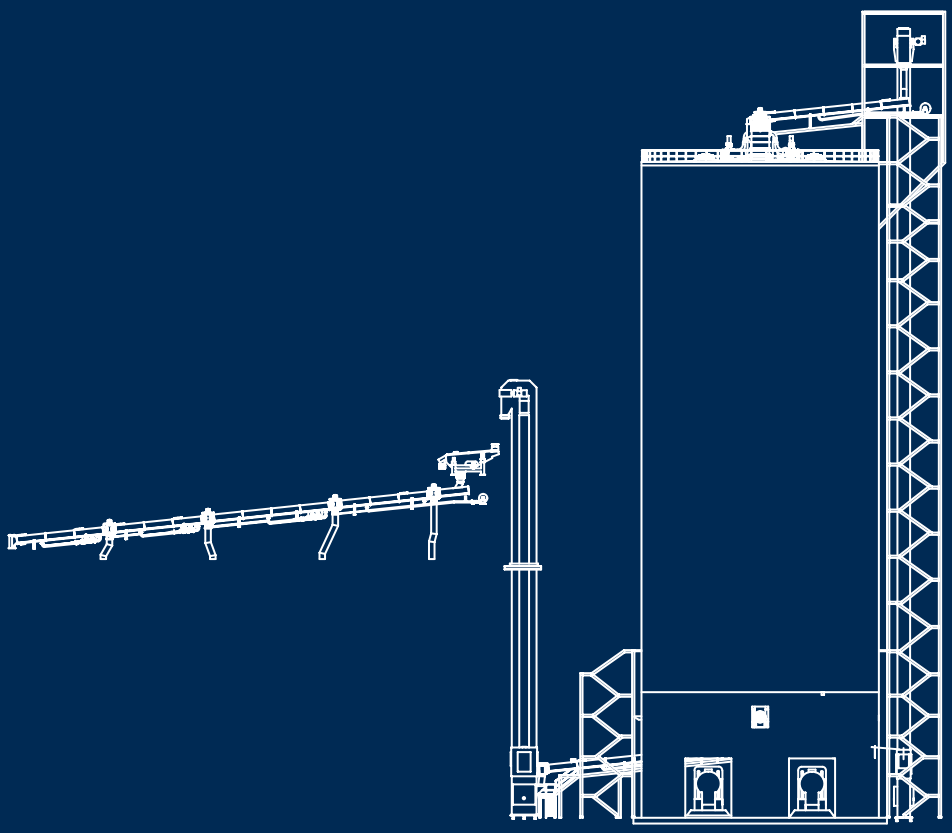
FLSMIDTH CEMENT

SILO-SAFE CEMENT SERVICE

No lumps and blockages. Just high-quality cement.

WHAT CAN YOU EXPECT?

Our Silo-safe Cement Service is suitable for all silos and mills



KEY BENEFITS

Higher quality cement

Less inspection and silo cleaning

More cement to sell

SILO-SAFE CEMENT

The quality of cement can be compromised by the conditions in the mill system and cement silo. But improving silo conditions is a complex and expensive process. As an industry leader in cement grinding and high-quality cement production, we help cement plant operators produce silo-safe cement.

Based on our extensive inhouse research and more than 130 years of cement grinding experience, we provide a range of specialised silo-safe cement services. Whether helping you to avoid blockages and lumps in your cement silos or optimising the grinding process for any mill system, including ball mills, roller presses or vertical roller mills, we help you stay focused on what's important: delivering a high-quality product at the lowest cost.

What is silo-safe cement?

Water is always present during cement production, either through injection during grinding, via gas vapor or from feed materials, such as gypsum, slag and trass. But it is vital to avoid the premature reaction of cement with water – known as prehydration.

Prehydration of clinker and cement has been known for many years, and it can happen during clinker storage, cement grinding and storage in silos or during transportation. The main effects of early hydration may be lumps and blockages in the silo, setting problems and lower cement strength.

To advise you on the optimum way of operating your mill and grinding materials, a part of our analysis includes a measurement of prehydration and gypsum water in cement.

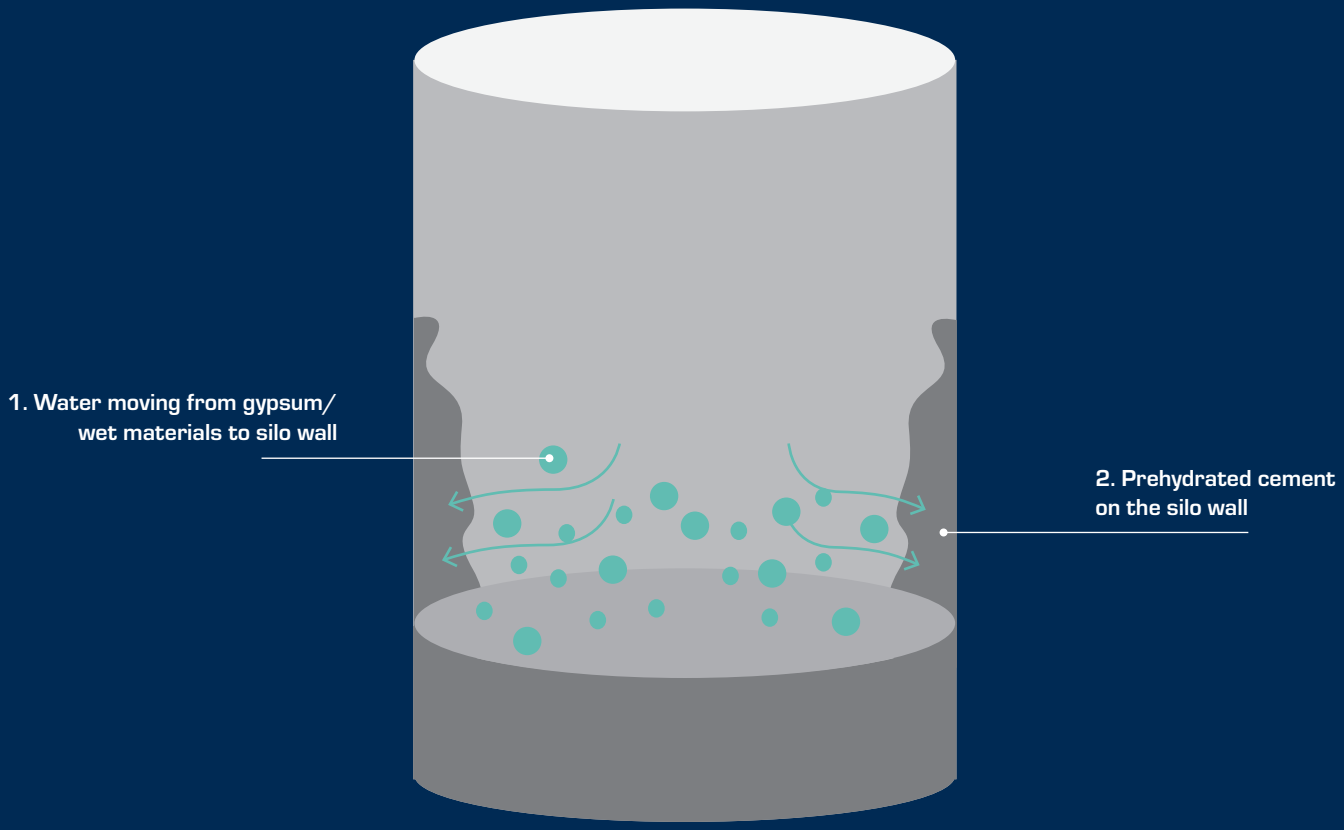


Figure 1. At temperatures above approximately 70°C, the water from gypsum/wet materials moves to the colder parts of the silo (typically the wall, silo outlets and roof), where it prehydrates the cement and eventually forms coating and lumps.

Why does cement prehydrate?

Cement prehydration can occur when cement is exposed to humidity. For example if the combination of water and temperature in the mill is not optimized. In the silo, prehydration usually occurs when moisture entering with the cement evaporates during storage and reacts with the cement, see figure 1.

A number of reactions can potentially occur in the cement mill and silo:

1. Dehydration: gypsum or wet materials
Gypsum dihydrate = > Gypsum hemihydrate/anhydrate + water
Wet material = > Material + water
The released water might react and prehydrate the cement.

2. Prehydration: cement
Cement + water = > Prehydrated cement

SAFE AND SOUND

Silo cleaning is not a standard or desirable operation. In addition to causing downtime and an unsellable product, it increases unwanted silo cleaning. Silo cleaning also poses significant safety risks for personnel.

Silo-safe cement offers important economic and safety benefits. It eliminates unplanned stoppages, reduces product waste and the need for extra inspections and silo cleaning.

Maintaining high product quality

Early hydration of cement (prehydration) in silos or mills compromises the final quality of the cement product through, for example, longer setting time and loss of compressive strength.

Silo-safe cement prevents prehydration, helping you to ensure important quality parameters.

In the figures below, we share the results from our inhouse research about the importance of silo-safe cement. In figure 2, a 90°C silo storage test using cement ground at 100°C and high water injection shows that the use of non-appropriate grinding parameters result in gypsum dehydration and cement prehydration in the silo. In figure 3, thermogravimetric analyses (TGA) of cement at different prehydration water levels also show that increased cement prehydration decreases the compressive strength at early and late age. This means water may hydrate cement phases and have a negative impact on the reactivity and compressive strength.

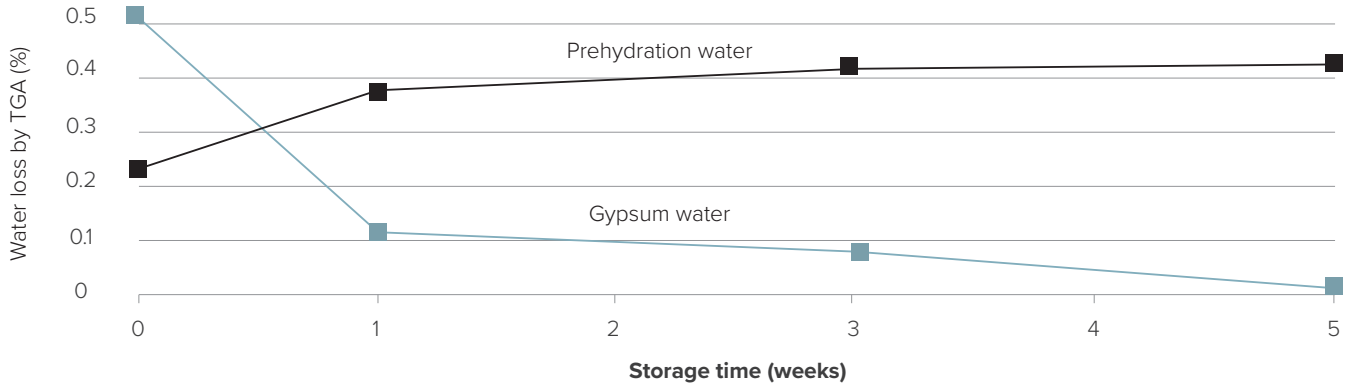


Figure 2. Already after one week of storage at 90ºC, gypsum is seriously dehydrated and cement is highly prehydrated.

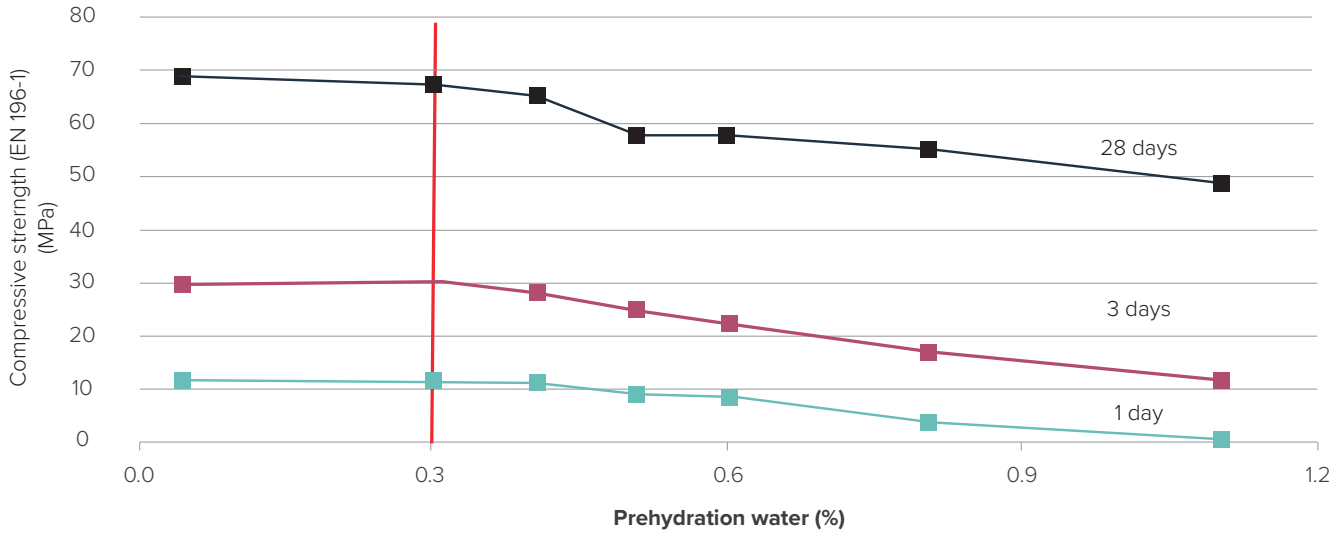


Figure 3. The impact of prehydration on the compressive strength: above approximately 0.3%, a decrease of strength is observed.

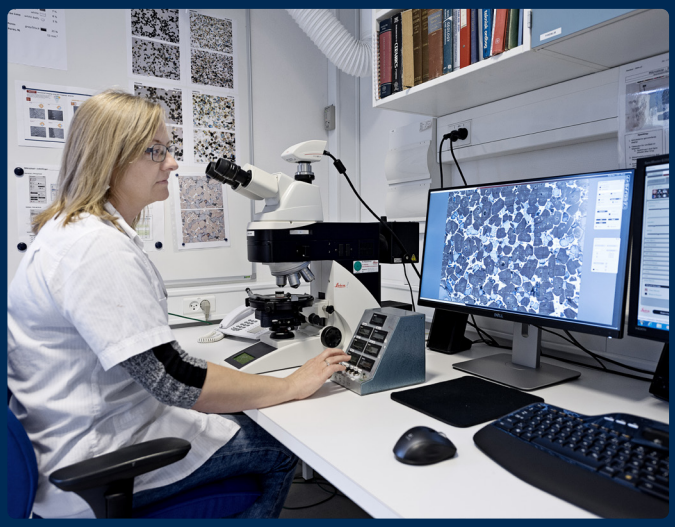
WANT TO ENSURE SILO-SAFE CEMENT?

Grinding parameters are plant-specific and dependent on materials, grinding process and silo conditions. To help you achieve silo-safe cement, we gather information about all aspects of your specific cement grinding system, including operating data, physical and chemical properties of materials and plant layout.

Based on these data, we perform a detailed analysis to identify the causes of any potential problems and the solutions to remedy them.

With this in mind, our Silo-safe Cement Service follows a consistent, proven process to ensure the optimal outcome for your operations.

01 Dialogue and scope definition	We create a specific scope for each unique cement plant and its particular challenges with silo storage. We gather information through an initial dialogue and collect data on the grinding process, storage conditions and materials proprieties
02 Materials evaluation	Samples are sent to the FLSmidth Cement laboratory for chemical and physical tests of: A) Raw materials (limestone, gypsum, SCMs, clinker) B) Materials after grinding C) Cement from silo
03 Final analysis and recommendations	We prepare a final report including: A) A complete lab analysis (chemical and physical properties) of the materials/cement before and after grinding B) Cement quality (strength, setting time, normal consistency) C) Recommendation of the best settings for the mill operations (temperature, water injection) This will help you avoid silo issues (lumps and blockages) and produce high-quality cement.



FLSmidth Cement Dania

Research and Development Center

Dania is one of the world's most advanced laboratories for the analysis of raw materials and cement. It is well-equipped with pilot scale tests and laboratory to support and advise you on the optimum way of operating mills and grinding materials.

Want to know more about our Silo-safe Cement Service?

FLSMIDTH CEMENT

www.flsmidth-cement.com

C 05-18 300-33-ENG