

Clear Solutions

No. 1/2003

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

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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;
- Integrated water treatment systems;
- Equipment service and maintenance;
- Contract treatment; and
- Equipment lease.

Earth Systems has developed innovative treatment technologies that can be packaged into a range of integrated water treatment systems suitable for use at industrial facilities, 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.

water.treat@earthsystems.com.au

In Focus: Turbidity made clear

What is turbidity and how is it measured ?

Turbidity is caused mainly by the presence of clays, silts, colloidal solids and microscopic organisms suspended in water. Increased turbidity can result from high rainfall, flooding, bushfires, deforestation, landslides, excessive erosion, salinity related die-back and strong winds. Turbidity is commonly measured with a nephelometer, or turbidity meter, which estimates turbidity in Nephelometric Turbidity Units (NTU's) from the proportion of light scattered by particles suspended in the water. As an indication the World Health Organisation (WHO) guidelines suggest drinking water be <5 NTU's and recommends <1 NTU for disinfection.



Turbid water body prior to treatment

Impacts

Turbidity impacts on a range of issues depending on water use. The main impact on drinking water is on the effectiveness of the disinfection process. For other uses impacts include the reduction of aquatic organisms, depletion of dissolved oxygen, damage to piping and pumping infrastructure, the ability to discharge and an overall reduction in the range of water uses.

Treatment

Turbidity can be reduced by dosing with chemical reagents. Reagents available for treating turbidity include aluminium sulphate or alum ($\text{Al}_2(\text{SO}_4)_3 \cdot x\text{H}_2\text{O}$), ferric chloride (FeCl_3), gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), poly-aluminium chloride, long chain acrylamide-based polymers and numerous proprietary reagents. These primarily work by bridging between suspended charged particles, causing them to combine (form *flocs*) and settle from the water due to their increased mass. Reagent selection is partly controlled by water chemistry and type of suspended particles. Mixing and dosing techniques impact on the

reagents effectiveness, with continued excessive mixing damaging *flocs* and reducing reagent effectiveness. The use of some reagents (eg. Alum) may require additional pH correction of the water following treatment for turbidity.



Water body after treatment

Management

To avoid or minimise the risks associated with turbidity events, management strategies need to be implemented both in the catchments and storage reservoirs. Strategies include revegetation, the installation of structures to lower the velocity of water entering reservoirs and traveling along denuded channels, modifications to reduce the impact of wave action on banks and strategically positioning off takes. In particularly problematic situations, floating turbidity barriers may also be useful to contain or isolate the impacts of turbidity events.



Water Quality Monitoring Systems

Earth Systems now offers a range of monitoring systems capable of displaying and logging multiple water quality parameters. These systems use high quality components installed in secure IP66 rated panels.

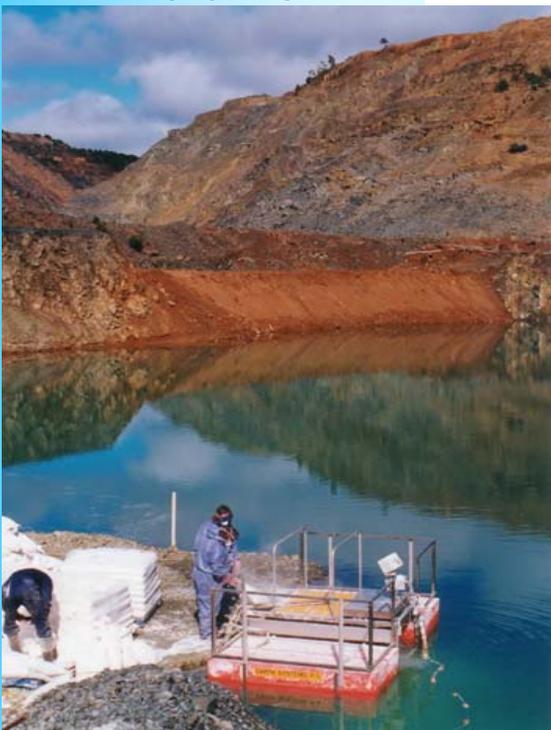
Parameters currently supported include;

- ✓ Temperature
- ✓ pH
- ✓ Conductivity
- ✓ ORP / Redox

Contact Earth Systems for more information

water.treat@earthsystems.com.au

Above Right: Water-based mill lowering the iron content of groundwater pumped from beneath an operating open cut gold mine in Peru. Below: ARD treatment using a water-based mill at a large operating mine site.



Equipment Solutions

Water-based Dosing Units – Portable multipurpose treatment solutions

Whether the issue is pH, elevated metal contents, turbidity, TDS, nutrients or odour, the first reaction by most is to look at the installation of a fixed water treatment plant. In some cases this may be required, but often the size, frequency of the water quality issues and capital costs involved don't warrant the construction of a costly fixed plant.

To address the need for low cost, low maintenance, efficient treatment options, Earth Systems has designed and developed a series of portable water-based



dosing units. These dosing units are based on the patented, Neutra-mill technology, and are capable of dispensing up to 5 tonnes of dry powdered reagent per hour.

How do they work?

The water-based units float on the water body requiring treatment. Reagent is fed into the stainless steel mixing chamber where it is mixed with water and dispensed as a slurry directly into the water body requiring treatment. The rate of dosing can be controlled by the amount of reagent fed into the mixing chamber and the rate of rotation of the chamber. This method of dosing avoids the need to pass the entire water body through the unit resulting in faster and cheaper treatment.

The units can be loaded manually or integrated as part of a larger system configured to receive reagent from a land based hopper via a floating conveyor or auger. The second option is ideal for treatment tasks requiring large volumes of reagent or automated dosing at remote sites.

The water-based dosing units have low power requirements (3 - 5kW) and can be configured to run from generator, grid or solar power.

Applications

Water-based mills can be used to dose a wide range of reagents and therefore can be used for a range of treatment tasks. The most common use of these water-based dosing systems is to dispense lime-based products for pH management and alum (aluminum sulphate) to control turbidity. In addition, they are capable of dispensing reagents to lower TDS, remove toxic metals, control nutrient levels, control odours and assist in the breakdown of cyanide.



Need Help with Water Quality Issues ?

We understand that site personnel are required to take on many different roles and are often expected to provide expert opinions at short notice.

To help in this area, Earth Systems' water quality specialist personnel are available to speak to you regarding any water quality issues you may have.

Contact Dr. Jeff Taylor or Dr. John Waters on
+61 3 9205 9515,
or email: water.treat@earthsystems.com.au

Below: 240ML pit lake being treated with quicklime in the base of an open cut



Benefits

The key benefits of these systems are their low cost and portability. Systems can be towed by 4WD between sites on a custom built trailer. The design of these systems averts the need for costly pumping and piping infrastructure, resulting in rapid set-up times. This makes these systems ideal for rapid response and intermittent dosing tasks. Units are self contained and available with outboard motors making them ideal for use at remote and/or abandoned sites.



Water-based mill used for emergency turbidity control in a drinking water storage reservoir.

Treatment Solutions

Treatment of ARD in large volume pit lakes:

Remote Australian Minesite.

In late 2000 a large mine site in a remote part of Australia required the neutralisation of two pit lakes containing a total capacity of 340ML of acid rock drainage (ARD) as a result of a period of unseasonably high rainfall. Treatment had to be achieved in part of an active open cut mine with no infrastructure or power. The average initial pH of the pit lakes was 2.8 (100ML) and 3.0 (240ML). Treatment of these lakes conducted by Earth Systems was achieved by the addition of 175 and 320 tonnes of quicklime respectively. The larger pit lake was also dosed with an additional 50 tonnes of hydrated lime. Most of

this reagent was added using one of Earth Systems' water-based dosing units. The result was an increase to pH 7.0 over 11 days in the smaller lake and pH 8 in the larger lake over a four week period. The final water quality of the pit lake was uniform throughout, indicating that the water could be used immediately after treatment for dust suppression and vehicle washing.



Treating ARD - how, when, where and why.

The May issue of *Mining and Environmental Management* contains a review article on acid rock drainage (ARD) treatment technologies.

The article "Treating ARD - how, when, where and why", summarises the range of both active and passive treatment systems available, as well the parameters you need to consider when selecting and implementing these technologies.

Next Issue

- In Focus: **Passive Treatment Systems**
- Land-based Dosing Units
- Treatment Solutions

Upcoming Events

- 29 June - 2 July, 2003, 2003 International Water Congress, New York, NY, Watershed Management for Water Supply Systems. For more information, visit <http://www.awra.org/meetings/conferenceindex.html>.
- 14 - 17 July, 2003, 6th International Conference on Acid Rock Drainage (ICARD), Cairns Convention Centre, Cairns, QLD, Australia. For more information contact AUSIMM Tel: +61 3 9662 3166, Fax: +61 3 9662 3662. Or visit <http://www.ausimm.com>.
- 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>
- 15 – 18 December, 2003, International Conference on Water and Environment, Regional Research Laboratory, Bhopal, India. Organisers: Council of Scientific and Industrial Research, Dr. R.N. Yadava, Tel: +91 0755-289343. E-mail: dryadava@yahoo.com. For more information, visit <http://www.rribpl-we2003.com>

Useful Web Solutions

- International Water Association: <http://www.iwahq.org.uk>
- Environmental Events, Conferences & Trade Shows: <http://www.environmental-expert.com/events.htm>
- USGS Mine Drainage Interest Group (MDIG): <http://mine-drainage.usgs.gov/>
- International Mine Water Association: <http://www.geo.tu-freiberg.de/~cwolke/IMWA/IMWAHome.htm>
- Canadian Water and Wastewater Association: <http://www.cwwa.ca/>

Want to find out more ?

Please tick as appropriate and Fax back to Earth Systems:

- Send me information on turbidity control and treatment
- Send me information on Water-based dosing units

- Send me information on Water Monitoring Systems
- Send me information on Contract Treatment Capabilities
- Send me the current Earth Systems Water Treatment Equipment Catalogue

Comments / Suggestions:

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