Oil spill disasters are a worldwide problem and current technologies do not satisfactorily address the issue. It is important to recognize that “miracle microorganisms” and “magic kites” sprayed on an oil spill will not do the job. An integrated approach considering at the same time: (1) metabolic requirements of biodegrading organisms alongside the properties of the oil, (2) environmental limitations on oil biodegradation and (3) innovative delivery mechanisms for agents that alleviate these bottlenecks is critical. This is the essence of the KillSpill project. It represents a European initiative fully committed to tackle oil spill disasters in an integrated and interdisciplinary fashion employing highly efficient remediation strategies.

OBJECTIVES & PROJECTS:

The principal objective of KillSpill is to develop highly efficient, economically and environmentally viable solutions for the clean-up of oil spills caused by marine transport or offshore oil exploration and related processes, which have been fully validated in large mesocosm facilities under controlled conditions and by application to real life oil spills. In general, once crude oil is spilled, it takes at least one week before biodegradation processes begin to take effect. KillSpill aims to shorten this start up period to the absolute minimum by providing technologies for example, that provide the necessary nutrients together with hydrocarbon degrading consortia and/or enhancing compounds (biosurfactants) to both accelerate and maximum bioremediation rates of the time of application. In addition, when the use of dispersants is recommended, the previously mentioned biostimulation and bioaugmentation formulations will be applied together with specific compounds acting as dispersants that take the oil from the surface to the water column and ultimately to the sea floor.

Taking into account that we go deeper in the water column, the amount of dissolved oxygen is more difficult to replenish by diffusion, KillSpill also offers specific novel technologies (Doxgel® and Aerobeads®) that release oxygen over longer periods of time. It maintains as a result greater bioremediation rates of dispersed oil in the water column, even when it reaches the sediments. In cases where it is not feasible, this approach will be complemented with the development of processes to stimulate the biodegradation of anaerobic in anoxic sediments. Once the dispersed oil reaches the sediments, bioremediation rates are substantially reduced due to the prevailing anoxic conditions. KillSpill provides a series of highly innovative technologies (e.g., “KillSpill snorkel”, “KillSpill Robot”, “KillSpill Sed-Cleaner”) that overcome this problem and induce enhanced biodegradation rates in the sediments. These technologies can also be used for the remediation of recurrently polluted sediments (from oil spills) in all types of environments from the Eastern Mediterranean to Disko Bay in Greenland. In addition, several other innovative products will be developed, e.g., “KillSpill All-in-One”, “KillSpill Deep-sea”, “KillSpill Bio-boom”, besides the “KillSpill Biosensor” for in situ monitoring of oil degradation.

The solutions developing from the KillSpill project are evaluated against current industry standards, and promoted to the European oil spill industry through conferences and seminars. Thus, KillSpill consortium will generate new industrially driven foreground and deliver innovative processes and services to policy makers and European citizens. The KillSpill project has also much to offer to the Marine Strategy Framework Directive (MSFD). For example, all the technologies developed for hydrocarbon polluted sediments can be part of a decision making process to return marined environments to Good Environmental Status (GES).

Furthermore, the monitoring tools can be used by Member States in the requested initial assessment to identify current environmental status. Moreover, many of the KillSpill biostimulation strategies can be applied to sea areas faced with chronic pollution.

---

**The KillSpill Approach to Combat Oil Spills**

<table>
<thead>
<tr>
<th>Primary Goal: Contain &amp; recover oil or disperse oil and initiate biodegradation at high rates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Booms &amp; Slimmers</strong> (contain and recover)</td>
</tr>
<tr>
<td>Novel dispersants (dispersal oil in the water column and initiate biodegradation)</td>
</tr>
<tr>
<td><strong>Innovation</strong></td>
</tr>
<tr>
<td>No action (oil dispersion accomplished by strong winds)</td>
</tr>
<tr>
<td><strong>Novel Bioremediation Agents</strong></td>
</tr>
<tr>
<td><strong>High efficiency integrated approaches employing bioremediation agents</strong></td>
</tr>
<tr>
<td><strong>Innovations</strong> (biodegrading agents, aerobic/anoxic, in situ)</td>
</tr>
<tr>
<td><strong>Immediate clean up of contaminated sediments</strong></td>
</tr>
</tbody>
</table>

**Sediments decontamination & environmental monitoring**

- **Innovation** (Oil biodegradation & thin long exaggeration, under fauna degradation)

---

**The KillSpill Consortium**

**Partner (S) Contact**
- Technical University of Crete (Kalogerakis) 1
- University of Applied Sciences and Arts Northwestern Switzerland (Philippe Corvin) 2

**Country Type**
- Greece RTD
- Switzerland RTD
- Italy RTD
- Italy RTD
- Denmark RTD
- Mexico-Mexico RTD
- Spain RTD
- UK RTD
- Italy RTD
- Italy RTD
- Slovenia RTD
- Belgium RTD
- Czech Republic RTD
- Denmark RTD
- UK RTD
- Germany RTD
- UK SME
- Ireland RTD
- UK SME
- Ireland RTD
- Belgium SME
- Greece SME
- Switzerland SME
- Norway SME
- Slovenia SME
- Italy SME
- UK SME
- Germany SME
- Slovenia SME
- USA SME

---

**Integrated Biotechnological Solutions for Combating Marine Oil Spills**

Nicolas Kalogerakis 1 and Philippe Corvin 2

1. Technical University of Crete, Department of Environmental Engineering, Politecnioiuoioi, Chania 73100, Greece. E-mail: nicolas.kalogerakis@enveng.tuc.gr
2. University of Applied Sciences and Arts Northwestern Switzerland, School of Life Sciences, Institute for Ecopreneurship, Gründenstrasse 40, 4132 Muttenz – Switzerland. Email: Philippe.corvin@fhm.ch

---

**KiliSpill PRODUCTS & TECHNOLOGIES**

**Number Technology Application**
1. **“KillSpill Mimosa”** (bioremediation agents for IC monitoring) On-site monitoring of oil degradation
2. **“KillSpill FISH-Kit”** (Colloidal independent) CARD-FISH diagnostic kit for on-site monitoring of microbial communities
3. **“KillSpill FISH-Kit”** (Colloidal independent diagnostic kit) FISH-TCM diagnostic kit for on-site monitoring of microbial communities
4. **“KillSpill Chip”** (Micromini chip) On-site monitoring of microbial communities
5. **MBOSS** Monitoring of oil degradation
6. **Polymer-based non-woven fabrics** Sorbent material (shoreline and near-shore)
7. **Organic-based powders** Sorbent material, accelerated bioremediation (oxic and anoxic environments)
8. **Oxygen-releasing dispersants (DOPGEL®)** Dispersant, accelerated bioremediation (oxic and anoxic environments)
9. **Phytostimulant (ARBOBEAD®)** Phytostimulant oiling agent, accelerated bioremediation (oxic and anoxic environments)
10. **Plant-based biosurfactant blends (SC1000®)**, **SUPERSOL®**, **EASYSOL®** Emulsification and mobilization of oil, sand washing, accelerated bioremediation
11. **Microbial biosurfactants and emulsifiers** Inorganic and organic solutions of oil, sand washing, accelerated bioremediation
12. **Formulated HC-degrading MOs and consortia** In-situ bioremediation (oxic, anaerobic Further technology development
13. **High pressure reactor** LB-scale testing environment for deep-sea cases
14. **Microodrill reactor** Improvement/solution of degrading MOs
15. **Low-cost biostimulation formulations** Accelerated bioremediation, further technology development
16. **“KillSpill Electro”** (Electrode-based oxygen supply) In-situ sediment cleanup
17. **“KillSpill Snorkel”** (Microbial electrochemical reactor) In-situ sediment cleanup
18. **“KillSpill Robot”** (Bio-electrochemical roaming system) In-situ sediment cleanup
19. **Infusia accelerated degradation** In-situ sediment cleanup
20. **“KillSpill Sed-Cleaner”** (Module system for enhanced bioremediation) In-situ biostimulation and bioaugmentation for sediments
21. **Sequestrating sorbents** Sorbent material for oil sequestration in sediments
22. **“KillSpill Deep-sea”** (Multi-functional bioremediation agents) Enhanced bioremediation of HC/“biodegraded” formed in deep sea oilseas
23. **“KillSpill Aromas®”** (Mesoporous silica (porosity)) Enhanced bioremediation through biostimulation and bioaugmentation
24. **“KillSpill Starchase”** (Starch release microparticules) Enhanced bioremediation through biostimulation and starch release in liquefied biopolymers
25. **“KillSpill A in On”** (Multi-functional carrier) First response measure for enhanced bioremediation and set up of an oil spill、“biodegradation
26. **“KillSpill Mineralsol”** (Multifunctional sorbent material) Mineral binding agent and oil (oxidised to contaminated sediments) and enhanced bioremediation
27. **“KillSpill Bio-carriers”** (Protein bio-carriers) Biocatalysts for remediation of HC degrades and biofilters for seawater sediments
28. **“KillSpill Bio-boms”** (Improved biodegrading booms) Oil barriers (booms) with enhanced sorbent & bioremediation capabilities.

---

This project is supported by the European Commission through the 7th Framework Programme (total EU contribution 8,996,600 €) under Grant Agreement 312139 within FP7–KBBE.2012.3.5-01.