

# GROUNDWATER & ENVIRONMENT NEWSLETTER

A PERIODIC NEWSLETTER COMPILED FOR HYDROGEOLOGICAL & ENVIRONMENTAL PROFESSIONALS IN W.A. MINING & RESOURCE COMPANIES

## MONITORED NATURAL ATTENUATION

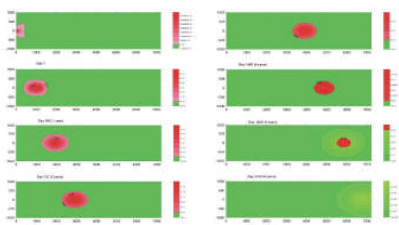
MNA (also "intrinsic or passive" remediation) may be defined as naturally occurring physical/ chemical/ biological process/es that reduce concentration & mass of polluting substances in groundwater (DEC, 2004) and soil. MNA is a process of field monitoring & laboratory analysis to confirm that the remediation is occurring as expected. MNA processes can include:

- Biodegradation (consumption by microbes & conversion into less/ non-harmful substances)
- Physical processes (e.g. adsorption (soil adherence), evaporation etc)
- Chemical processes (e.g. hydrolysis, precipitation, cation exchange, oxidation/ reduction, aerobic/ anaerobic degradation, fermentation/ reductive dechlorination/ dehydrohalogenation)
- Dilution (mixing with unpolluted water)- non-destructive!.

However, MNA must:

- Demonstrate a reduction in mass/ concentration/ toxicity occurs.
- Be sufficiently rapid to prevent impact on receptors & minimise plume expansion
- Achieve remedial goals within one generation, ~30 years.
- Include monitoring over 2-3 years+ that MNA is occurring
- A contingency plan if MNA is not achieving remedial goals.

Typically MNA is part of a remedial strategy which includes removal of the source (e.g. leaking tanks/ PSH on the water table) & may be used with other active strategies (e.g. air sparging/ vacuum extraction/ oxidation agents et al).



### A Four Stage Process (WA DEC):

- 1) Screening Stage (Assess Viability)
  - A soil & groundwater investigation establishing contaminant source, extent/ nature of the plume, aquifer characteristics & groundwater geochemistry
  - Identification of sensitive gw receptors
  - A feasibility assessment of MNA for the identified site characteristics, (e.g. Low to High)
- 2) Demonstration Stage (quantitative demonstration of the rate of MNA)
  - (Primary evidence): historical monitoring data of concentration decreases with time/ distance
  - (Secondary): geochemical mass balance assessment and/or observed data for a shrinking or stable plume.
  - (Tertiary): Laboratory demonstration of degradation processes.
- 3) Assessment Stage (Is MNA an acceptable remedial option?)
  - Identify receptors to be protected, remedial targets to be achieved, & a remedial timescale)
  - Modelling of the MNA process/es & aquifer environment, including predictive scenarios
  - Reporting of the assessment results to DEC
- 4) Implementation
  - Design of a monitoring program (Sampling & Analysis Plan)
  - Monitoring reports submitted to DEC
  - Recommendations whether remedial goals are achieved, or on-going monitoring is required.

Adopted from DoE 2004 (Use of MNA for Gw Remediation)

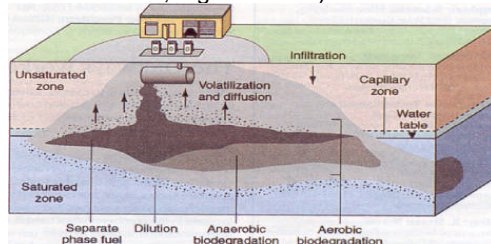
### Advantages & Disadvantages:

Advantages:

- Transformation into innocuous by-products (e.g. CO<sub>2</sub>, ethene, H<sub>2</sub>O)
- Relatively non-intrusive, allowing ongoing use of infrastructure
- Uses natural process/es
- No waste production
- Lower energy use/ emissions

Disadvantages:

- Longer time-frames to remediate
- Longer monitoring periods
- Complex site characterisation
- Affected by environmental changes (e.g. renewed mobility)
- Secondary toxicity (of transformed chemicals, e.g. TCE>VC)



### Typical Applications:

- Hydrocarbon contaminated sites (e.g. service stations/ underground storage tanks/ fuel farms, for TRH, BTEX, PAHs)- Chlorinated hydrocarbons (e.g. solvents)
- Landfill leachate impacts (e.g. NVOCS, NH<sub>4</sub>, Cl, phenols, OCs, PAHs etc)
- Non-point sources (e.g. OCPs)

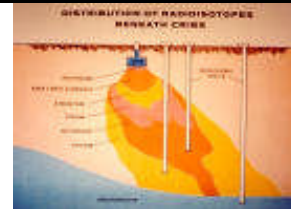
### Useful References:

- [www.claire.co.uk](http://www.claire.co.uk) (SIReN)
- [www.sandia.gov/eeseector/gc/na/mnahome.html](http://www.sandia.gov/eeseector/gc/na/mnahome.html) (US government MNA Toolbox)

### HydroSolutions Pty Ltd

We are a specialist hydrogeological consultancy providing expert services including investigation, potable & process resource development & dewatering. Our environmental capabilities include contaminated site investigation, auditing, remediation & risk assessment - qualitative/ quantitative, health, & ecological.

### Next issue – Numerical Modelling



See in 5d!

Visit us at: [www.HydroSolutions.com.au](http://www.HydroSolutions.com.au)  
Broadband NetMeeting conferencing available for remote sites.

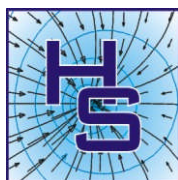
Tel: +61 8 9457 5448

Fax: +61 8 9457 4293

Mob: 0403 021533

[stuart.jeffries@HydroSolutions.com.au](mailto:stuart.jeffries@HydroSolutions.com.au)

[www.HydroSolutions.com.au](http://www.HydroSolutions.com.au)



**HYDROSOLUTIONS** PTY LTD  
Hydrogeological & Environmental Consultants