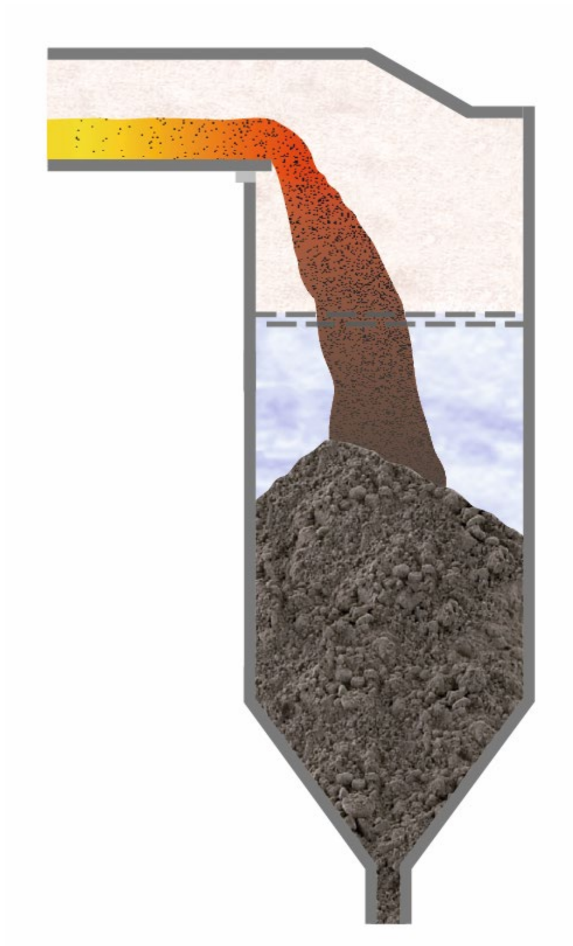
Level Control in Cement Clinker Cooler

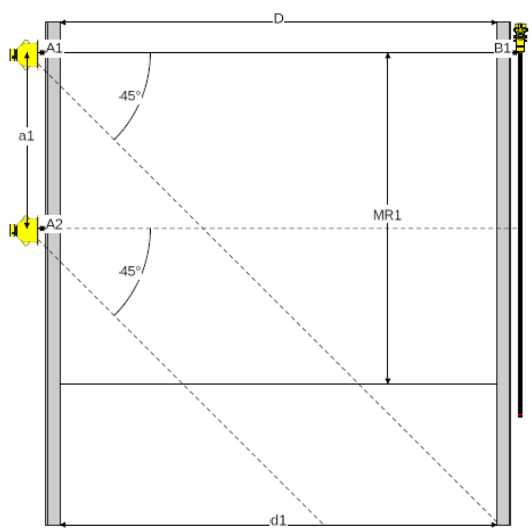
During the production of cement a mixture of ground limestone, clay, and silica sand are sintered in a rotary kiln. The product of this operation are nodules of a material called Alite. The nodules leave the kiln at temperatures over 1400°C (2552°F) and enter the clinker cooler. The job of the clinker cooler is to cool the clinker to less than 100°C (212°F) so that it can be safely transferred on a conveyor to the grinding operation. If the clinker is too hot it will burn up the conveyor belt, leading to down time and repair.



When the cooler is the vertical box design the end user gains benefit from a continuous level measurement of the clinker. The cooling in many cases is controlled by maintaining a level in the clinker cooler box sufficient to give the clinker satisfactory residence time . When the level is too low then there is not enough residence time for cooling, and the clinker will exit the cooler at too high of a temperature, potentially burning up downstream equipment. It's equally important to prevent overfill of the cooler, and back-up into the kiln. Maintaining the level of a bed of red hot clinker nodules falling into a vertical box cooler allows for sufficient cooling.

Challenges of this measurement for many technologies include damage due to mechanical abrasion from falling nodules, as well as high temperatures.

The radiometric solution overcomes these challenges due to its non-intrusive mounting scheme. Radiometric systems broadcast a beam of gamma rays through vessel walls from a source holder to a detector, both mounted outside of the cooler. They are not damaged by the falling clinker, nor the high temperatures encountered inside of the cooler. In general a key advantage of radiometric measurement systems over other technologies is the non-intrusive, "set it and forget it" nature of the solution. It's an especially important advantage in this application.



The radioactive source is sized so that enough gamma energy reaches the detector when there is no clinker in the path, but no radiation reaches the detector when clinker is in the path. Therefore the level of the clinker can be determined.

Typically clinker cooler walls are lined with refractory material. Twelve to eighteen inches thick per side in some installations. That much mass requires a relatively high amount of Cesium 137, and may require the use of the higher gamma energy of Cobalt 60. The problem with Cobalt 60 is the half life at only 5.2 years, requiring source replacement after 5 to 8 years. In several installations partial removal of the refractory brick has allowed much smaller source activities to be used to make the measurement. As an example, removing all but about 3" of the refractory on the source side of the vessel in many installations has allowed the smaller activities of Cesium 137 to be used.

Figure 1 Cooler - Typically, the clinker coolers walls are lined with refractory.

Another consideration of the proposed solution is the upper ambient temperature limits for radiometric detectors of about 60°C in general. Alleviating issues associated with exceeding the upper temperature limit of the detector include mount of the detector 12” or farther from the vessel wall, radiant heat shields, or active cooling whereby a fluid (air or water) is circulated around the detector in order to pull the heat away.

Operational success of clinker production requires proper level measurement and control in the clinker cooler. Radiometric measurement continues to be the set-it-and-forget-it solution for this challenging task. Reach out to VEGA for an evaluation of your application parameters.

Figure 2 - The upper ambient temperature limit for radiometric detectors is about 150°F.