EASTMAN

SUSTAINABLE GROUNDWATER REMEDIATION OF A FORMER PRODUCTION SITE

RESPONSIBLE CARE® EUROPEAN AWARDS 2010

APPLICATION FORM:

COMPANY NAME: Eastman Chemical B.V.

NUMBER OF EMPLOYEES: 10,000 (worldwide)

ADDRESS:

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PROJECT TITLE:

SUSTAINABLE GROUNDWATER REMEDIATION OF A FORMER PRODUCTION SITE

BRIEF DESCRIPTION OF PROJECT:

In partnership with ARCADIS Belgium (ARCADIS) and SITA Remediation (SITA), Eastman invested in a new novel technology to speed up the remediation process of a formerly owned site through a biodegradation route using a waste by product from the sugar refinery industry.

The site was historically contaminated with chlorinated solvents in the ground water, from a previous owner. With Eastman investment the new bioremediation technology has enabled a sustainable route to remediate the contamination within a significantly shorter timeframe than traditional pump and treat methods. This also resulted in a significant reduction in waste, water and energy. Good stakeholder engagement and relations lead by Eastman with the site owners, regulators and associated businesses ensured that the project was a success.

SUSTAINABLE GROUNDWATER REMEDIATION OF A FORMER PRODUCTION SITE

Eastman Chemical B.V. (Eastman) in partnership with:

ARCADIS Belgium (ARCADIS)

SITA Remediation (SITA)

DESCRIPTION OF COMPANY

Eastman's chemicals, fibers and plastics are used as key ingredients in products that people use every day. Approximately 10,000 Eastman employees around the world blend technical expertise and innovation to deliver practical solutions that help make the world a better place. Eastman is committed to finding sustainable business opportunities within diverse markets we serve. Headquartered in Kingsport, Tennessee, USA. Eastman has thirteen manufacturing sites in eight countries in addition to having sales and representative offices all over the world.

Sustainability at Eastman is creating value through environmental stewardship, social responsibility and economic growth now and for future generations.

PROJECT SUMMARY

INTRODUCTION – WHY WE STARTED THE PROJECT

As part of a stock deal acquisition Eastman acquired the Lokeren site in Belgium in 1999. The site was heavily contaminated with chlorinated solvents (CVOC's) from the previous ownership. Eastman started remediation works using a pump and treat installation. Soon afterwards production was ceased and the site was sold to a new owner. Eastman retained environmental liability.

For the remediation of the groundwater contamination Eastman partnered with ARCADIS and SITA, which resulted in the investment and first pilot case in Holland and Belgium of a new bioremediation technology using a sugar by product waste.

REMEDIATION TREATMENT – WHAT WAS DONE

To remediate the groundwater of the CVOCs, a pump and treat system was installed in 2001. This pump and treat system was successful in decreasing the contamination in the down gradient area, but contamination in the source zone still persisted. It was estimated that the pump and treat system would have to run for more than 30 years for clean up to become effective. In addition, activated carbon, sand filters, a flocculation unit and chemical dosing treatment was used daily as part of the pump and treat system, which added to the cost, time management and waste disposal. Around that time a new technology came into the picture: Enhanced Reductive Dechlorination (ERD). With this technology the natural reductive degradation of the chlorinated molecules are expedited by injection of molasses, a natural waste product from sugar refinery. With this technology, it would be possible to treat the contamination much faster, and avoid active carbon filter waste and unnecessary dosing chemicals. As the molasses are a sugar refinery by product this also presents another use of an otherwise waste product from the food industry. A schematic representation of the dechlorination process and the injection of molasses are shown in figure 1.

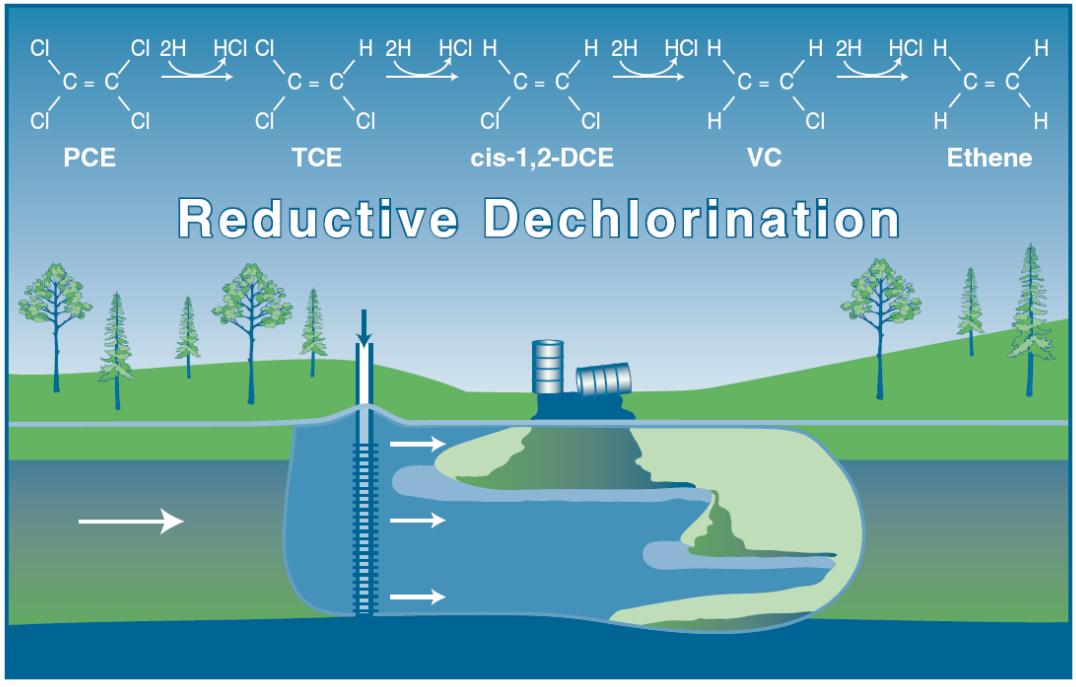


Figure 1. In situ bioremediation of chlorinated ethane: DNAPL source zones, June 2008, ITRC).

In 2008 Eastman invested in the new ERD technology upgrading the existing remediation equipment to trial the injection of molasses over a five year period, with the aim to reduce the remediation time using a bio based methodology. This resulted in the installation of numerous additional wells under the production buildings, see figure 2.

Figure 2 illustrates the extent of the contamination, along with the past and current remediation well systems in place. In the contamination illustration the green line represents the boundary of contamination with the lowest concentration at 10 microgram/liter (this is called the background value). The yellow line is 50 microgram/liter (this is called the soil remediation value) and the red line represents the highest concentration at 1000 microgram/liter.

COMPANY COLLABORATION – OVERCOMING ISSUES

The installation of the full scale system was very challenging. Three new owners/users occupied the building so good collaboration and communication was critical from the start, to ensure the safe installation of the wells and pipes inside the buildings, with the least amount of business interruption.

Despite these difficulties the system was successfully installed because of good cooperation and regular communication between Eastman, ARCADIS (design and remediation oversight), SITA (construction and operation), OVAM (regulatory agency) and the current owners and users of the property. Figure 3 shows some pictures during the installation of the system.

Figure 3. Pictures of the installation

CONTINUAL IMPROVEMENT & STAKEHOLDER ENGAGEMENT

During operation of the system a meeting is organized with all stakeholders every 6 months to present the results of the remediation and to discuss problems. The system is continuously optimised to use less resources and to tackle problems that arise. Some examples:

- Because gas formation in the soil was noticed due to fermentation processes, the injection concentration was lowered and the injection system was adapted so that it could serve as a gas collection system.
- Because the injected molasses spread fast, it was not needed to continuously extract water at the hydraulic barrier. Extraction was lowered to 6 months per year, which resulted in an overall improvement of 92% reduction in water usage versus the conventional pump and treat system over the 5 year remediation life cycle.

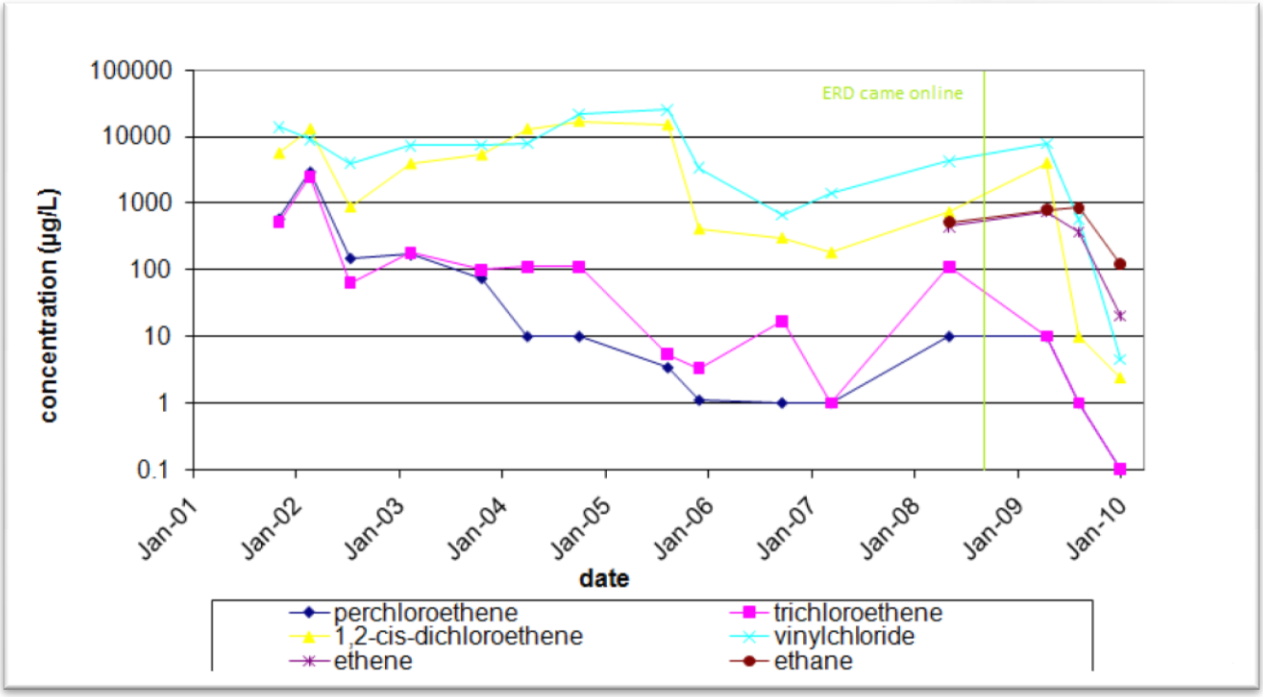
RESULTS

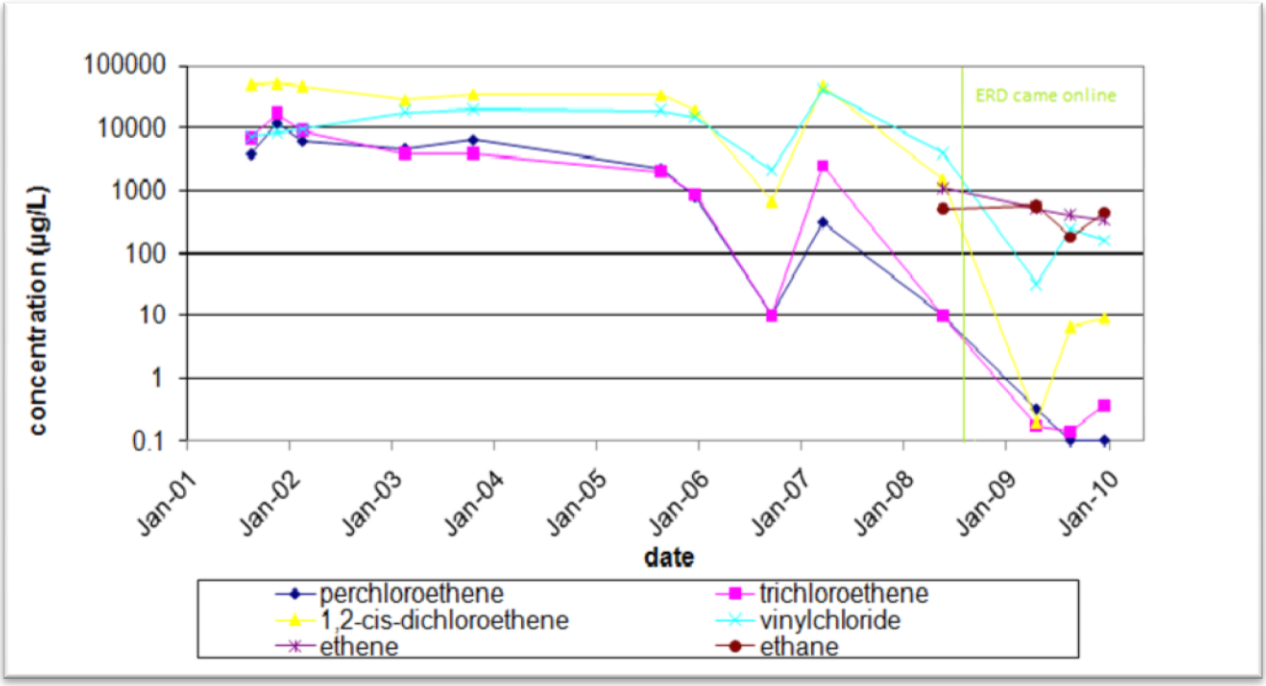
THE REMEDIATION LIFE CYCLE COMPARISONS

The remediation life cycle comparison below shows that the current ERD system is more sustainable than the former pump and treat system as it utilizes significantly less resources.

	Pump and treat		ERD		
	per year	**lifecycle**	**per year**	**lifecycle**	**Reduction (%)**
Duration (years)		30		5	
Water					
pumped (m^3)	21,000	630,000	10,500	52,500	**92**
reinjected (m^3)	0	0	4,500	22,500	
discharge (m^3)	21,000	630,000	6,000	30,000	**95**
Energy					
Electricity (kWh)	7,300	220,000	10,000	51,000	**77**
CO2 (ton)	1.5	44	2	10	**77**
Waste					
Sludge (ton)	3.7	111	1.8	9	**92**
Activated carbon (ton)	2.1	63	1.05	5.25	**92**
Raw materials					
Molasses (ton)	0	0	56	279	

The ERD bio-remediation system has been running since September 2008 and is estimated to run for 5 years, compared to around 30 years for the pump and treat system. Currently, we can already see very good results of the remediation. The graphs below show the fast decline of the contaminant concentrations in the last year, compared to the eight years of using the old pump and treat method. The molasses act as an active feed for biological activity hence speeding up the remediation process.





Graph 1 & 2. Reductive dechlorination chemical concentrations detected in the ground water of two of the sampling wells within the high concentration zone (red line, figure 2), over time.

CONCLUSIONS

- The former ‘traditional’ pump and treat system was retrofitted with a sustainable bioremediation system that will clean up the contamination within 5 years, rather than the usual 30 years using the conventional pump and treat system. The molasses act as a rich biological feed which catalyses the remediation process.
- The project investment overall resulted in significant environmental reductions not only in the life span of clean up but it is proposed that the project will result in a reduction of water usage by 92%, energy reduction by 77% and a 92% reduction on waste.
- Adaptations are made to continuously improve the remediation system, through regular maintenance and stakeholder engagement meetings.
- Extensive cooperation and communication was necessary between the different parties, which was successfully led by Eastman.
- A best practise example of a technology that can be used for other sites contaminated with CVOCs and to retrofit existing non-sustainable remediation systems.