AustStab Technical Note

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Quicklime and Hydrated Lime in Stabilisation

1 Introduction

The purpose of this technical note is to provide guidance on binder selection, when considering hydrated lime or quicklime. It provides guidance about handling, storage, personal protective equipment and the chemical reactions for both products.

This technical note also provides discussion on the advantages of hydrated lime and quicklime.

Notes regarding testing and performance are outside the scope of this technical note.

Quicklime and hydrated lime are both suitable for stabilisation. In the majority of cases AustStab would recommend quicklime.

Quicklime is

- Normally considerably more cost effective
- Less likely to be affected by wind
- Requires fewer trucking movements
- Better at drying out wet materials

2 Safety

Both products require similar, simple safety precautions to be taken during application to minimise risk. Quicklime should not be ruled out as an option due to the incorrect perception that it is much more dangerous to handle in stabilisation applications compared to hydrated lime.

- When water is added to quicklime, hydrated lime is produced and some steam is generated (exothermic reaction).
- Quicklime and hydrated lime are strongly alkaline (pH >12).
- The process of spreading hydrated lime can create more dust due to lower bulk density and finer particle size. This is more evident in windy conditions. The dust issue can be reduced by using quicklime.

PPE when using quicklime or hydrated lime in stabilisation

- Dustproof goggles
- Impervious gloves
- Long pants and long sleeved shirts

First Aid Should lime come in contact with the skin or eyes the preferred treatment is flushing with Diphoterine® otherwise use plenty of water.

3 Chemical Reaction

All stabilisation objectives can be achieved using either product.

- Limestone is heated (calcined) to produce quicklime
- Quicklime reacts with water (slaking) to produce hydrated lime.
- Hydrated lime reacts with the silicates and aluminates in the clays to produce a permanent cementitious materials at pH 12.4

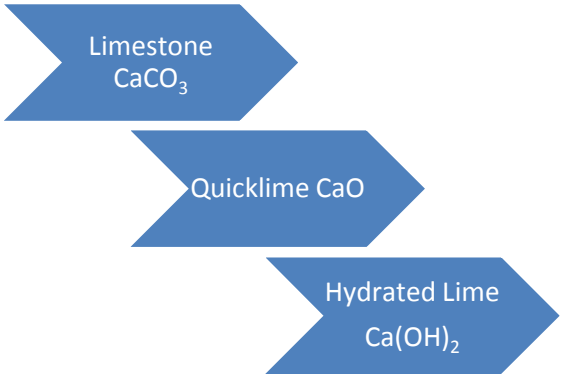

Figure 1 The Lime Cycle

Figure 2 - Slaking of Quicklime in the field

4 Advantages of Quicklime

- Quicklime per tonne costs significantly less than hydrated lime per tonne.
- Approximately 30% less quicklime (by mass) compared to hydrated lime is used to achieve the same stabilisation outcome therefore cost reduced further using quicklime.
- The bulk density of hydrated lime (typically 500 – 700kg/m^3) is much lower than bulk density of quicklime (typically 1000 - 1200kg/m^3). Therefore, more hydrated lime by volume and mass is required to achieve the same outcome.
- Site silos will hold much (approx. double) more quicklime by mass. Similarly, a delivery tanker can carry more (by mass) quicklime than hydrated lime, unless it is a high capacity vessel.
- Fewer truck movements are required if using quicklime.
- There is often less production and storage capacity for hydrated lime so it is often difficult, and sometimes impossible to supply larger projects. Quicklime is more readily available in large quantities.
- If Quicklime is spread from flocon or similar, less dust is likely to be generated compared to the amount of dust generated when spreading hydrated lime under similar conditions.
- Quicklime's higher density means less air born particles are generated in the spreading operation compared to the lower density hydrated lime in similar conditions.
- Quicklime dries out materials, as it uses the soil moisture as part of the reaction. The exothermic reaction can cause evaporation of excess water.

Image 1 - Quicklime

5 Advantages of Hydrated Lime

- Hydrated lime is the only lime that can be used in an enclosed mixing process.
- Water is added to quicklime so that slaking occurs. The exothermic reaction generates some steam for a short period of time. In almost every case this should not be an issue. There may be a possibility, albeit unlikely, that traffic is delayed for a short period if steam affects visibility.
- Less water is required if using hydrated lime. If water availability is limited, hydrated lime may be preferred.
- If poor quality water (e.g. mine process water high in sulphates) is used for slaking the efficiency of the slaking reaction may be reduced and side reactions can reduce the amount of lime that will be available for stabilisation reactions. This is rarely an issue. Generally, potable or suitable water is available for slaking requirements.

Image 2 - Hydrated Lime

6 Conclusion

Quicklime when reacted with water produces hydrated lime. Both quicklime and hydrated lime ultimately produce the same chemical and pozzolanic reaction with the clay content of soils.

Product selection should be based on a triple bottom line basis, of economic, social and environmental benefits and should be considered case by case.

Diphoterine is distributed in Australia by Amare Saftey, www.amare.com.au or www.diphoterine.com

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