



# NEWSLETTER

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## Land Restoration and Bioremediation of Oil-Soaked Soil at ONGC Gujarat Asset

Oil and Natural Gas Corporation Ltd (ONGC), Assets are engaged in exploration and production (E&P) activities in Gujarat. It produces crude oil from about more than 4000 wells located in different oil fields of Gujarat. The wells are connected to various GGS/CTF through pipelines, known as flow line. Line leakage due to corrosion, rupture, etc., is a very common phenomenon. The leakage causes spillage of oil at leakage points and damages the soil. The spilled oil not only damages the agricultural land, but also causes environmental and safety hazards. Thus, ONGC intends to land restoration and safe disposal of oil-soaked sand through bioremediation to meet its legal, social, safety, and environmental obligations.

Despite the best possible efforts by the upstream petroleum industry and the consumers, the incidents of oil spill through oil pipelines and other related leakages are increasing, thus generating oil-soaked soil. Due to stringent norms by the regulatory authority and corporate responsibility of oil companies to protect the environment, new techniques are continuously in demand in India. However, in developed countries, new technologies are continuously being invented and implemented for treatment of oil spill sites and oily sludge pits. Several technologies, which were considered as emerging a few years back, are now well accepted in the field of hazardous waste treatment.

After 6 years of extensive research, The Energy and Resources Institute (TERI) has developed a microbial consortium known as Oilzapper. Oilzapper is a mixture of four natural occurring bacterial strains which could biodegrade the crude oil present in oily sludge and/or oil-soaked soil. TERI has given patent rights of Oilzapper process to ONGC TERI Biotech Limited and now ONGC TERI Biotech Limited is using Oilzapper microbes for large-scale restoration and bioremediation of oil spills/oil contaminated soil in India and abroad.

Bioremediation is a process that uses naturally occurring microorganisms to transform harmful substances to nontoxic compounds. Bioremediation exploits this natural process by promoting the growth of microbes that can effectively degrade specific contaminants. Thus, Oilzapper technology utilizes the bioremediation potential of specific microbes that degrades the toxic hydrocarbon compounds leaving behind non-hazardous end products or metabolites and hence there are no harmful effects. Not only is this technique environment friendly but also it is highly cost-effective when compared to storage of oily waste/oily sludge in human-made sludge pits. Further, it shows that the bioremediation technique could greatly help in solving oil contamination and wastewater effluent sludge waste management problems of ONGC.



## Oilzapper – As a Biotechnology Intervention for Remediation



Oilzapper is a biotechnological intervention for remediation of oily sludge, oil-contaminated soil, and oil-contaminated drill cuttings. Since oily sludge is a complex molecule, there is no single bacterial strain found to biodegrade all its components. Hence, the approach of selecting specific bacterial strain for biodegradation of specific component of hydrocarbon and making a consortium of selected bacterial strains has given success in the field bioremediation study (Mishra et al., 2004; 2001; 2001a). TERI, New Delhi, under the sponsorship from the Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, initiated a research study to find out a suitable biotechnological solution for the disposal of oily sludge/oil-contaminated soil.

OILZAPPER, a consortium of crude oil/drill cutting/oily sludge degrading bacterial strains derived from various bacterial cultures existing in the natural environment was developed through an extensive research at TERI. At the same time, TERI jointly with Indian Oil Corporation Ltd R&D centre, Faridabad, developed Oilivorous-S and Oilivorous-A for application to the specific quality of oily sludge. Oilivorous-S was found to be effective against the oily sludge with high sulphur content whereas Oilivorous-A was developed specifically for the oily sludge that is highly acidic in nature.

### Advantages of the Oilzapper Technology in Bioremediation

Oilzapper microbes are indigenous, natural occurring efficient microbes which exist in soil and were isolated from different geoclimatic regions of India. The selected microbes are the most adapted to degrade toxic hydrocarbons at local environmental conditions. In the bioremediation process, a specially designed nutrient formulation is used to increase the efficiency of microbes. The microbes can biodegrade at the temperature ranging from 15°C to 60°C and even in high saline soil and up to 1.5 depth of surface. In the process, a consortium of four microbes is used which could degrade alkane, aromatic, NSO (nitrogen, sulphur, oxygen containing compound) and asphaltene fractions of crude oil/oily sludge.

It is an ecologically sound and natural process and sludge degrading bacteria can increase in numbers when an oily sludge (contaminant) is available. When the hydrocarbon pollutants are bioremediated, the microbial population naturally declines. The residues from the biological treatment are usually harmless products (carbon dioxide, water, and fatty acids). This technology is usually less expensive than other technologies that are often used to clean up the hazardous waste. The organisms used in the consortium are not pathogenic and easy to handle.

Although extensive research was conducted bioremediation, most of the existing studies concentrate on either evaluating the feasibility of bioremediation for dealing with oil contamination, or testing favoured products and methods (Mearns et al., 1997). Only limited numbers of pilot-scale and field trials, which may provide the most convincing demonstrations of this technology, are carried out. OTBL has a rich experience on field case studies related to bioremediation of oily waste using the OILZAPPER technology in India. This project aims at *in-situ* bioremediation of oily sludge pits and *ex-situ* bioremediation of farmers land affected due to various line leakages near different oil installations of ONGC Gujarat Assets.



## Objectives of the Project and Scope of Work

- i. To execute the job of cleaning, lifting, transportation, land restoration at line leakage points, and bioremediation of oil-soaked earth/sand at designated pits at ONGC Gujarat Asset.
- ii. The total job shall be divided in the following five major parts:
  - Cleaning and lifting of oil or oily sludge from the spillage area and its transportation to a designated pit or site. If the oil quantity is acceptable to ONGC, then it should be handed over to the Installation Manager of the plant.
  - Excavation of oil-soaked soil.
  - Transportation of oil-soaked soil to nearby bioremediation pits.
  - Refilling of affected area by fresh soil.
  - Bioremediation of oil-soaked sand in designated pits.

## Photographs of Land Restoration

**Site I Before**



**Site I After**



**Site II Before**



**Site II After**



**Site III Before**



**Site III After**



**Site IV Before**



**Site IV After**



**Site V Before**



**Site V After**



**Site VI Before**



**Site VI After**



**Site VII Before**



**Site VII After**



**Photographs of Bioremediation of Restored Oily Soaked Soil**

**Site VIII Befor**



**Site VIII After**



**Site IX Before**



**Site IX After**



**Site X Before**



**Site X After**



**Site XI Before**



**Site XI After**

