Environment Biotechnology-Remediation
IN SITU BIOTECH-REMEDIATION OF AN AREA CONTAMINATED WITH HYDROCARBONS

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INTRODUCTION

Ex Ravenna Mare gas power station, property of Eni S.p.A., E&P Division, contamination was referable to gasoline, raw petroleum product coming from gas extraction in the Adriatic sea. Characterization began in 1999. The reclamation project, about ten years long, enforced the biosparging approach, in association with SVE (Soil Vapor Extraction), which had partially reduced concentration of pollutants without achieving the reclamation aims. 2007: Assignment in order to re-design the intervention using C.O.R.® Biotech.

First Step: a test performed in A.R.P.A. laboratories in Ravenna and considering the great results, the planning and performance of the reclamation project.

Second Step: one year long reclamation: the concentration of pollutants decreased progressively therefore acheiving the aims, wich consists in threshold polluting concentration in public and residential grounds (according to D.Lgs. 152/06).

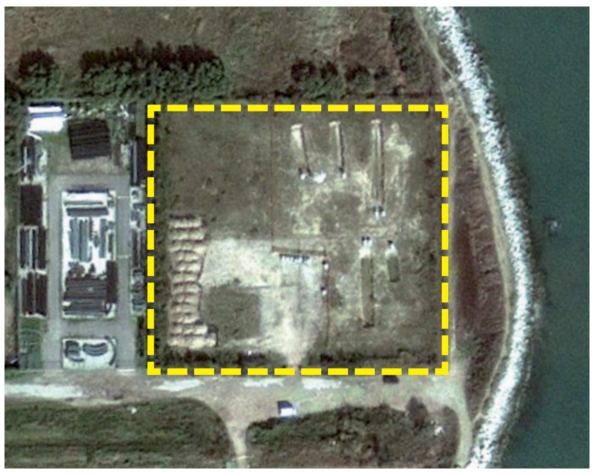
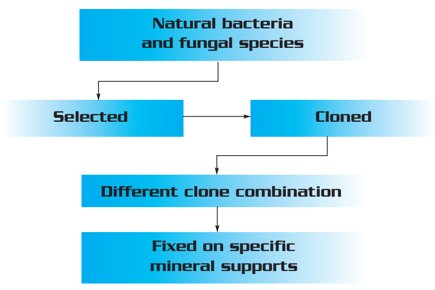


Figure 1*. Aerial view - ex Eni gas power station Ravenna Mare Vecchia.*

TECHNOLOGY AND METHOD

Biotech BSA C.O.R.®

This method uses microorganisms coming from natural optional aerobic or anaerobic strains, bacteria and fungal species, non pathogenic and not genetically modified 1st class (EFB European Federation Biotechnology).



Outcome:

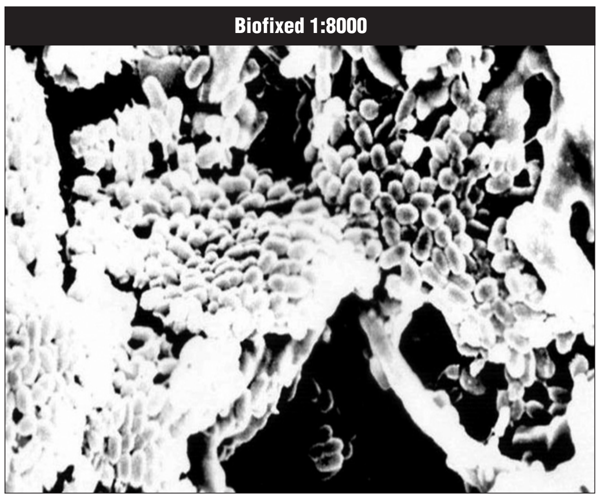


Figure 2*. Bio-fixed constituent C.O.R.®*

SELECTION AND CLONING allows to transfer genetic information to the cells without modifying them.

FIXING ON MINERAL SUPPORTS

The free cavities in crystals are partially filled with water. In this cavities the fixed microorganisms are able to degrade absorbed material.

Sodium, Potassium, Calcium and Magnesium ions present in supports contribute in maintaining crystal lattice balance. Part of these ions will be exchanged with other positive ions from the environment.

This is a sinergy between mineral supports and microorganisms, for a PHYSICAL, CHEMICAL and BIOLOGICAL process.

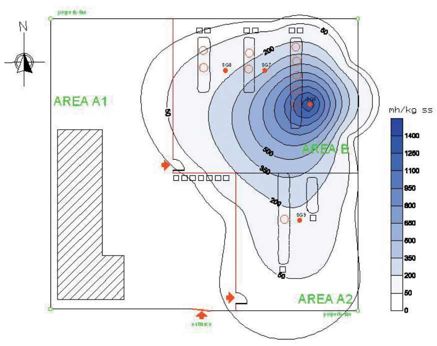


Figure 4*. Plume of contamination in November, 2009.*

Figure 3*. In situ application "sub irrigazione".*

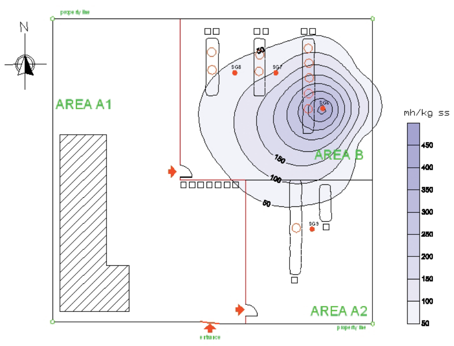


Figure 5*. Plume of contamination in February, 2010.*

Parameter	U.M.	SG6-A	SG6fA	SG6mA	SG6c	SG8-A	SG8f-A	SG8m-A	SG8c	SG9-A	SG9f-A	SG9m-A	SG9c
Height (m)		1,20÷2,40				1,20÷2,40				1,20÷2,40			
		25/11/09	24/02/10	19/05/10	15/09/10	25/11/09	24/02/10	19/05/10	15/09/10	25/11/09	24/02/10	19/05/10	15/09/10
pH	pH	8,5	7,9	8,8	n.a.	8,9	8,4	9,09	n.a.	8,8	8,4	8,54	n.a.
Ammonia nitrogen	mg/Kg	28,86	24,90	24,00	n.a.	19,21	46,2	17,2	n.a.	15,79	22,2	31,3	n.a.
Nitrogen	%	<0,01	0,03	0,02	n.a.	0,53	0,04	0,01	n.a.	<0,01	0,04	0,02	n.a.
Phosphorus	mg/kg	162	241	236	n.a.	264	420	414	n.a.	262	312	565	n.a.
Total Organic Carbon	%	0,19	3,89	0,55	n.a.	0,33	3,54	0,2	n.a.	0,61	3,18	0,66	n.a.
Biochemical Oxygen Demand	mg/Kg	<2	<1	<2	n.a.	<2	<1	<2	n.a.	8	<1	<2	n.a.
Hydrocarbons C<12	mg/kg	0,5	<1	<0,8	<0,9	3,4	<0,9	<1	<1	15	<1	3,5	<1
Hydrocarbons C>12	mg/Kg	1421	438	83	8,2	155	65	<4	3,4	170	<5,3	<4,6	5,94
Bacteria (22°C)	UFC/g	3,20E+05	1,80E+05	2,40E+05	n.a.	4,30E+07	2,80E+05	1,80E+05	n.a.	7,30E+05	2,00E+05	1,5*10^5	n.a.

Figure 7*. Monitoring during construction.*

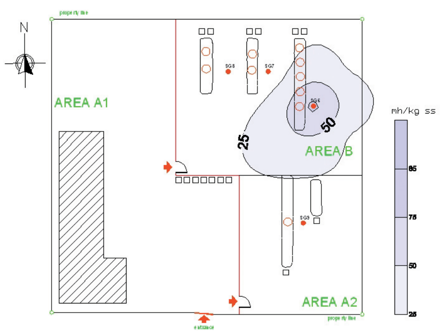


Figure 6*. Plume of contamination in May, 2010.*

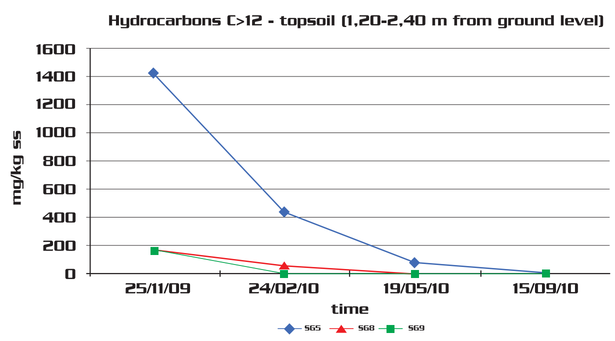


Figure 8*. Hydrocarbons degradation final graph.*

CONCLUSIONS

Some technology enable to reduce pollutants concentration in situ, but a residual contamination still remains and needs to be managed in the future, depending on limits dictated by the law. However, this involves an economic and technical effort and time (three years in the mentioned case). Therefore, the approach with advanced techniques should be used to have a timed solution of the problem in defined time and cost. The C.O.R.® technology, developed by **BSA Ambiente**, enabled to achieve, according to schedule, the aim of the reclamation project. In the D.Lgs.152/06, Titolo V, Parte Quarta, there are indications about the definition of "best technology available" where "best" stands for "the most effective techniques to get a high level of protection of the environment", considering in the decisional process the cost/effectiveness and cost/benefit analysis. In the mentioned case, a technical, economical and methodological benefit can be proved.