

Clear Solutions

No. 2 / 2004

www.earthsystems.com.au

Welcome to **Clear Solutions**. This biannual newsletter produced by Earth Systems explores up-to-date water treatment issues, solutions and technologies. We encourage you to contact us with feed back on its contents and make suggestions for future issues.

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About Earth Systems

Earth Systems is an environmental research and consulting group that has developed and implemented water management strategies for over 10 years. We provide:

- ❑ Specialist water quality advice;
- ❑ Monitoring, data assessment and management;
- ❑ Integrated water treatment systems;
- ❑ Equipment service and maintenance;
- ❑ Contract treatment.

Earth Systems has developed innovative treatment technologies that can be packaged into a range of integrated water treatment systems suitable for use by industry, water authorities, mine sites and other remote locations. Our team includes more than twenty professional staff and associates.

Earth Systems has worked in more than 15 countries and offers consulting and management services in the water, wastewater, mining, solid waste, environmental data and environmental research fields world wide.

Contact us for our latest catalogue of water treatment equipment, or for assistance with your water quality issues.

Nutrient Pollution: Preventing Algal Blooms

Introduction

One of the great challenges facing water managers worldwide, particularly in industrialised countries, is the problem of nutrient pollution and algal blooms. The two key nutrients of concern are phosphorous, in the form of ortho-phosphate (PO_4^{3-}), and nitrogen, in the form of nitrates (NO_3^-). Unnaturally high concentrations and quantities of these compounds are discharged to waterways and oceans as point source emissions from sewage treatment plants. Urban runoff and excessive fertiliser use in modern agriculture is also responsible for broad-scale, diffuse discharge of nutrients into lakes and rivers by overland flow and groundwater discharge.



Algae affected water body

Nutrient pollution is an expensive and difficult problem for water managers because it can result in nuisance growth of potentially toxic algal blooms that can increase maintenance costs, ruin infrastructure and damage or destroy local ecosystems by consuming available oxygen reserves and blocking out light.

In freshwater systems, excess phosphorous is the main concern, as this is the key limiting nutrient in algal growth. In seawater environments however, the key nuisance nutrient is nitrogen, as nitrate concentrations generally limit the growth of algae in our oceans.

Nutrient Release from Bottom Sediments

In freshwater settings, phosphorous can occur as soluble ortho-phosphate compounds in the water column and as a variety of solid compounds (eg. ferric phosphate) stored in the sediments at the base of rivers and lakes. Recent research has demonstrated that some algal blooms are related to the seasonal release of stored phosphorous from lake or river sediments. This work has highlighted the need for remedial strategies to include measures for lowering soluble phosphorous concentrations and also to block its release from sediment storages.

Two reactive barrier systems for simultaneously lowering soluble phosphorous concentrations and preventing its release from organic-rich sediments have been developed recently (see inset page 3). These are Phoslock and AlgalBLOCK.



Earth Systems joins QUADREM

Earth Systems range of specialist water treatment equipment and water quality consulting services are now also available through the QUADREM e-marketplace. With the increasing use of this web-based purchasing tool throughout the Mining Sector this will enable Earth Systems to provide equipment and services to existing and new Clients who have moved across to this innovative procurement system.

For those companies currently using this web-based procurement system Earth Systems OrgID is Q114860. We are also registered as a supplier on QUADREM'S electronic sourcing tool – QUEST.

You can now tackle that water quality issue and keep the purchasing / accounts department happy at the same time.

For further details contact:

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Want more information?

For more on the available options to manage and treat Nutrient pollution issues contact Earth Systems

WaterQuality@earthsystems.com.au

Phoslock Dosing

Recognising the impact of algal blooms on inland waterways across the world, CSIRO (the Commonwealth Scientific and Industrial Research Organisation) developed a specialised chemical reagent for fixing phosphorous and largely removing it from biological cycles. This reagent is called Phoslock, a bentonite-based clay compound that has been doped with a rare earth element as the active ingredient. Phoslock forms stable compounds with the soluble phosphorous in the water column and soluble phosphorous released from sediments. IMT Holdings Limited, the public company established to commercialise



Pond being treated using a floating Neutra-Mill

Phoslock recently completed its first commercial application of Phoslock at a sewage treatment lagoon in Queanbeyan, New South Wales.

IMT engaged Earth Systems to provide specialised dosing equipment and expertise to design and undertake the dosing program at Queanbeyan. Over a 4 day period 14 tonnes of



(above) The Neutra-Mill in action



Hydro Slurry spraying over water– the system is capable of distributing a plume up to 20 metres from shore



Shore based dispensing with Hydro Slurry System



Dry powdered reagent being vacuum fed from a small stockpile

Phoslock was dispensed into a 5.4 hectare polishing lagoon. Dosing was conducted to permit the uniform deposition of an approximately 1 mm thick blanket of Phoslock across the base of the lagoon. Equipment used included Earth System's patented water-based Neutra-Mill mixing and dosing system (above), and a shore-based hydro-slurry mixing and dispensing system (left).

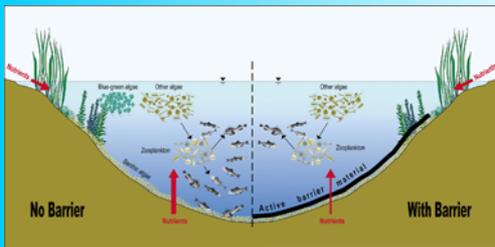
The dosing program was successful, and the installed barrier is expected to prevent algal blooms for a period of at least 2 years and possibly up to 5. IMT has asked Earth Systems to assist them with the dispensing of Phoslock.

How do Barrier Technologies Work?

Reactive barrier technologies work by fixing nutrients as they are released from sediments at the base of water bodies.

Traditional treatment methods for controlling nutrients target soluble nutrients within the water column and do little to prevent future release of sediment bound phosphorous.

Reactive barriers overcome this significant shortfall in traditional nutrient control by providing sustained protection against the seasonal release of phosphorous from basal sediments.



Barrier Technology Explained

Barrier technologies can lead to improved water quality and reduce management costs by providing prolonged nutrient control without the need for on going treatment.

Want more information?

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WaterQuality@earthsystems.com.au

Development of AlgalBLOCK

While CSIRO and IMT were testing and developing their reagent, a joint German - Australian research alliance, funded by the federal governments of both countries, was also working on the remediation of nutrient pollution. The Water Studies Centre at Monash University in Melbourne, Australia (led by Prof. Barry Hart) and the Research Centre Karlsruhe, Karlsruhe Germany, worked on ways of improving the ability of natural compounds such as limestone (calcium carbonate) to bind phosphorous. Researchers were able to identify some artificially crystallised calcium carbonate products that were highly successful in binding soluble and sediment hosted phosphorous (publications can be supplied on request- see page 4). Artificially crystallised calcium carbonate is referred to as precipitated calcium carbonate. The ability to use a natural, environmentally benign compound for effective nutrient control was a major breakthrough.



Collecting sediment cores for laboratory trials

Earth Systems was invited to become an industry partner in the research due to extensive dosing experience, patented dosing equipment and product commercialisation expertise.

While a commercially produced precipitated calcium carbonate was identified as an ideal product for phosphorous control, it was far too expensive to be useful for large-scale nutrient control. Earth Systems has spent almost 2 years searching the world for a more cost-effective but technically suitable variety of precipitated calcium carbonate.



Laboratory testing of nutrient release from sediment cores

Following extensive testwork, an excellent material was found. Not only is this precipitated calcium carbonate relatively inexpensive, but it has the capacity to remove 5 grams of phosphorous for every 100 grams of calcium carbonate. Full-scale field demonstrations for this material, known as AlgalBLOCK, are planned for late 2004 to early 2005.

AlgalBLOCK, an environmentally benign, essentially natural material is expected to complement the use of Phoslock in the management of algal blooms.

Apart from nuisance weed reduction, ecosystem restoration and public safety applications, Earth Systems is seeking to use AlgalBLOCK as a benign material for isolating and removing phosphorous from sewage plant effluent streams. Earth Systems is examining the possibilities of dosing AlgalBLOCK at treatment plants in a manner that permits the residual phosphorous-rich calcic compounds to be reused as feedstock material for fertiliser manufacture, or possibly applied directly to farmland as a fertiliser and pH supplement.



Next Issue

- In Focus: Salinity
- Rapid Response Treatment Systems
- ARD related Salinity
- The Water Map of Melbourne

For more information on upcoming features contact Earth Systems.

Upcoming Events

- 7-9 February 2005, **USDA/ CSREES National Water Quality Conference— Research, Extension and Education for Clean Water**, San Diego, USA. For more information, visit their website www.soil.ncsu.edu/swetc/waterconf/main.waterconferenc.htm#back or contact them at www.usawaterquality.org/feedback.html
- 8-11 March 2005, **WATER CHINA 2005** 6th International Water, Wastewater & Water Treatment trade show. Guangzhou (PR China). For more information visit <http://www.merebo.com/EN/Exhibitions/exhibitions.html>
- 5-12 May 2005, **Ozwater Watershed— The turning point for water**, Brisbane (5– 7 May) & Townsville (8– 12 May), Australia. Contact www.awaozwater.net/watershed/2
- 18–21 September 2005, IWA Conference **Nutrient Management in Wastewater and Recycle Streams**. Krakow, Poland. For more information email: adamk@lemtech.krakow.pl or visit <http://www.bnr2005.krakow.pl>

Useful Web Links

- General info on nutrient pollution issues www.esa.org/science/Issues/FileEnglish/issue7.pdf
- Phoslock Trials— Canning River WA www.wrc.wa.gov.au/srt/publications/pdf/RiverScience17C.pdf
- Murray-Darling Basin Commission Algal Management Strategy www.mdbc.gov.au/naturalresources/algae/algae_manage.htm

Want to find out more ?

Please tick as appropriate and Fax back to Earth Systems:

- | | |
|---|--|
| <input type="checkbox"/> Send me information on Phoslock | <input type="checkbox"/> Send me information on AlgalBLOCK |
| <input type="checkbox"/> Send me information on Nutrient Control Dosing Systems | <input type="checkbox"/> Send me information on Contract Treatment Capabilities |
| <input type="checkbox"/> Send me copies of published articles on development of reactive barrier technologies (pdf version) | <input type="checkbox"/> Send me the current Earth Systems Water Treatment Equipment Catalogue |

Comments / Suggestions:

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