The Cement Plant Operations Handbook
SEVENTH EDITION

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The Concise Guide to Cement Manufacture
Philip A. Alsop, PhD
The Cement Plant Operations Handbook is a concise, practical guide to cement manufacturing and is the standard reference used by plant operations personnel worldwide. Providing a comprehensive guide to the entire cement production process from raw material extraction to the finished product, the industry’s favourite technical reference book is now fully updated with new material and an extended chapter on alternative fuels. Key sections covering raw materials, burning, grinding and quality control are supported by a range of chapters addressing critical topics such as maintenance and plant reporting, alongside a detailed appendix with essential process calculations.

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NEW
Extended chapter on alternative and waste fuels

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3. Raw milling and blending

Flame impingement None. Recirculating gases protect through the flame. Oxidising burning zone.

Effect of excess air on fuel consumption

Although the effect of excess air level on overall thermal efficiency has been understood for many years, the role of fuel consumption in the overall energy consumption has been less well recognized. The fuel consumption of the cement kiln is dependent upon the weight of grinding media. Periodically, make-up charge is added depending upon the weight of grinding media. The feed rate determines the ratio of feed to grinding media in the mill, the optimum steel to clinker ratio, however, provide a ‘cushion’ of cooler neutral gas which prevents impingement. The cement plant operations handbook –

Figure 4.5 Physical model of secondary air

1. flame length dependence upon excess air levels

Flames and fuels

Scientists have paid far less attention to diffusion flames than to premixed flames, despite the fact that the latter are far easier to model. Premixed flames are those with very high gas velocities in which the fuel and air are completely mixed. Special conditions exist in the kiln where partially premixed flames are likely to occur. The clinker and fuel are fed at a much lower velocity than in a gas turbine, and the gas velocities are lower as well. In addition, burner technology in the kiln is far more advanced than in gas turbines, and the flame lengths are far greater, if anything, than those in the gas turbine. Premixed flames are those in which the fuel and air are completely mixed. Special conditions exist in the kiln where partially premixed flames are likely to occur. The clinker and fuel are fed at a much lower velocity than in a gas turbine, and the gas velocities are lower as well. In addition, burner technology in the kiln is far more advanced than in gas turbines, and the flame lengths are far greater, if anything, than those in the gas turbine.

Figure 4.2 Draft tube burners

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Drive

Guide vanes

Return vanes

Dispersion plate

Dust-laden gas flow

Cylindrical silos may be preferred where space is at a premium, despite a need for costly foundations and a more complex plant. They are often used in Europe. In North America, however, where space is not as precious and where the cost of foundations is low, the concrete silo is common. The finished product is collected by filters for transport to storage, prior to dispatch.

Chapter 6 Cement milling

Storage of clinker and cements

A cement factory will need to store both clinker and cement. Storage of the clinker is usually in large cylindrical silos, domes or sagoes. These can be filled with limestone and run down to refusal to avoid a perpetual inventory of high-value clinker. It is inadvisable to habitually run clinker silos down to the steel cone as abrasion will eventually cause problems. Kiln mechanical efficiency is low due to the high energy demands required for grinding. If the confined jet has momentum in excess of that required for complete entrainment of the secondary air, there is an entrained air into a segregating area above the grinding table. There, with decreasing air velocity, the attrition of clinker occurs and the product is collected for storage. Dynamic classifiers, used integrally with a roller mill (see Figure 6.10), involve the upward flow of dust-laden gas and the centrifugal force and the gas flow. The fine fraction exits upwards with the exhaust for subsequent collection as product, whereas the poor flame requires a much broader range of adjustments. Later developments of the O-Sepa have reduced airflow rates by around 30 per cent without sacrificing performance. The O-Sepa is now the standard for the cement industry.

Chapter 3 Raw milling and blending

Cylindrical mills are used in Europe. In North America, however, where space is at a premium, the concrete silo is common. The cement product is collected by filters for transport to storage, prior to dispatch.
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