Clear Solutions

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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.

In This Issue

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.

In Focus: Passive Water Treatment

What are Passive Water Treatment Systems?

Passive water treatment systems are low cost, low maintenance engineered technologies designed for the treatment of a range of water quality issues. They are termed passive principally because they do not require routine reagent addition, require minimal intervention and make use of a range of naturally available components. Their low cost and low maintenance requirements make them ideal for long term water treatment tasks (eg. 10's years).

Wetland System.

There are a wide variety of designs used for pH and turbidity control as well as for the control of a wide range of inorganic (eg. metals, phosphates and nitrogen-based compounds) and organic contaminants. Passive treatment systems are currently being used to treat municipal wastewater, acid rock drainage, agricultural wastewater, industrial waste water, municipal wastewater, landfill leachate and stormwater.

Types of Systems

There is a range of passive system designs currently in use or proposed. The most common include constructed reed beds, anaerobic / aerobic wetlands, oxic / anoxic limestone drains and alkalinity producing systems. In the case of wetlands these can act as natural filtration systems (ie. for reducing suspended solids), and assist in oxidising (breaking down organic compounds) and adding alkalinity to influent waters. Systems using limestone, such as limestone drains and some of the alkalinity producing systems, are used for pH correction and lowering dissolved metal concentrations (eg. Al). Promoting oxidation in these system can also lead to the removal of BOD as well as additional metals (eg. Fe, Mn), as carbonate, oxyhydroxide and oxide precipitates.

Factors Controlling Performance

Open Limestone Drain showing a build up of iron precipitates (brown) coating limestone fragments.

There are a number of factors that control the success of passive treatment in dealing with any particular influent water. Of prime importance is the chemistry of the influent waters. For example, when using limestone-based systems (eg. limestone drains) for pH / metal control of acid waters (eg. acid mine drainage), Total Acid Loads of 150kg $CaCO_3$/day are generally an upper limit. Above these

Passive Treatment Systems

- Anoxic / Oxic limestone drains
- Settling basins
- Sedimentation ponds
- Limestone diversion wells
- Reed beds
- Aerobic / Anaerobic wetlands
- Vertical flow wetlands
- Bio-retention ponds
- Alkalinity producing systems
- Alkalinity producing covers
- Permeable reactive barriers
- Gas Redox Displacement Systems (GaRDs)
- Slag leach beds
- Pyrolusite limestone beds
- Microbial reactor systems (MRS)

Want more information?

For a more detailed review of both Active and Passive Treatment Systems contact Earth Systems for a copy of:

Treating ARD—How, When, Where and Why?
Mining and Environmental Management, May 2003.

water.treat@earthsystems.com.au

values most passive systems are likely to be ineffective in controlling pH and dissolved metal contents, or will fail due to clogging of the system with treatment precipitates (eg. Fe-, Al-hydroxides, gypsum) soon after commissioning.

Other critical factors are in the design parameters of the system. Appropriate scaling of the system is required to handle flow rates, sediment load and required retention (settling / oxidation) times. The selection of appropriate plant species within wetlands to accommodate metal uptake and adsorption is also of importance.

Continued monitoring of the systems is also required to maintain the appropriate, flow / permeability, nutrient, reduction/oxidation and alkalinity levels within each individual system.

Conclusions

Passive systems have in important role to play in the cost efficient remediation of contaminated water from a variety of sources. They have proven useful in the control of suspended sentiments and the treatment of wastewater. If the limitations of each system design is understood, and they are scaled, designed and implemented correctly, passive systems can be useful in a variety of remediation projects, including urban run off, stormwater management, industrial effluent and minesite discharges, including acid drainage.

For more information contact john.wisniewski@earthsystems.com.au

Equipment Solutions

Mixing & Dosing Units – Portable multipurpose treatment solutions

Portable mixing and dosing units offer a cost effective alternative to fixed water treatment plants. Their innovative design allows the treatment to take place directly at, or even in the affected water body (i.e. *insitu treatment)*. This combined with their portability means you can take your treatment plant to the water, not your water to your treatment plant, reducing costs associated with pumping and piping and enabling a single plant to treat water at one or more sites. This makes them ideal for water treatment in remote locations.

These dosing units are based on the patented Neutra-Mill mixing technology and can be scaled and optioned appropriately for the task at hand. No two sites have exactly the same requirements, so systems based around these mixing and dosing units are often designed specifically for each individual site. They can be configured as self contained automated systems, which provide portability and ease of use, or can be integrated into existing treatment plants for pre- or supplemental treatment. Systems can be configured to mix and dose a reagent slurry directly into fixed reactor tanks, pipelines, open channels or static water bodies (eg. dams / lakes).

Discount Offer on World Environment Map

Earth Systems' Environment Maps combine multi-disciplinary data onto a single resource that provides a 'snapshot' of the state of a regions' environment. The World Environment Map (2002) presents key global environmental data, trends and statistics on 50 charts and 400 spatial information points.

Also available:

- Environment Map of Australia (2000)
- The Australian Water Map (2003)

Prices start at AU$41.50 (For postage within Australia incl. GST, p&h) or US$40.00 (for postage outside Australia incl. P & H) for a map. Laminated copies available.

Mention this newsletter for a 15% discount on published prices.

To view and order maps visit
www.earthsystems.com.au/map

Below left: Pit lake prior to treatment
Below right: Pit lake after treatment

Systems are comprised of a stainless steel mixing tank, which can either be skid mounted or trailer-mounted to enable easy mobilisation / demobilisation. Water is pumped into the mixing tank by an on-board pump and mixed with reagent to form a suspension, or solution, which is then dispensed into the water body requiring treatment. As the treatment takes place *insitu*, (ie. within the water body), the need to pass the entire waterbody through the dosing unit is avoided, resulting in faster and more cost-effective treatment. The basic systems can dose up to 3 tonne/hour of dry powdered reagent as a reactive slurry, making it suitable for a range of applications normally handled by much larger fixed plants.

With a footprint of around 2m^2 and weighing less than 500kg the basic dosing units are easy to handle and require only a small area of level ground. Systems can be powered to suit individual site requirements and require as little as 0.7kW to operate. All the motors, pumps and fittings are provided so that the dosing unit can commence operating shortly after it arrives on site. Dosing units can be loaded manually or configured with a range of reagent storage and delivery systems capable of feeding a range of dry powdered chemicals suitable for a wide variety of treatment tasks including pH control, acid neutralisation, disinfection, nutrient control, BOD reduction and lowering dissolved metal concentrations.

All of this adds up to a low cost flexible dosing system capable of handling a range of treatment tasks across single or multiple remote or accessible sites.

For more information contact water.treat@earthsystems.com.au

Treatment Solutions

Treating acid drainage for re-use as process water — NSW, Australia

In late 2002 Marlborough Resources NL, the operator of a mine in New South Wales, Australia, decided to trial treat historical acid drainage stored on site for re-use in their mineral processing circuit. Suitable on site water was limited due to an extended period of drought and purchasing water was an expensive option. A low cost method of treating the acid water was required.

Treatment of acid water ponded on site was conducted by Earth Systems using 25 weight % calcium hydroxide slurry. In total, 50,000 litres of calcium hydroxide slurry was dispensed into a 3.5ML dam, raising the pH from 2.06 to 8.8. Dosing was conducted over a period of three days without the need for specialist equipment or disruption to minesite operations. Analysis of the water following treatment indicated that it had a range of significantly reduced metal concentrations (eg. Mn, Fe, Zn, Cu) and was of sufficient quality for its intended use in the mineral processing circuit.

The trial treatment demonstrated that historical acid drainage could be cost effectively recycled for process water, and potentially a range of other on site uses.

Acid Drainage Workshops

At the recent 6th International Conference on Acid Rock Drainage organised by the AusIMM and ACMER, and sponsored by The International Network for Acid Prevention (INAP), Earth Systems was selected to conduct a short course on Treating Acid Drainage. Earth Systems now offers short courses on a range of Acid Drainage Management and Treatment topics that can be presented on site to minimise the disruption to operations and maximise technology transfer.

For more information on the range of topics Earth Systems, in conjunction with Dobos & Associates, can tailor for your site personnel and water quality issues please contact john.waters@earthsystems.com.au

Next Issue

- **In Focus: Salinity**
- **Rapid Response Systems**
- **Treatment Solutions**

For more information on upcoming features contact Earth Systems.

Upcoming Events

- 26 – 29 January 2004, Wastewater Treatment for Nutrient Removal and Reuse, Bangkok, Thailand. Organisers: Telephone: +662 524-5644; Fax: +662 524-5644 E-mail: ajit@ait.ac.th For more information, visit http://www.serd.ait.ac.th/twinning.
- 28th March – 1st April 2004, Enviro 04, Water: Planning for the Future. Sydney, NSW, Australia. Organisers: Quitz Pty Ltd, Telephone +61 2 9410 1302, Fax +61 2 9410 0036. For more information, visit http://www.enviroaust.net/e4/default.html
- 20 – 24th April 2004, Expomin 2004, Centro de Eventos Espacio Riesco Av. El Salto 5.000, Huechuraba, Santiago, Chile. For more information, visit http:// www.expomin.cl
- 20 – 24 September 2004, 4th IWA International World Water Congress, Marrakech, Morocco. Organisers: International Water Association (IWA). Tel: +44 20 7654 5500, Fax: +44 20 7654 5555 E-mail: water@iwahq.org.uk. For more information visit http:// www.iawq.org.uk

Useful Web Solutions

- The International Network for Acid Prevention: http://www.inap.com.au/inap/homepage.nsf
- Environment Institute of Australia and New Zealand: http://www.eia.asn.au/
- Passive Insitu Remediation of Acidic Mine / Industrial Drainage (PIRAMID) http://www.piramid.org/

Want to find out more ?

Please tick as appropriate and Fax back to Earth Systems:

- ☐ Send me information on Passive Treatment Systems
- ☐ Send me information on Land-based dosing units
- ☐ Send me a copy of the MEM published paper *Treating ARD—How, When, Where and Why?*
- ☐ Send me information on Contract Treatment Capabilities
- ☐ Send me the current Earth Systems Water Treatment Equipment Catalogue

Comments / Suggestions:

EARTH SYSTEMS PTY. LTD.

Suite 507
1 Princess Street
KEW, Victoria, 3101
AUSTRALIA

Phone: +61-3-9205 9515
Fax: +61-3-9205 9519
water.treat@earthsystems.com.au
www.earthsystems.com.au

Name _____

Position _____

Organisation _____

Address _____

_____

Phone Contact _____

Email _____

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