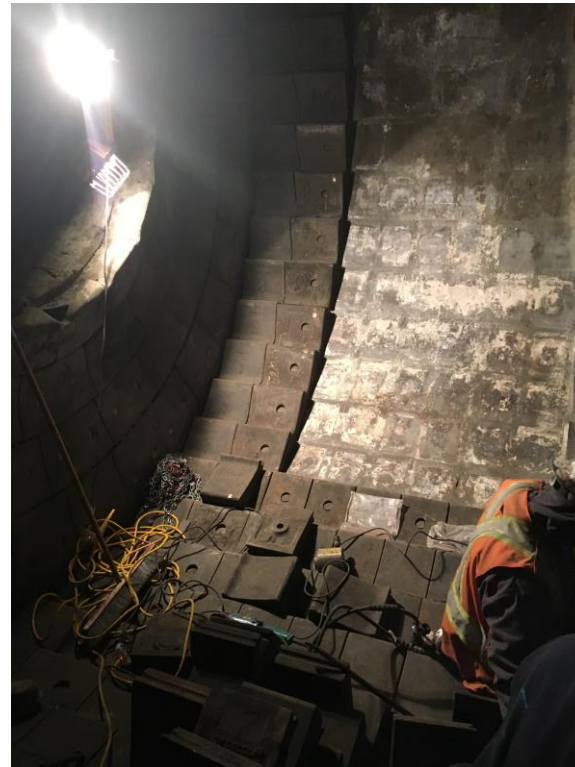
The finish mill is a rotating drum filled with steel balls which crush the clinker into fine cement powder. The finish mill makes approximately 120 tons of cement per hour.



Finish Mill in Operation



The balls are removed and sorted. Balls that have eroded too small are removed.



The internal walls are inspected and repaired as required.



New balls are put in so the finish mill can start up again.

Special Projects



Kiln Shell Replacement 2017



Stack Extension 2020