A.S.T.C.
REMEDIATION SRL

A.S. T. C.
Remediation srl

Via Lazzaro Papi, 22
20135 Milano – Italy
C.F. & P. I. 06242290960 REA MI – 1879753
Albo Nazionale Gestori Ambientali: Cat. 9 – MI 30516

 +39/02 54121213  +39/02 5512365

 www.astc.it  astc@astc.it

Ing. Alberto Piepoli  +39/348 73 55 044  albertopiepoli@astc.it

Ing. Guido Piepoli  +39/348 73 55 022  guidopiepoli@astc.it

A.S.T.C. REMEDIATION is a consultancy, based in Milan. A.S.T.C. REMEDIATION complies with every need of companies and industries in the environmental field.

Company's main activities areas are:

- **ENVIRONMENT**
  - ⇒ ISCO – In Situ Chemical Oxidation: reclamation activities through chemical oxidation;
  - ⇒ ISCR – In Situ Chemical Reduction: reclamation activities through chemical reduction;
  - ⇒ waste treatment and disposal plants: planning and projecting, works direction, control;
  - ⇒ reclamation works: feasibility studies, projecting, works direction, control;
  - ⇒ geological, geotechnical, idrogeological surveys;
  - ⇒ land use planning: waste master plans;
  - ⇒ slope stability engineering works;
  - ⇒ environmental impact assessment;
  - ⇒ environmental monitoring systems;
  - ⇒ GIS - Geographical Information Systems: topographical surveying and graphic rendering.
- **SAFETY**
  - ⇒ risk analyses for industrial plants;
  - ⇒ risk assessment for wastes treatment plants;
  - ⇒ safety and hygiene in working places;

⇒ safety plans for building yards;
⇒ Directive Machines: Declaration of Conformity “CE”
⇒ landfill safety: surveys and monitoring for groundwater and biogas migrations

- **TECHNOLOGY**

⇒ studies and research for innovative plants in environmental engineering;
⇒ feasibility assessment and financial plans;
⇒ aid in technical - commercial contacts to national and foreign companies

- **CONSULTING**

⇒ environmental analyses for industries, plants, residential areas;
⇒ renewal of environmental and safety permissions;
⇒ Quality Systems certifications ISO 9000;
⇒ Environmental Management Systems certifications ISO 14000 / EMAS standard;
⇒ software development dedicated to Quality Systems Management;
⇒ training on Quality Systems and Environmental Management Systems;
⇒ database development and software dedicated to monitoring data management.

A.S.T.C. REMEDIATION works with highly qualified staff, which has obtained University Degrees in Environmental Engineering, Geology, Computing Sciences and is specialized in Environmental studies and projects and in the development of Quality Systems, Environmental Management Systems and training courses.

The core competencies developed by A.S.T.C. REMEDIATION in recent years, concern the development of ISCO techniques. This technology found important applications in Italy and has good prospects for development.

The main activities developed in the last two years are the following:

Reclamation project of a Cr^{VI} contaminated site. Application of an in situ chemical reduction technology (ISCR) – Project development and on site application

Reclamation project of a chlorinated solvents contaminated site. Application of an in situ chemical oxidation technology (ISCO) – Project development and on site application

Executive Project of a plant for the recovery of incineration waste – Project development and final approval by the authorities

Executive Project of a plant for the recovery of paving – Environmental impact, site assessment and construction management

Reclamation project of an hydrocarbons contaminated site. Application of an in situ chemical oxidation technology (ISCO) – Project development and on site application

Underground water monitoring plan – Hydrogeological investigation, Project development and management of the monitoring network

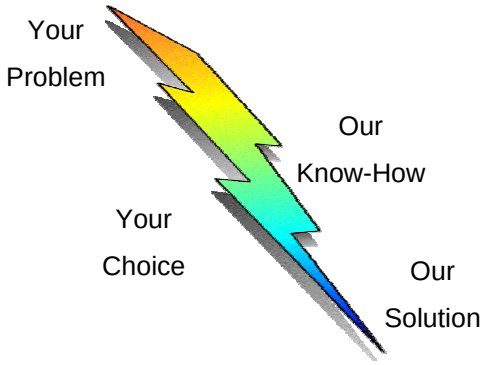
Executive Project for the upgrading of a waste water treatment plant – Project development final approval by the authorities

A.S. T. C.Remediation srl
Via Lazzaro Papi, 22 - 20135 MILANO – Italy
+39 02 54121213 - *+39 5512365*
www.astc.it - astc@astc.it
Albo Nazionale Gestori Ambiental Cat. 9 - MI 30516

Our references are:

A.S. T. C.Remediation srl
Via Lazzaro Papi, 22 - 20135 MILANO – Italy
+39 02 54121213 - *+39 5512365*
www.astc.it - astc@astc.it
Albo Nazionale Gestori Ambiental Cat. 9 - MI 30516

ISCO-Application – How we evaluate and operate



PROBLEM SOLVED

The appliance of chemicals to solve environmental problems is not a new idea.

Since over 100 years oxidants has been added to waters and wastewaters to reduce the contaminants. The further development of this branch of applications has brought to the appliance of chemicals to reduce the contamination in the soil using them on site and in site.

Our technique is based on the injection of a properly developed receipt of chemical compounds, which oxidize the organic contaminants. The treatment is obtained through the delivery of the chemicals in wells.

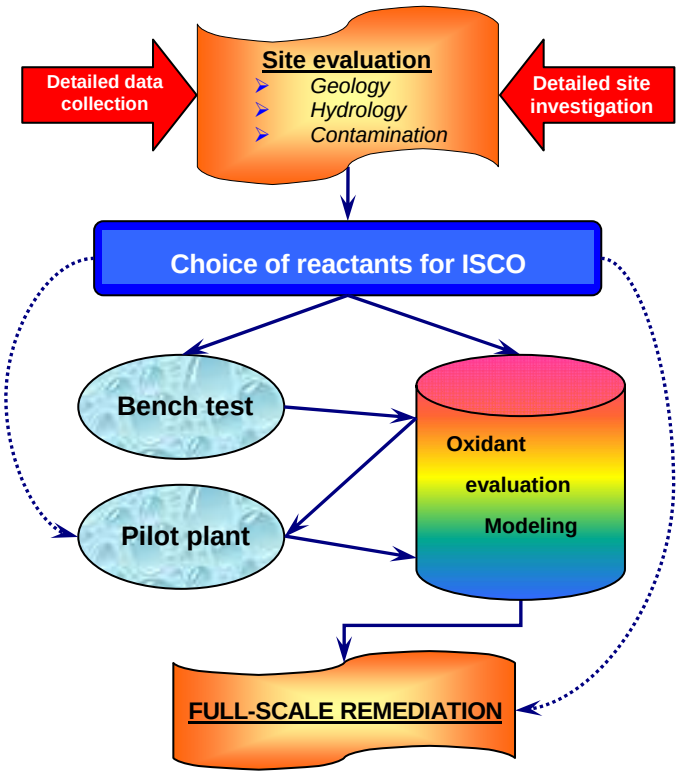
The target is to obtain the desired cleansing rate by reducing significantly the costs, the lasting and the hindrance of the application.

After a first step of characterisation, to determine the concentrations and the position of the contamination, A.S.T.C. REMEDIATION and its team are able to give you a global overview of the different solution to apply.

After your approval, we start the bench tests and in the same time we develop the project and work together with you to find the best solution to present to the Authorities.

Of priority importance is a detailed knowledge of the geology and hydrogeology of the site. Moreover it is also important to determine the concentration and a 3D model of the contamination. This might seem to be only a cost, but to strike the target you need to find and define it.

Field activities are then very short and normally do not create any impediment to the common activities done on site.



A.S. T. C.Remediation srl
Via Lazzaro Papi, 22 - 20135 MILANO – Italy
+39 02 54121213 - *+39 5512365*
www.astc.it - astc@astc.it
Albo Nazionale Gestori Ambiental Cat. 9 - MI 30516

Underground water reclamation polluted by Solvents

1. Site description

The company packets solvents and has a storage tank net into the ground used to feed the packaging lines.

The leakages from same thanks caused an underground pollution by aliphatic solvents (Acetone and Ethilacetat) and in low amount by BTEX (Toluene and Xilene).

The pollutants were spread into the first aquifer at a depth of 2 m with values 50,000 µg/l for Acetone and 700 µg/l for Ethilacetat.

After the preliminary investigations and the start up of hydraulic barrier the polluted area has been detected. The storage tanks located into the ground cut the water table and locally modified the water table flow.

The thanks and the plants into the ground didn't allow a venting remediation system for the soil and the round water, it was necessary too avoid any stop to plant production.

An in situ remediation project has been developed to allow the increase of a natural microbiological activity to depredate the pollutant.

2. ISCO application

The project approved and authorized by the Authorities, is divided in two steps: the preliminary one includes the field test and the final one extended to the entire polluted site.

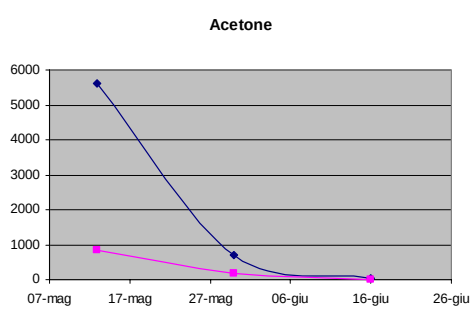
The field test has been developed on a first line of 5 wells located upstream of the underground storage thanks. The values into the monitoring well upstream of the thanks site and those downstream, highlight the efficiency of this method. For this reason the second phase of the project has been authorized. Calcium peroxide (CaO_2) has been used; it's a compound with slow oxygen releasing in this way a constant DO level is warranted and can support the natural microbiological improvement. The process has been checked by a multiparametric probe located into the downstream well.

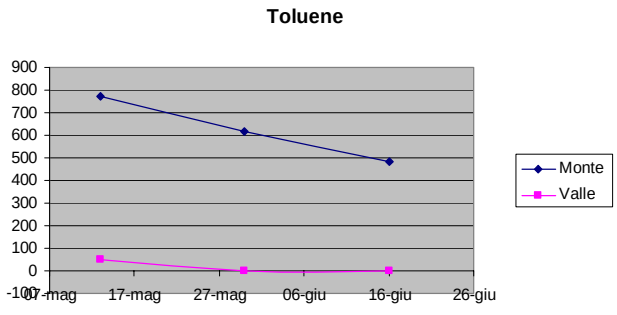
The peroxide not dissolved and in excess remains into the aquifer and starts the slow realizing. This increase was not detected by the probe because the microbiological respiration consumes the oxygen amount released by peroxide.

The CaO_2 doesn't produce byproducts but only oxygen dissolved very slowly in water increasing the natural soil macrobiotics to metabolize the pollutant compounds without any development of free oxygen as gas.

3. Results

The two diagrams below highlight the Acetone and Toluene trend into the upstream and downstream wells after the treatment.





A.S. T. C.Remediation srl
Via Lazzaro Papi, 22 - 20135 MILANO – Italy
+39 02 54121213 - *+39 5512365*
www.astc.it - astc@astc.it
Albo Nazionale Gestori Ambiental Cat. 9 - MI 30516

In site remediation at a printing company of underground water polluted with toluene by oxidation (ISCO)

1. Site description

The industry, a printing company for magazines production, caused the underground pollution due to the leakage of toluene by a pipe partially buried in the soil.

The pollutant for the specific local hydrogeology dropped down deeper in the aquifer affecting a layer 2 meters height. The water pollution has very high concentration with values over 500,000 µg/l.

After the preliminary investigation and the start up of hydraulic barier, the polluted area was detected by MIP (Membrane Interface Probe).

The remediation project is based on two items:

- clean the site,
- avoid any break to the plant production.

For those reasons a in situ remediation project by chemical oxidation (ISCO - In Situ Chemical Oxidation) was developed.

2. ISCO application

The project approved and authorized by the Authorities, is divided in two steps: the preliminary one includes the field test and the final one extended to the entire polluted site.

The field test highlight the efficiency of the methodology selected. The chemicals quantities to inject has been dimensioned by a bench test in our lab and by a mathematical model to take in account the specific geology, geochemistry and hydrology of the polluted area.

The field test was carried on where the toluene pipe leaked. The oxidizers (persulfate and hydrogen peroxide) properly activated were injected with following cycles.

The production in the plant is going on normally without any interruption or change in the dayly program.

3. Results

The underground water was tested before and after the oxidation process. The results are reported in the following table.

	t=0	t= 2 weeks	t= 1 mounth	t= 7 mounts
Toluene [µg/l]	173,000.00	6,500.00	610.00	<0.1

A.S. T. C.Remediation srl
Via Lazzaro Papi, 22 - 20135 MILANO – Italy
+39 02 54121213 - *+39 5512365*
www.astc.it - astc@astc.it
Albo Nazionale Gestori Ambiental Cat. 9 - MI 30516

PAH Pollution – ISCO application

1. Site description

The site is a dismissed industrial area included in the list of the National Priority Sites. Here heavy hydrocarbons were distilled. The pollution has been caused by PAH leakages.

The area is characterized, below the filling layer, by a sand and gravel level with silt lenses till 14 m of depth leaned on a clay layer that bind the first aquifer. The water table is located round 2 – 3 m below ground surface (bgs).

The clay layer stopped the PAH's movement and created a contaminated layer of different thickness. Below the distillation plant this level reaches 1 m of hight. The concentration detected is >8,500 mg/kg.

An hydraulic barrier has been put in place after preliminary investigations to hold the underground diffusion. The on site oxidation approach, had to test:

- the feasibility of the method,
- the efficiency in pollution reduction.

ISCO has been carried on using catalyzed hydrogen peroxide activated persulfate.

2. ISCO Application

The project approved by the Authorities, has been divided in two phases: the preliminary one with lab tests to assess the soil desorption of PAH's from the grains, the second one the pollutant degradation and evaluation of the chemical dosages.

The field test has been carried on in area of the distillation plant where the highest concentration was detected. Inside the monitoring well located in the centre of the injection area a multiparametric probe was installed to record the physical – chemical parameters during the injection.

The ISCO field activities lasted three days for the injection activities. The soil was sampled after 4 weeks.

3. Results

The analytical data listed in the table highlight the feasibility and the efficiency of the methodology applied. The comparison in the photo of the two soil samples before and after the treatment are a clear example.

	S3 after treatment	S3 before treatment	% Reduction	S2 after treatment	S2 before treatment	% Reduction
Acenaftene	413,83	877,92	85	340,92	640,22	47
Acenaftilene	5,42	11,48	82	5,45	10,41	48
Antracene	81,12	153,74	62	65,46	107,63	39
Benzo(a)antracene	63	106,8	74	55,2	98	44
Benzo(a)pirene	47,1	100,4	84	47,8	84	43
Benzo(b)fluorantene	67,4	142,1	84	68,1	118,4	42
Benzo(g,h,i)perilene	20,2	37,4	84	21	33,4	37
Benzo(k)fluorantene	28,7	59,3	84	28	48,9	43
Carbonio Organico	1,85	4,02	86	1,52	2,91	48
Crisene	124,1	278,4	85	117,1	214,9	46

	S3 after treatment	S3 before treatment	% Reduction	S2 after treatment	S2 before treatment	% Reduction
Dibenzo(a,h)antracene	3,9	8,3	84	3,7	7,2	49
Fenantrene	1158,77	2222,93	82	965,78	1851,48	48
Fluorantene	579,26	1266,83	85	478,99	908,55	47
Fluorene	338,98	665,94	82	279,01	528,85	47
Indeno(1,2,3cd)pirene	21,9	50	83	21,55	45,8	53
Naftalene	585,49	753,34	89	543,12	982,57	45
Pirene	478,3	1120	87	435,2	788,5	45
Σ IPA	4019,32	7858,9	84	3477,9	6471,72	46
TOC	1,854	4,020	86	1,516	2,905	48

A.S. T. C.Remediation srl
Via Lazzaro Papi, 22 - 20135 MILANO – Italy
+39 02 54121213 - *+39 5512365*
www.astc.it - astc@astc.it
Albo Nazionale Gestori Ambiental Cat. 9 - MI 30516

A. S. T. C. Remediation srl

Sede operativa: Via Lazzaro Papi, 22 20135 MILANO Italy
Sede legale: Viale Stelvio, 70 20159 MILANO Italy

+39 02 54121213 +39 02 5512365

www.astc.it astc@astc.it