

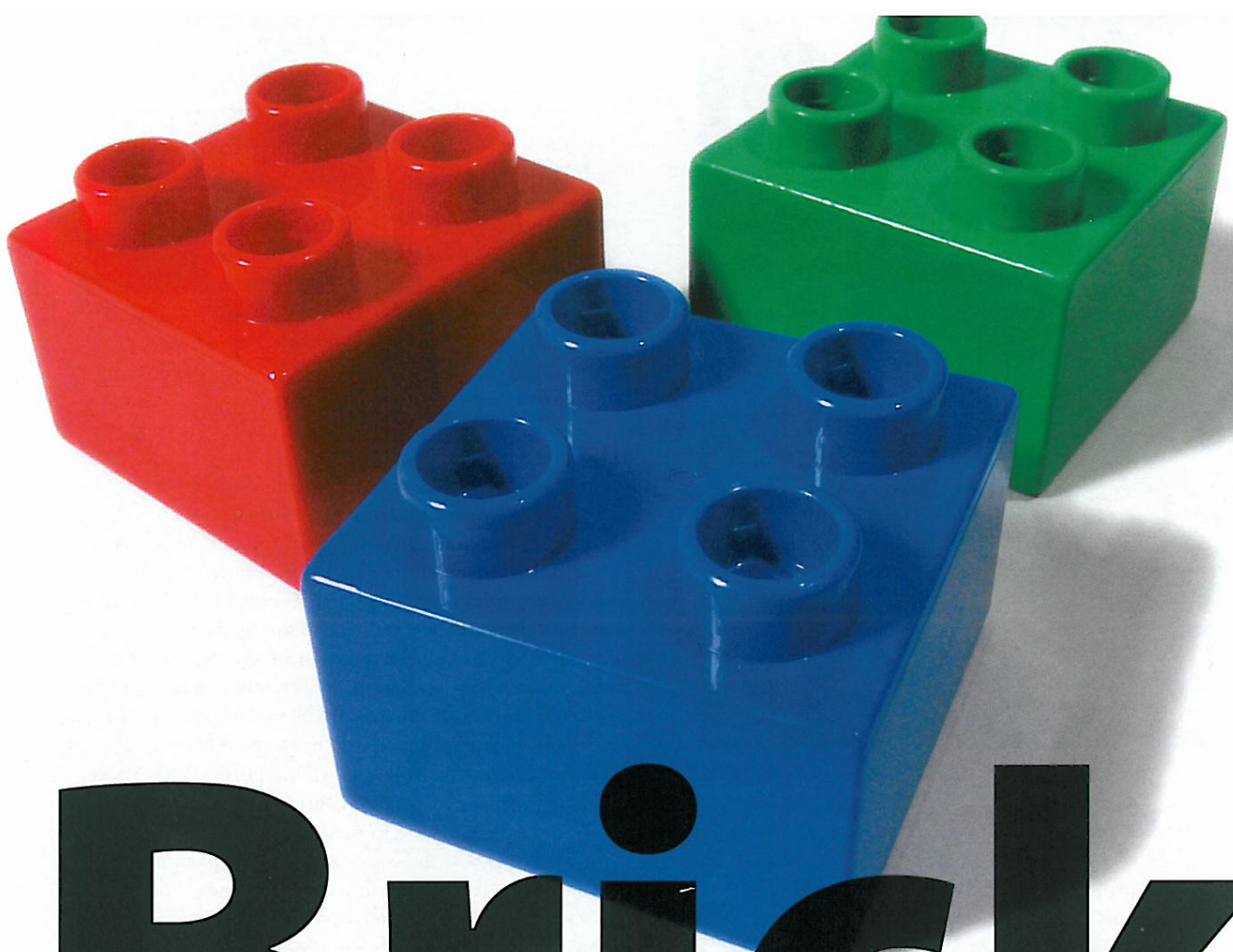
WORLD CEMENT®

February 2011



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Brick by BRICK

GEORGE TOOLE, BRICKING SOLUTIONS, USA, ON THE BASIC STEPS TO SUCCESSFULLY MANAGING A REFRACTORY OUTAGE.

Introduction

Refractory management is critical to a cement plant. Ideally, a plant will only shut down its kiln for one refractory overhaul each year. In reality, a large number of plants schedule a second, smaller refractory outage part way through the year to insure against unexpected and unscheduled outages.

In today's economy, a cement plant faces many challenges, and in order to reduce costs a variety of fuels and raw materials are being used. These materials can affect

the refractory and greatly shorten its working lifespan. This stress on the kiln system can necessitate premature and unscheduled kiln outages to replace a damaged refractory, further emphasising the importance of refractory management.

Refractory management can start up to a year before a major overhaul. Inspection during the tear out determines the wear mechanisms on the brick. Coating is inspected, which helps to determine the zoning of the kiln brick: for example, dolomite brick may be installed in an area



Figure 1. Using the 'Port-A-Track', two men can push a 4000 lb pallet of brick up the kiln.

of unstable coating that causes premature brick failure. Brick samples are taken and analysed to determine the type of chemical attack on the brick and assist in choosing one more appropriate for that area. Mechanical stresses near the support tyres and kiln drive can be detected. Support tyres may need shimming to reduce ovality; or a kiln alignment may be required to reduce some of the mechanical stresses. All this information must be recorded and later analysed so the plant can decide if the brick type or the location of a brick type needs to be changed during the next outage. This history can also show areas of repeated short brick life; these areas need special attention to assess the cause of the failures and determine possible solutions to them.

Bricking equipment must be inspected and brick needs to be ordered. With long delivery times, it is important to order brick well in advance. Emergency stock must be kept on hand in case of a premature failure. The right brick, properly installed and properly



Figure 2. Bricking rig with 5.2 m deck at 6810 kg capacity allows three full pallets of brick, plus men and equipment.

preheated can still fail within days if a burner pipe is improperly aligned and the flame is allowed to impinge on the brick.

It is important to coordinate the activities between refractory overhaul work and other mechanical and electrical overhauls. Certain repairs may require the kiln to be turned on. Proper draft is required while brick and coating are being removed. Welding and other activities can affect the environment inside the kiln while a brick crew is working. Such details need to be considered before the work commences.

Installation efficiency

Staging of brick for easy access to the kiln is critical. Once the bricking has begun, large quantities of brick need to be moved to keep the masons well supplied. This often involves the movement of many different types of bricks and the key bricks for each type. In many cases, a hoist is needed to bring pallets of brick to the burner floor. This is another piece of equipment that needs inspecting and evaluating for safe operation. A correctly engineered lifting device can speed up the process by making it easier to load and unload the brick, and brick to be lifted in greater volumes. Correct management of the burner floor space will help keep the brick job progressing.

In most cases, access to the kiln means an access ramp and bridge to cross the cooler throat. Ramps must be inspected for damage to ensure they still meet the rated capacity and must be correctly set up for safe access. The integrity of the castable in the kiln hood must be considered. It is difficult to tell if the anchoring system for the castable is still secure. An access ramp should be easy to assemble and hand rails should be incorporated for safety. If the current ramp is difficult to set up, or does not have the required live load capacity, a new ramp should be considered. If there is any doubt and access is required to the kiln before removal, then a certified safety cage is recommended.

Coating must be removed for safe access into the kiln. If necessary, an inspection cage can be used for safe access under the coating for up-kiln inspection. If minor repairs are required up-kiln then a safety tunnel may be an option to allow repairs to be completed without removing the coating in the burning zone, and therefore extending the life of the refractory.

Once the refractory debris is mucked and the shell prepped for bricking, then the installation can start. The bottom brick must first be bedded to allow the bricking rig to be set up. Depending on the size of the bricking crew available, the bottom and top brick can now be installed simultaneously. In large diameter kilns, a forklift may be able to transport brick under the bricking rig to supply the bedding crew up-kiln of the bricking rig. If this is not possible then conveyor rollers or conveyor belts can be used to transport brick under the bricking rig. Another option is a 'Port-a-Track' conveyor that allows a full pallet of brick to be moved easily under the bricking rig. This eliminates the need to pre-stock the kiln or increase brick handling and possible damage. In kilns with a large diameter, planks or a bedding cart are often used to give masons access to install brick on the sides of the kiln. The bedding cart has a platform on each side and secured planks to allow

Case study

A plant had a 14 x 500 ft. wet kiln that was prone to building rings on the alumina brick above the upper transition zone of the kiln. The burning of whole tyres mid-kiln caused the rings to build even faster, which in turn caused the kiln to be shut down and the ring removed with a remote Brokk demolition machine. In order to remove the ring, the operator had to accompany his machine through the burning zone. In the past, the coating would be removed from the dolomite brick to allow safe access through this zone. Removing the coating also brought 1.5 – 2 in. of brick down that was adhered to the coating, greatly reducing the life of the brick.

The plant purchased an inspection cage that allowed the operator safe access through the burning zone without removing the coating. The ring could be demolished and the debris rolled out of the kiln prior to light up. Using the inspection cage allowed the kiln to operate one full year on the same brick in the burning zone; without the cage the coating had to be removed several times. This would have forced the brick in the burning zone to be replaced at least a second time that year. The inspection cage made a great saving in time and money.

safer, easier and faster brick installation. The cart is mounted on wheels for quick advancement and protects newly bedded brick from damage.

A pneumatic bricking rig is recognised as the safest and most efficient installation method for overhead bricking.

Earlier installations used a wooden arch and spring loaded pogo sticks, but set up and advancing in the kiln was slow. The introduction of pneumatic bricking rigs greatly sped up the bricking process. The rig can usually be set up in 2 - 4 hrs and is easily advanced during the bricking process.

The bricking rig is a key device for refractory management. It must provide a safe platform for the masons to install the brick overhead in the kiln. It must be able to carry a large work crew, the tools and brick required for the job, and must not breakdown. Bricking Solutions' premium bricking rigs have a 17 ft. deck with a 15 000 lb live load capacity, allowing three full pallets of brick with the appropriate number of men and any necessary equipment to be on the machine for installation. This enables a constant supply and proper staging of bricks for the masons during installation. Tables or shelving can also be designed into the rig to make the job easier. The speed of the brick job can be affected by something as simple as the masons waiting for brick to be passed through under the bricking rig arch. Since keying of the brick is critical to the installation, the rig must give good access to the key area for the masons. Delays here are very difficult to make up.

Proper installation is critical to ensure maximum brick life, as improperly installed brick can fail as early as during the kiln preheat. The pneumatic bricking rigs allow for the strongest keying because they provide room for the brick to be jacked and shimmed to ensure tightness of the key section. Some rigs can be adjusted to allow for bricking over taper sections in a kiln, which is always a difficult area, but the pneumatic rig can make this installation much easier. These rigs also make it easier to go through sections

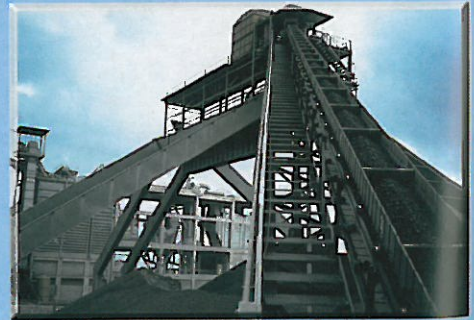
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of warped kiln shell. Once the bricking is completed, the pneumatic bricking rig is easily torn down and removed from the kiln. The rig should be inspected daily during use to ensure it has not been damaged during moves or whilst loaded with brick by a forklift or any other machinery.

Proper alignment of the rows of brick to the kiln is very important. It is easy for one side to advance more than the other, causing the rings to come out of alignment with the kiln. Measuring to the shell welds helps ensure the rows are straight and allows for corrections to be made before the rows get too far out of alignment. A laser alignment tool can be used for quick and easy confirmation that the rings are properly aligned.

Supervision of the brick installation by an experienced plant person is essential. Whether it is plant employees or outside contractors installing the brick, mistakes can be made and it is better to find and correct them early. It is also important that installation expectations are clear with the installer before the job starts, such as:

- How many key brick and shims are acceptable.
- Whether mortar can be used and where.
- What the safety procedures are.
- How the kiln is locked out, etc.

Conclusion

Refractory installation management means getting the best out of the people and the equipment available. Proper planning and communication can make a brick overhaul run smoothly, just as poor planning can turn it into a nightmare. Proper coordination with the other contractors,

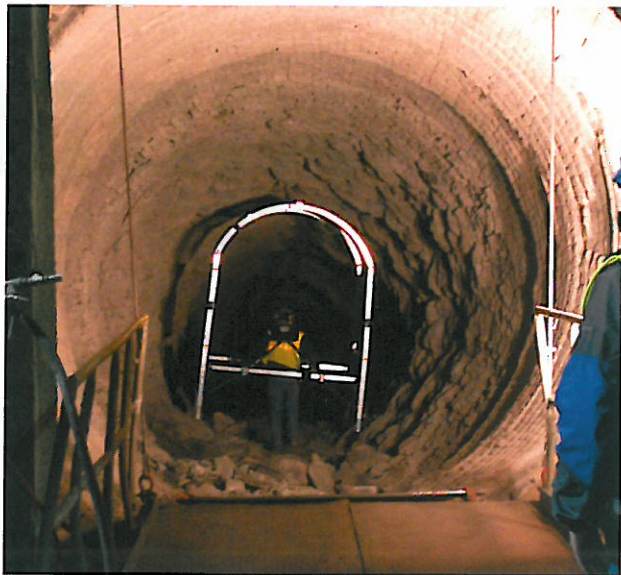


Figure 3. The safety inspection cage is rated for 114 kg dropped from 60 cm with a 3:1 safety factor.

plant employees working around the kiln during the overhaul, and proper supervision during the installation is essential. It means evaluating the methods and equipment being used and sometimes it means investing in new, modern equipment. When considering the cost of lost production, any investment in equipment that helps the masons perform the job safer and faster is a wise business choice. ☺

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