



Bioremediation of Open Water Spills

Satya Ganti
President & CEO

Advantages of Bioremediation

- Bioremediation offers a complete solution
 - There is no residue for disposal
 - Bioremediation is also a 24/7 process
 - Bacteria work day and night with no rest!! (☺)
 - Works on-site on-oil



Today's Situation

- Organized agencies like OSRO for cleanup
- Organized transport system
- Portable storage facilities
- Expensive oil recovery and reuse programs
- Technology for clean disposal:
 - **Not available**
- End of chain solution for final disposal
 - **Not in place**



Biodispersion Technology

(US # 6,267,888; CA # 2,338,249)

- Biodispersion
 - Bacteria in the product disperse oil into smaller droplets before consumption
- Solubilization
 - Bacteria transform dispersed droplets into soluble state for cell transport
- Assimilation
 - The solubilized oil is assimilated by the bacterial cell for growth and multiplication
- Mineralization
 - Assimilation and breakdown of oil into CO₂ by bacteria leaving no waste oil for disposal



Products for Open Water Spills

- **SpillRemed (Marine)®**
 - Open water oil spills
 - Shoreline cleanup
 - Remediation of sheen in ports
- **SpillRemed (Industrial)**
 - Contained open water spills
 - Containment ponds
 - Storm water retention ponds
- **VaporRemed®**
 - Cleanup of shoes and clothing of spill cleanup teams
 - Pre-treatment of oiled birds



SpillRemed (Marine)[®]

- SpillRemed (Marine) has been included in the NCP list by US EPA
 - SpillRemed (Marine) can be used in open water oil spills
 - Test protocol
 - Analysis of results
- Licensed by Fish & Wildlife, California for use in open water spills

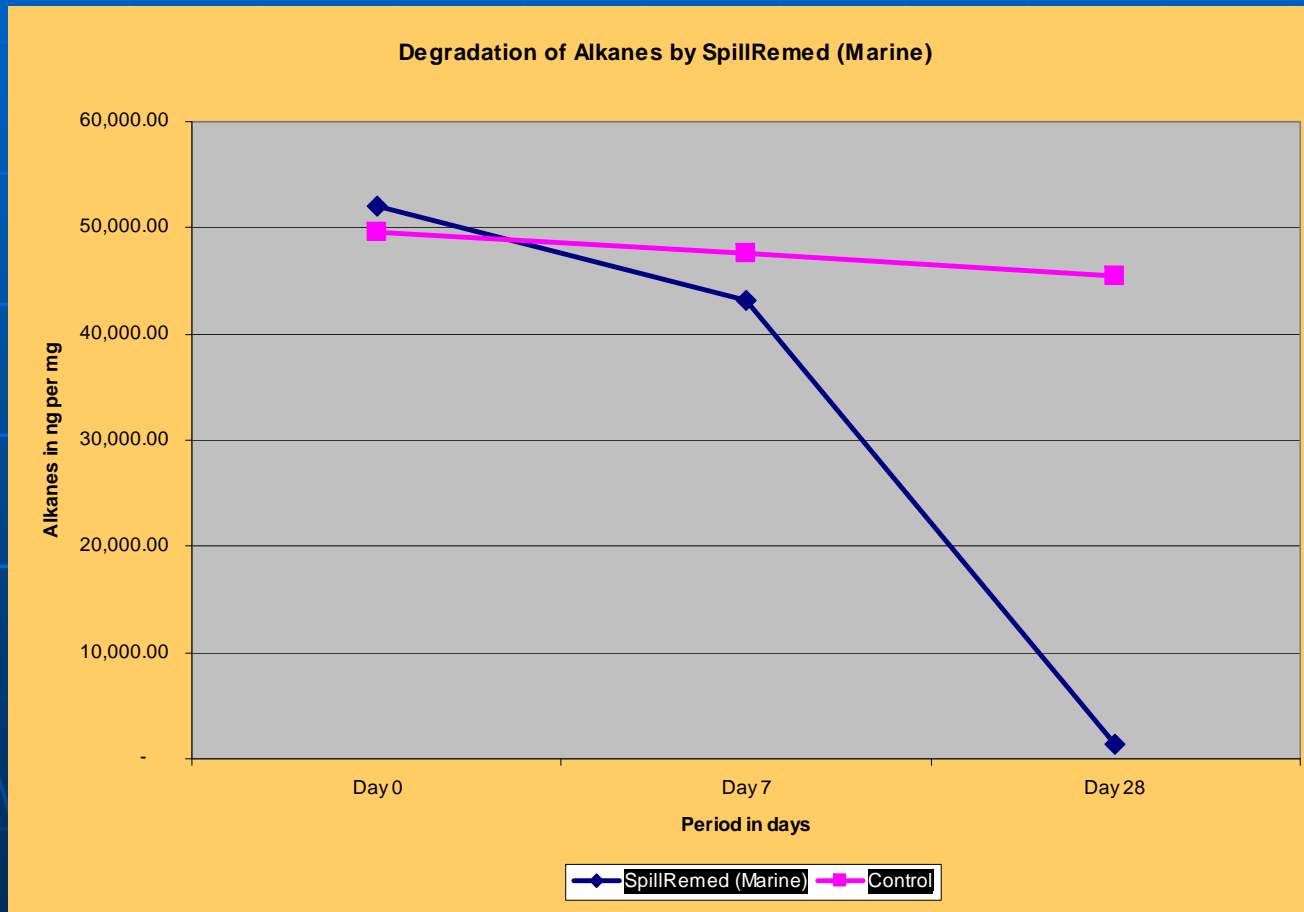


Analysis of the Tests Results per NCP Protocol

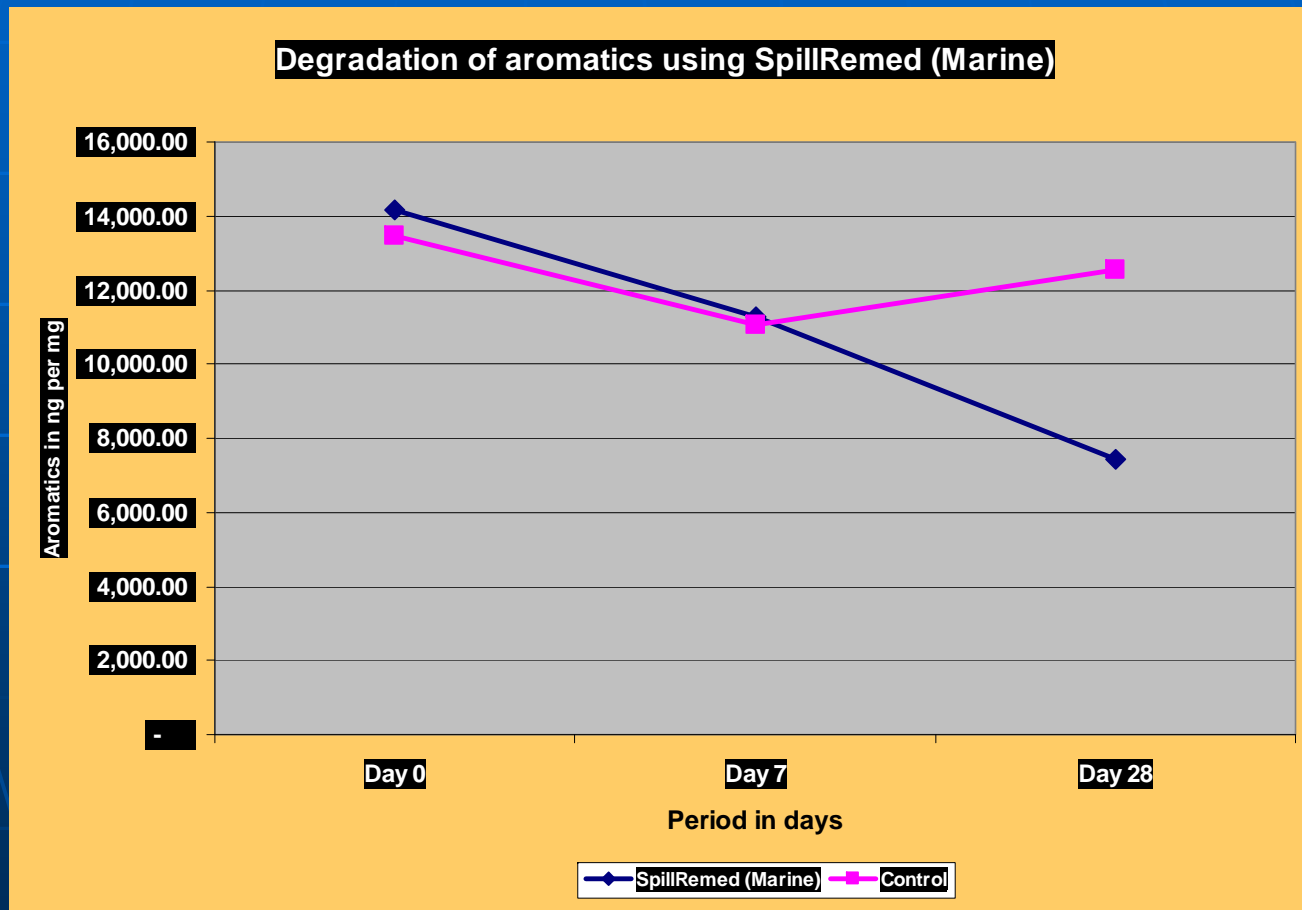
- The test was conducted as per the protocol documented in CFR 40 Part 300.
 - Crude oil was heated to 541° C to remove all low boiling point fractions.
- Data shows 97% reduction of Alkanes and 41% reduction of aromatics at the end of 28 days
- Participation of bacteria in consumption of oil is evident
- Bacteria increased from initial 16000/ml to 341,000,000/ml after 28 days



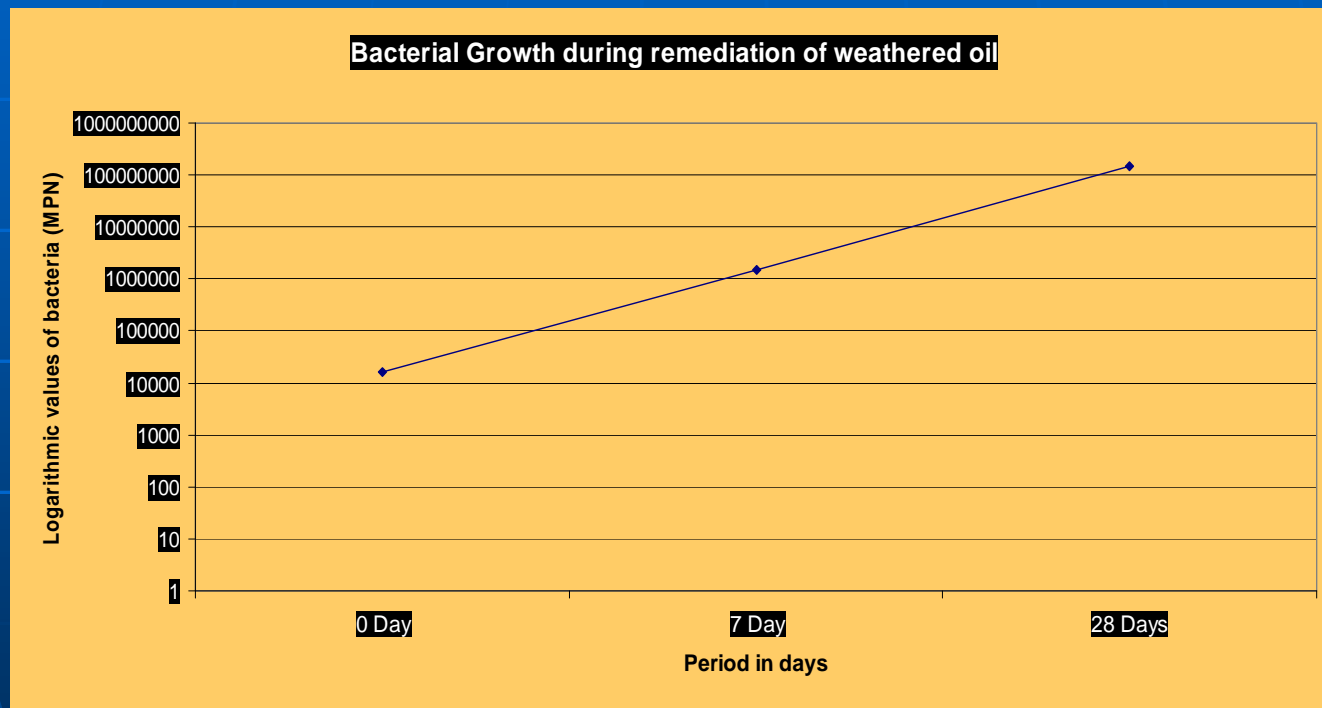
Alkane reduction by SpillRemed (Marine) in 28 days



Reduction of aromatics by SpillRemed (Marine)



Bacterial Growth During Evaluation of SpillRemed (Marine)



SpillRemed (Marine)[®] for Open Water Oil Spills

- SpillRemed (Marine) is effective in treating following oils
 - Weathered oil
 - # 6 Fuel Oil
 - Hydraulic oil
 - Diesel
- It is a consortium of naturally occurring bacteria isolated from Alaskan waters
- **Does not contain Genetically Modified Forms**

Disclaimer: SpillRemed (Marine)[®] is on the US EPA's NCP Product Schedule. This listing does not mean that EPA approves, recommends, licenses, certifies or authorizes the use of SpillRemed (Marine)[®] on an oil discharge. This listing means only that data have been submitted to the US EPA as required by subpart J of the National Contingency Plan 40 CFR Section 300.915



Benefits of SpillRemed (Marine) to Oil Spill Cleanup

- It is available in a ready to use liquid form
- It is sprayed over a spill and is effective over a wide range of hydrocarbons
- Does not leave any waste for disposal
- Once the oil is consumed bacteria die a natural death
- SpillRemed (Marine) is non-toxic to marine life
- It is effective in the ratio of 1:10 of oil



Benefits of SpillRemed (Marine)[®]

- Environment friendly solution
- Non toxic to marine life
- Low cost and low energy solution
- Requires minimum supervision
- No waste for disposal
- Fraction phase solution
 - Works on the oil phase of the solution
 - Strong correlation of bacterial growth to oil degradation
- Restores the ecosystem
 - Use of SpillRemed reduces toxicity of fuels thereby allowing for growth of protozoans, for example (as shown in the photographs below).



Treatment Protocol For SpillRemed (Marine) To An Open Water Spill

- Sprayed immediately after spill
 - Oil consumption begins instantaneously
 - 10% of oil is likely to be reduced before containment
- Sprayed after containment as
 - SpillRemed (Marine) is effective even on weathered oils
 - SpillRemed (Marine) can be introduced during any phase of the cleanup lifecycle
- SpillRemed (Marine) for shoreline cleanup
 - Effective in the ratio of 1 gallon for 20 sq.ft.
- SpillRemed (Marine) has been found to be suitable for cleanup of feathers of oiled birds after spill



SpillRemed (Industrial) for Fresh Water Oil Spills

- SpillRemed (Industrial) is a low salinity product for industrial application
- It is effective in contained open water spills
- Used for cleanup of retention ponds by metal recycling companies
- It has also been used for other industrial applications



Case Study I: Cleanup of a Spill in a Canadian mine

- A diesel spill in contained berm in a Canadian mine in Rocky Mountains
- Oil absorbent boom absorbed water and sank, releasing the oil
- SpillRemed was the only available solution
- SpillRemed was added
 - At near freezing temperatures the spill was cleaned up after 6 weeks
 - Water discharged in the waste water stream
- One time addition
- No maintenance and no waste for disposal



Cleanup of spill in a berm

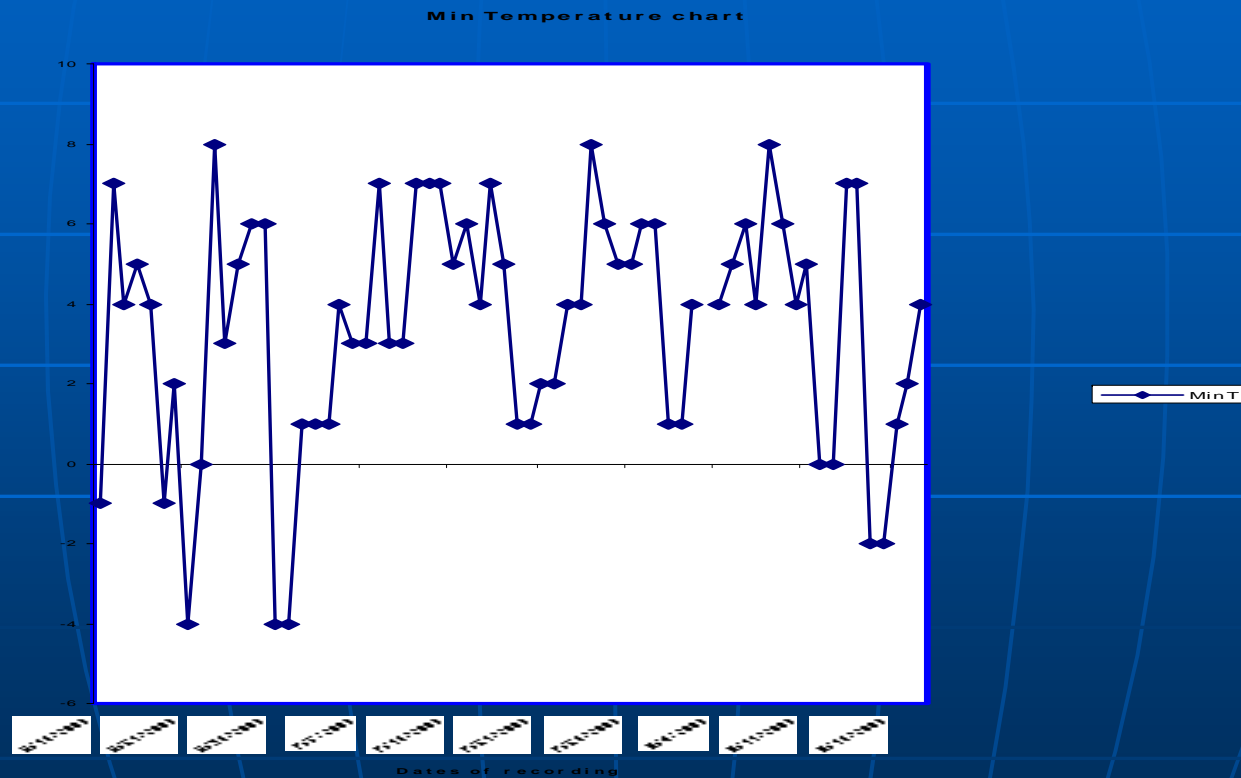


Before Spill Remed



After 6 Weeks

Temperature conditions



Use of VaporRemed During Cleanup of oil spill

- VaporRemed eliminates fuel oil fumes almost instantly
- When used on spill it will reduce the effect of fumes to cleanup crew
- VaporRemed can be sprayed on the clothing and



References

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2. Pretreatment of oiled birds
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3. License from California state
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5. Report on Pre-treatment of OWS in SJPC, NJ

<http://www.sarvabioremed.com/spillremed-industrial/pre-treatment-of-oil-before-passing-through-oil-water-separators/file>

6.

