

Clear Solutions

No. 1/2007

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 provide feed back on its contents and suggestions for future issues.

In This Issue

- In Focus: Water Chemistry
- AcidBLOCK
- Introducing:
Earth Systems Technologies

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.

Earth Systems

Suite 507, 1 Princess Street
Kew, Victoria, 3101
AUSTRALIA
Ph 61-3-9205 9515
Fax 61-3-9205 9519

www.earthsystems.com.au
WaterQuality@earthsystems.com.au

In Focus: Water Chemistry

This is the first in a series of articles that summarize and simplify water chemistry. This article, on water collection and preservation procedures, provides an introduction to some of the less obvious aspects of water chemistry that can greatly influence the reliability of water quality data.



The choice of sample containers for water analyses is dependent on the analyte (eg. element or compound) being measured. In general corrosive, strongly acidic or alkaline samples, and most trace metals are best collected in plastic bottles, typically polyethylene. Biological samples may require the use of specialized sterile plastic bottles. Analysis of organic compounds such as hydrocarbons will require collection in glass, often with specialized end-caps. Depending on the number and type of analytes, several samples in different container types may be required for a single water sample. Samples may need to be completely filled to the top to exclude air, while others may need a volume of air included, especially if the samples are to be frozen (see below). Prior to sampling the volumes required should be checked with the laboratory.

The collection of water may or may not require filtering (< 0.45µm) prior to sampling. This will depend on the purpose of the analysis. Filtering will be required where the contaminants under consideration can be adsorbed onto suspended matter (eg. some organic compounds) or where the concentration of only the dissolved components is required (material passing through a 0.45µm filter is considered soluble).

Where possible, a number of chemical parameters, such as pH, alkalinity, acidity and EC

Parameter	Sample Container	Preservation	Transport and Storage
pH, EC, Alkalinity	Plastic	chill	<24hrs
Al, As, Cd, Ca, Cu, Fe, Pb, Mg, Mn, Zn	Acid washed plastic	Acidify with HNO ₃ (<pH2)	<1 month
BOD	Plastic or glass	Fill to exclude air, chill	in dark, <24hrs
Nitrogen, total kjeldahl (TKN)	Acid washed plastic or glass	Acidify with H ₂ SO ₄ to pH1-2, chill	<24hrs
cyanide	Plastic or glass	Adjust pH to >12 with NaOH, chill	in dark, <24hrs
Total Phosphorous	Plastic or glass	chill freeze	<24hrs <1month
Monocyclic hydrocarbons	Solvent washed glass PTFE lined caps	Acidify with HCl to pH<2, for chlorinated samples add Na ₂ S ₂ O ₃ , chill	< 1 week
Polycyclic hydrocarbons	Solvent washed glass PTFE lined caps	For chlorinated samples add Na ₂ S ₂ O ₃ , chill	in dark, <1 week

Table 1: Summary of sampling procedures for selected elements and compounds. For more detail see references below.

should be measured in the field as these can change between the time of sampling and analysis due to oxidation and/or precipitation process. Re-measurement of these parameters at the time of analysis is also useful to gauge the degree to which the sample may have changed since collection.

Most analytes have a 'shelf life' and can decompose or react with other analytes over time affecting their initial concentrations. As a result, some chemical parameters have specific preservation

(Continued on page 2)



(Continued from page 1)

and transport requirements. The addition of various chemicals (eg. acids) is required to stabilize certain dissolved components such as trace metals (see Table 1). These preservatives are either present in the sample containers prior to filling (eg. in containers provided by commercial labs) or added after the sample is taken. Some samples may also require chilling or freezing, and need to be transported to the laboratory and analysed quickly. Prior to analysis samples should be restored to room temperature and thoroughly mixed.

Blanks and duplicate samples should be submitted for analysis for quality control.

For a more detailed overview of sampling procedures contact Earth Systems or view the following publications: AS/NZS 5667.1: 1998. *Guidance on the design of sampling programs, sampling techniques, and the preservation and handling of samples*, or *A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes*, 7th Edition, EPA Victoria Publication 441.

Want more information?

For more help with understanding your water quality issues contact us on:

(61-3) 9205 9515

Or by email at

WaterQuality@earthsystems.com.au

Roofwater Harvesting

With drought conditions prevailing across Australia and record low levels in water storages there is increasing urgency to find alternative water sources to reduce the current demand on potable water supplies.



The harvesting of roofwater is seen by many as a viable low risk alternative to the use of potable water for such activities as irrigation,

infrastructure wash down, evaporative cooling and toilet flushing. Specialist software has been developed by Earth Systems to calculate the optimum storage capacity for roof water based on daily demand and up to 100 years of area specific daily rainfall data. Coupled with in-house expertise in water quality, Earth Systems can provide low risk options for the use of captured and stored roofwater.

Case Study: Federation Square, Melbourne

Recent work by Earth Systems at Melbourne's Federation Square site has provided an assessment of storm water volumes and water quality generated at the high profile Melbourne CBD site. The potential to recover 4.5ML of rainwater was identified, with this being used as a low risk alternative to potable water for toilet flushing. Using the in-house software, optimum storage requirements based on daily water demand and a number of roof water harvesting scenarios were calculated. Using this data, a water quality risk assessment and an economic assessment, Earth Systems produced a concept design and detailed functional specification for a roof water harvesting and re-use system for Federation Square.

Further Information

For more information contact Jeremy Ham (Jeremy.Ham@earthsystems.com.au) or download an information sheet on Roofwater Harvesting and the Federation Square Case Study from www.earthsystems.com.au/cons_water_efficiency.htm.

STOP PRESS:

Federation Square has been successful in obtaining funds from the **2006 Community Water Grants** to implement the water harvesting project based on the concept and specifications provided by Earth Systems.



AcidBLOCK

AcidBLOCK is a new minimization and control technology under development by Earth Systems Technologies to reduce the acid load discharged from mining waste rock piles.

Existing waste-rock cover systems are designed to minimise the Acid and Metalliferous Drainage (AMD) load discharged from the waste rock pile by lowering water infiltration. AcidBLOCK is a series of new materials being developed for placement within, or on top of, new and existing soil covers that permit the controlled release of alkalinity to near neutral infiltrating waters (eg. rainwater). The aim of this technology is not to treat acid water generated within the waste rock pile but to minimise its production, which in turn reduces or removes the need for ongoing treatment of any seepage. Alkalinity released from the application of AcidBLOCK reacts with acid salts along preferential flow pathways in waste rock piles to create inert, precipitate-coated channels that inhibit further reaction. Acid generation is not being limited, but is probably slowed by the near-neutral conditions, but an overall reduction in the physical interaction between water and acid producing materials can be achieved, producing sustained improvements in seepage water quality.

AcidBLOCK is based on mineral carbonates with enhanced solubility characteristics, and calcium-enriched caustic magnesia (MgO) materials that have been subjected to controlled calcination grades and grain sizes to maximise both solubility and dissolution kinetics. Alkalinity concentrations of up to 500mg/L CaCO₃ equivalent in rain water can be achieved, with a typical saturation pH of 9.0-9.5. It is envisaged that combinations of the above materials can be deployed within existing and new waste rock cover systems to cater for short, medium and long term acid discharges, thereby providing a significant advance in the control of AMD from waste rock piles.

For further information on AcidBLOCK contact Dr. Jeff Taylor at Earth Systems on (+61 3) 9205 9515 or email Jeff.Taylor@earthsystems.com.au

Introducing: Earth Systems Technologies

Since its inception Earth Systems has been dedicated to devising and developing innovative remediation strategies and technologies in order to meet clients' needs and maintain the company's position at the leading edge of environmental best practice and technology innovation. The result of this has been the growth of a significant portfolio of intellectual property (IP) with world-wide applications.

With a vision of being able to 'deliver world-changing environmental technologies for a sustainable future' Earth Systems Technologies (EST) was formed in 2006 and handed the Earth Systems' IP portfolio.

With several very exciting potential products in the pipeline the current focus is on commercialising our lead product, a non-invasive sub-surface barrier, which is currently undergoing final field testing.

To find out more about EST, or our IP pipeline, please contact Mr Russ Wood, Commercial Manager, on 61-3- 9205 9515 or Russ.Wood@esttechnologies.com.au.

For a copy of the publication:

"Alkalinity producing cover materials for providing sustained improvement in water quality from waste rock piles."

Visit the downloads site;

www.earthsystems.com.au/tools.htm

Or email Earth Systems at;

WaterQuality@earthsystems.com.au

Earth Systems Expands Internationally

Earth Systems has expanded Internationally with the opening of new offices in **Sydney, Australia** and **Shanghai, China**.

Both offices draw on local and international expertise and are backed by the resources of the entire Earth Systems group.

Both offices can be contacted directly through their respective web pages or directly via email.

Sydney office:

www.earthsystems.com.au
sydney@earthsystems.com.au

Or

Shanghai office:

www.earthsystems.com.cn
enviro@earthsystems.com.cn



Best Practice Environmental Management in Mining Booklets—Upgrade

The Department of Industry, Tourism and Resources (DITR) is overseeing a revision of the *Best Practice Environmental Management in Mining* booklet series first produced in 1995. Known as the **Leading Practice Sustainable Development Program for the Mining Industry** the new handbook series is available now.

Dr Jeff Taylor and Sophie Pape of Earth Systems co-authored the handbook on Managing Acid and Metalliferous Drainage. The handbook includes an up-to-date review of regulatory framework, risk assessment, minimization, control and treatment, monitoring and performance evaluation and reporting among others.

Visit the DITR website (www.industry.gov.au) or contact Sophie Pape at Earth Systems (Sophie.Pape@earthsystems.com.au) for more information.

Useful Web Solutions

- US EPA page on water related topics <http://www.epa.gov/ebtpages/water.html>
- Environmental chemistry resources Univ. Liverpool <http://www.liv.ac.uk/Chemistry/Links/refenviron.html>
- European Association of Chemistry and the Environment <http://www.perc.plymouth.ac.uk/ace/>

Next Issue

In Focus: Water Chemistry

Barrier Technologies

Treatment Solutions

For more information on upcoming features contact Earth Systems.

Want to find out more ?

Please tick as appropriate and Fax back to Earth Systems:

- | | |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Send me information on Earth Systems Water Quality Management Capabilities | <input type="checkbox"/> Send me the publication on Alkalinity Covers (AcidBLOCK) |
| <input type="checkbox"/> Send me the Managing AMD Handbook | <input type="checkbox"/> Send me the Federation Square Roof Water Harvesting case study / Information on Roofwater Harvesting. |

Comments / Suggestions:



EARTH SYSTEMS
Environment—Water—Sustainability

Suite 507, 1 Princess Street
KEW, Victoria, 3101
AUSTRALIA

Phone: +61-3-9205 9515
Fax: +61-3-9205 9519

WaterQuality@earthsystems.com.au
www.earthsystems.com.au

Name _____

Position _____

Organisation _____

Address _____

Phone Contact _____

Email _____

- Please add me to the mailing list Please remove me from the mailing list