

HIGHLIGHTS

A new market for ACTI-Mag™ : Banana Washing

Sydney Water adopts ACTI-Mag™ SP60 Spray Coating

Interesting trial results for Calix at a NSW Council



Phil Hodgson accepting the Australian Technologies Competition "Water Division" Award on behalf of the Calix Team - September 2014.

EDITORIAL

Welcome to issue number 14 of the Calix Newsletter.



Phil Hodgson
CEO

In our last newsletter, we announced our progression to the second and final round of the European Union Horizons 2020 grant process, where Calix's Low Emissions Intensity Lime And Cement "LEILAC" technology is vying for 18m Euro in grant funding to build our first pilot plant to capture CO₂ from lime and cement manufacture.

I am pleased to advise that our submission was made on September 23rd, and included in our project consortium were industry leaders such as Heidelberg Cement, Cemex, LafargeTarmac and Lhoist, along with numerous research institutes from Europe and Australia. We remain hopeful of a positive grant outcome in late February / early March 2015.

Our business in Australia and the Philippines has continued to expand, based upon our magnesium hydroxide liquid (MHL) dosing and spraying technologies into sewer, waste water, agricultural and industrial applications. In this edition of our Newsletter, you will read about our successful MHL banana washing trials in the Philippines and a new contract award from Sydney Water for our sprayed MHL to protect sewage infrastructure. We are also nearing completion of our first inter-state MHL production facility in Queensland.

Our MHL business was also recently recognised with the "Water Technology" Award at the Australian Technology Competition. Being one of 6 award winners from a field of over 200 entries is a testament to our great product and technology and the team who deliver it.

We have also continued to develop our core IP, with 3 patent applications progressing to PCT status, and a fourth patent application on magnesium metal production with CO₂ capture being submitted in November.

As we approach the end of the calendar year, on behalf of the staff and Board of Calix I would like to wish our shareholders and stakeholders a safe and enjoyable Christmas and New Year. We look forward to continuing our momentum in 2015 to build a great business at Calix.

RECENT MILESTONES

A NEW MARKET FOR ACTI-MAG™ – BANANA WASHING.

In 2013, the Philippines exported over \$900 million in bananas worldwide. All bananas for the export market must meet strict standards which includes washing prior to shipping. Currently the large growers use large recirculating systems while smaller growers use manual hand washing.

When the bananas are harvested, they secrete a latex type product from the stem, which can mark and discolor the banana during transport. The current practice is to add both flocculent and coagulant in the wash basin at the beginning of the day and run the system on a closed circuit. One of the big issue is the large amount of sludge created daily in the sedimentation tank.

Calix had the idea of adding ACTI-Mag™ WTN60 to reduce the sludge. After trialling several different addition methods, we hit upon a dosing technique that resulted in a significant reduction of the sludge - a considerable cost saving for our customers.



WASTE WATER

SYDNEY WATER ADOPTS ACTI-MAG SP60 SPRAY COATING – CALIX'S REVOLUTIONARY CORROSION PROTECTION FOR SEWER ASSETS USING MAGNESIUM HYDROXIDE.

Sydney Water Corporation has recently awarded Calix a 3 (three) year contract for the supply of materials for protective coatings for concrete sewer pipes.

What is the unique selling point of this technology, how does it compare against competitors. What makes it better?

1st It is about the raw material ($MgCO_3$) we use to make ACTI-Mag™ SP60.

Calix has developed a novel process for the production of MgO particles from Magnesium Carbonate ($MgCO_3$).

During calcination, the particles pop like popcorn as the CO_2 is released converting to MgO. In doing so the MgO particles achieve a porous structure thus a very high surface area (in the range of 250-300 m^2/gm , compared to the conventional 25-75 m^2/gm from competitive manufacturing processes). Under a microscope these porous particle looks like many nano particles attached together.

2 ... which then leads to the biocidal characteristics of ACTI-Mag™ SP60.

When applied on sewer walls, ACTI-Mag™ SP60 Magnesium Hydroxide is thought to inhibit bacterial growth not only due to high pH, but also due to the inherent biocidal characteristics. Calix's ACTI-Mag™ SP60, having VHSA MgO, should inhibit bacterial growth for a much longer time period compared to the existing Magnesium Hydroxide Liquid's technologies, due to its superior biocidal properties.

3 High surface area and low viscosity, for enhanced reactivity.

Because Calix's ACTI-Mag™ SP60 is hydrated from Calix reactive magnesium oxide, it imparts excellent neutralisation speed due to the high surface area. Unlike other alkali choices, ACTI-Mag™ SP60 contains slowly dissolving $Mg(OH)_2$ particles. These particles have high surface pH and high surface area, but the slurry has relatively low viscosity (100 - 200 cP). This not only gives Calix the ability to tailor flow properties when changes occur in the magnesium carbonate ore, but also significantly enhances the reactivity of our Magnesium Hydroxide Spray Coating.

4 The other key benefit of ACTI-Mag™ SP60 is the narrow particle size distribution.

The presence of oversize particles is a common cause of blockages in spraying systems. This control of particle size is managed with the pre-grinding and flash calcination of the material which is significantly different from the wet bulk grinding method currently used in other existing Magnesium Hydroxide Liquid's technologies.

Last but not least: COSTS

It's not only less expensive, but it provides many more benefits.



^ v Manhole before and after spraying of ACTI-Mag™ SP60.



An economic evaluation comparing different rehabilitation method confirms Magnesium Hydroxide Spray Coating to be the lowest life cycle cost option for managing Sydney Waters' large Avoid Fail sewers.

There are not really many options for pipe protection:

- epoxy coating is very expensive and tends to break down.
- re-furbishing the pipes with concrete is also very expensive.
- re-lining with plastic is currently the most widely-used method.

However ... Spraying MHS every one to three years is estimated to be* 2 to 7 times more cost effective than re-lining with plastic for sewer sizes greater than 1200 mm diameter.

The numerous projects conducted over more than ten (10) years have conclusively demonstrated that the Magnesium Hydroxide Spray Coating technology can be used as an effective alternative trenchless technology method for the protection of concrete sewer assets from corrosion.

To get a copy of our technical brochure on ACTI-Mag™ SP60, contact us.

R&D UPDATE

INTERESTING TRIAL RESULTS AND FINDINGS AT GOSFORD CITY COUNCIL.

The first phase of a trial involving the use of Calix MHS on two sewer lines in a NSW council has confirmed the efficacy of MHS for controlling the formation of H₂S and thus odour and corrosion management. The data in the table below illustrates a 65% reduction in the average H₂S reading from 12ppm to 4ppm and a 90% reduction in total time in a 24hr period where H₂S is above 15ppm, an excellent result.

Target Issue	Key Indicator	FeCl ₃ Baseline Data		Mg(OH) ₂ Optimised treatment data		Mg(OH) ₂ Same-cost-basis data	
		Av.	> 15 ppm (hrs/Day)	Av.	> 15 ppm (hrs/Day)	Av.	> 15 ppm (hrs/Day)
Odour & Corrosion	H ₂ S	12	4.75	4	0.5	11.3	3

One question that arose from this result is the issue of chemical cost on a like-for-like performance basis. This question was challenging to answer as the addition rate of FeCl₂ to the system was already limited by the lower pH limit. (FeCl₂ addition lowers the pH in the system which impacts the downstream waste water treatment plant. Thus we were unable to increase the FeCl₂ dose to determine if the H₂S could be satisfactorily controlled in this system via the use of FeCl₂. An experiment

was designed in which the addition rate of MHS was restricted based upon the same \$/day spend on chemicals as that at the FeCl₂ addition rate limit. The result was fascinating. The MHS achieved a marginally lower average H₂S result (11.3 v 12.1ppm) but an almost 50% reduction in total time in a 24hr period where H₂S is above 15ppm. **This result proved MHS was superior to FeCl₂, on a like-for-like cost basis.**

Calix is now conducting a follow-up trial on another sewer line in the network to further explore the potential for MHS to replace FeCl in the system.



INTRODUCING

RALPH LLOYD-SMITH, BUSINESS DEVELOPMENT MANAGER, QLD

Ralph joined Calix in September 2014 as a Business Development manager. He has over 30 years of experience in the application of chemicals & industrial gases in Water & Wastewater treatment and other process industries.

He came to Calix following almost 25 years at BOC where he worked across a range of Business Development & Account management roles working with a diverse range of customers spanning municipal & industrial water, minerals processing, aquaculture, pulp & paper, food, chemicals, energy, process and allied industries. The common theme across this period was Ralph's ongoing involvement in & passion for water applications with a particular emphasis on working with customers to co-develop both gas & chemical based solutions. Prior to joining BOC Ralph worked with Melbourne Water for 5 years, undertaking a number of roles across both Water & Wastewater treatment. During this period he authored a chapter on Natural Ventilation of Sewers as part of the Melbourne Water's contribution to the Australian H₂S Control Manual.

Ralph graduated in Chemical Engineering from Monash University in 1980 before starting his career in the Pulp & Paper Industry at Australian Paper (then Aust Paper Manufacturers) Maryvale Mill. In his spare time Ralph enjoys riding his bike in Brisbane & surrounding hills or when on holiday in his favourite location: the Sunshine Coast hinterland. He and wife Erica like to enjoy time with their family of 4 kids when they can all get together.

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