A proposal to employ green bioremediation solution for cost-effective treatment of the gulf oil spill 2010

Satya Ganti
Sarva Bio Remed, LLC
11 North Willow Street,
Trenton, NJ 08608
www.sarvabioremed.com

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To Global Oil Pollution

Agenda

- Company overview
- Cleanup strategies
- Case studies (for reference)

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Sarva Bio Remed, LLC

- A leading environmental biotechnology company providing bioremediation solutions since 2001.

Vision

Developing *bioremediation* solutions to clean up oil contamination of the *past* to create a kinder, gentler *tomorrow*.

Parameters of success for bioremediation

Parameter	Starting point	End point	Time to achieve end point
TPH (in parts per million)	70,000 – 200,000	100	21 days
Bioindicators to indicate the vibrancy of the ecosystem	TBD (potentially none, due to toxicity of the oil)	Presence of diverse flora and fauna	40 days
Odor	Strong fumes	No odor	10 – 15 minutes per active region.
Sheen	Sheen seen on water	No sheen	3-5 days
Visual	Dark oily patches	Clean and negligible traces of oil (ideally no trace of oil)	40 days

Cleanup strategies

- AgroRemed application at a rate of 1 gallon per 20 sq.ft
- End points: TPH < 100 ppm over a uniform area.

Please click on the link to view a similar case study

Cleanup strategies (contd.)

- SpillRemed (Marine)
  - 1 gallon for 10 gallons of oil
- Preferably treat the oil contained in boom after skimming to treat the source
- Application approach
  - Airdrop (rain preferable to a spray to avoid waste)
  - Boats along the line

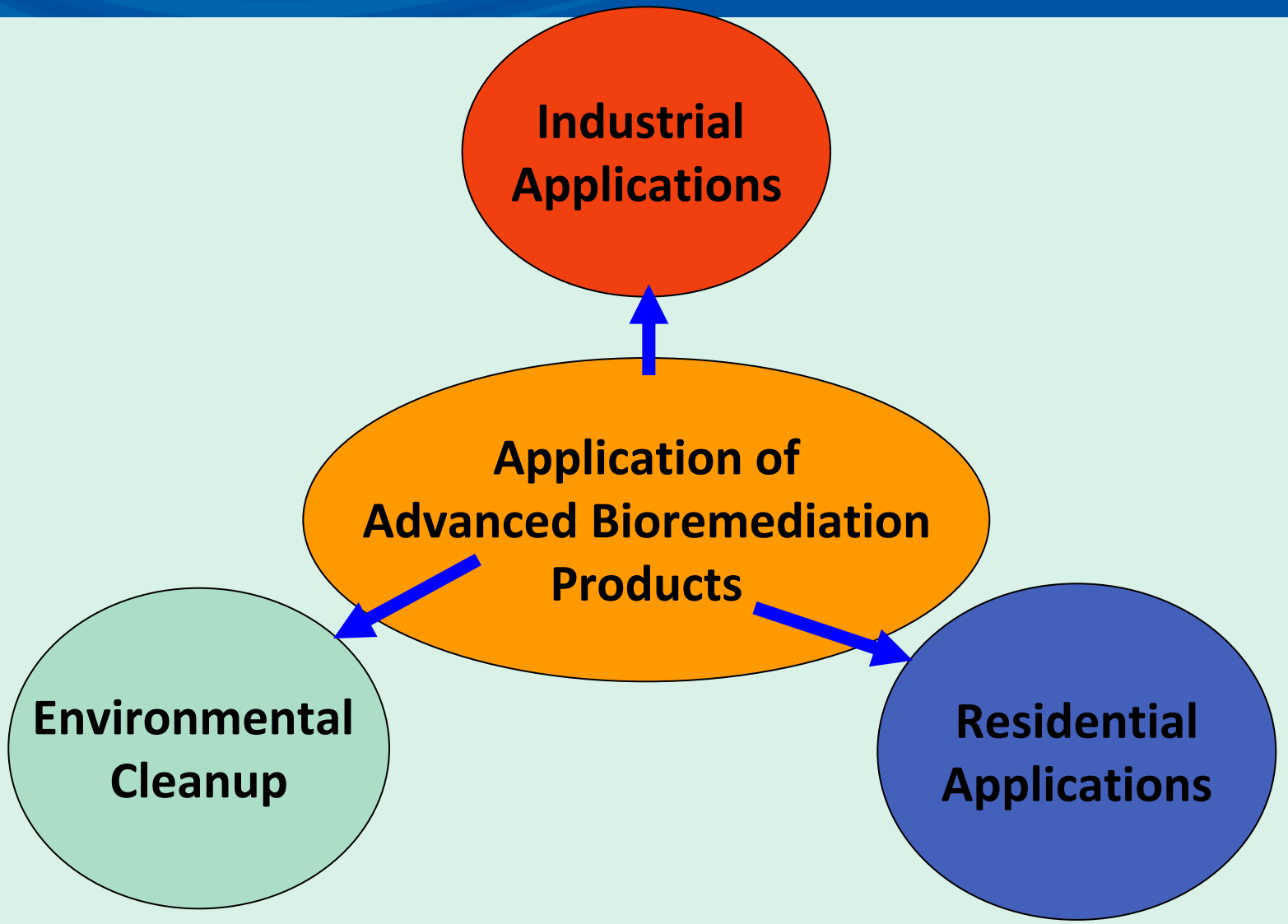
Cleanup strategies (contd.)

- SpillRemed (Marine) for treating birds and turtles in a gentle and safe manner
  - Eliminate harmful fumes
  - Act as a natural surfactant to disperse oil attached to the turtles and birds

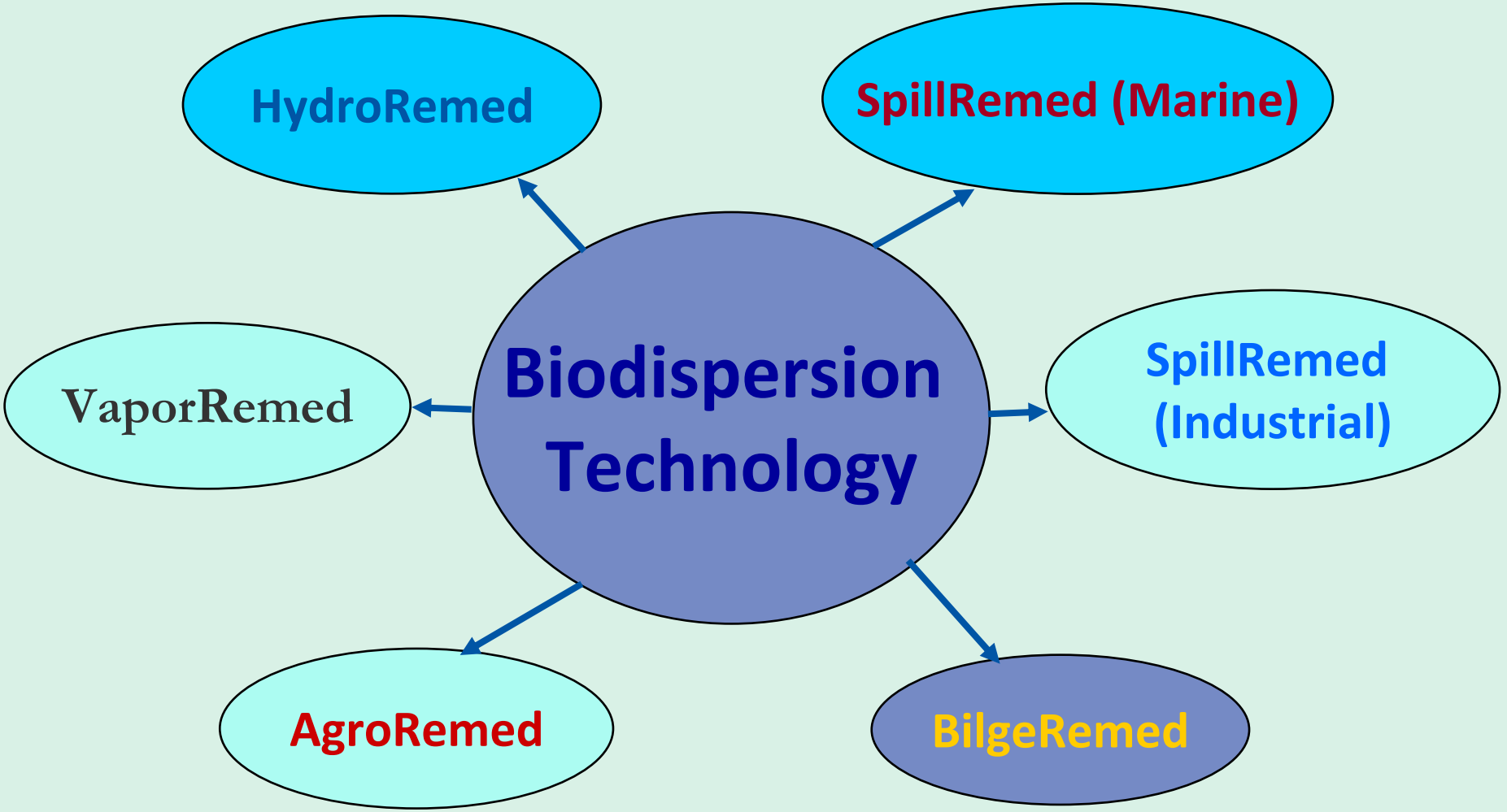
Cleanup strategies (Contd.)

- SpillRemed (Industrial): Contamination of marsh lands
- AgroRemed for contaminated coastal land.
- VaporRemed for eliminating crude oil fumes.

Field of Application



Our Products



VaporRemed

- VaporRemed
  - Eliminates fumes almost instantly
  - Is a permanent solution
  - Treats spill on concrete, wood and soil
- VaporRemed is ***not***
  - **A room freshener**
  - **A fume suppressant**
  - **An oil absorbent**

Features and Benefits of VaporRemed

- Effectively removes fumes permanently
- Effective on concrete, wood and other surfaces
- A fire preventative agent as hazardous fumes are removed almost instantly
- First response tool after any fuel oil spill
- Essential for service managers and truck operators in their tool kit
- VaporRemed works!!!

VaporRemed

Available Packaging

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VaporRemed

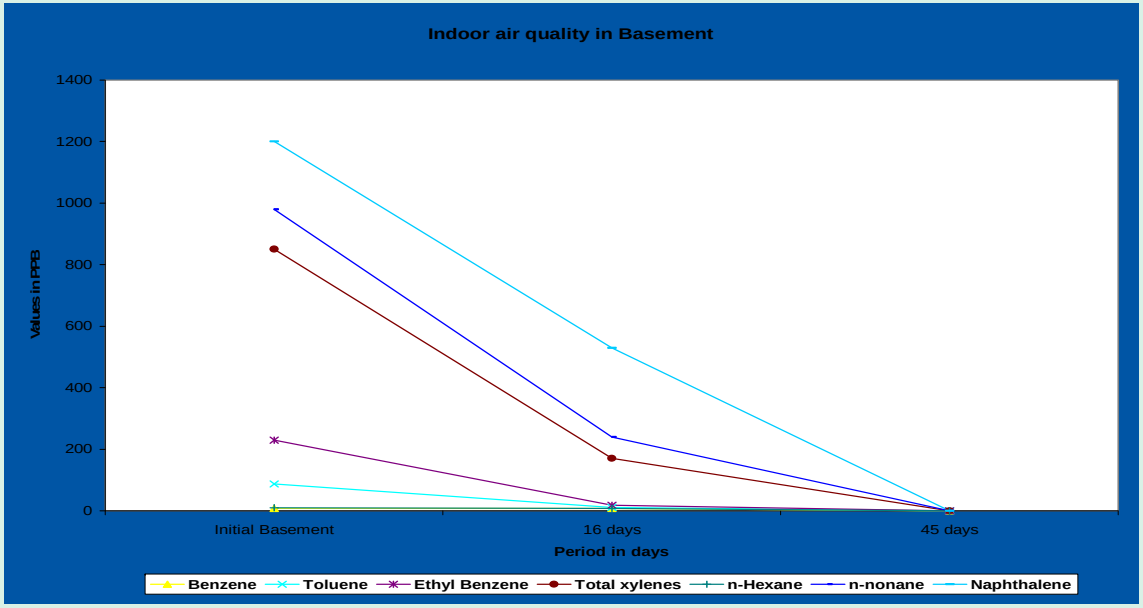
1: Residential Heating Oil Spill

- Spill in basement
- Concrete was cut
- Underlying soil was heavily contaminated with heating oil
- Strong odor produced and home owner was relocated
- Odor was gone on first application and house was re-occupied soon

VaporRemed

3. Vapor intrusion in the house

- **Heating oil odor remained after first clean up of spill**
- **Home owner mandated elimination of odors without cutting basement**
- **Insurance company requested for a non invasive treatment**
- **VaporRemed was used by the contractor as a non invasive solution**
- **Values of VOC were reduced as seen in graph below and home re-occupied.**



VaporRemed

Recovery of pets: Testimonial

VaporRemed

We recently converted our oil boiler to gas and the heating crew could not remove the half-full, 250-gallon oil tank until one week later. Hence, we had an open fuel oil tank (the pipes were removed) and strong oil fumes inside our home. As a result, our dog and cat became ill within a few hours. Upon receiving and spraying the VaporRemed, the fumes quickly disappeared and the animals recovered. After the fuel oil tank was removed, we sprayed a few final applications of VaporRemed and now, everyone in the household is breathing happily and without any adverse effects ... thanks for creating such an amazing product! ------- Denise in Maryland

AgroRemed

- A low carbon footprint remediation solution
- In situ treatment lends itself to a low energy approach
- Restoration of soil and vegetation

AgroRemed

Features of AgroRemed

- TPH of contaminated soils reduced by more than 90% within three weeks in most cases
- Easy to use
  - Generally, a one time application
- 1 gallon treats 20 sq.ft of contaminated soil
- Non invasive (environmentalist groups in Brazil loved that!!!)
- Shelf life – 4 years

Applications of AgroRemed

Reduces Petroleum contaminated soils to less than 90% in 3 weeks

Restoration of grass after an oil spill

Restoration without excavation (non-invasive)

AgroRemed

1. Cleanup of a shipyard site

- Spill from storage tank seeped into soil
- Soil had earlier contamination of oil & greases
- Site was on the river, therefore the site was not amenable to excavation.
- AgroRemed was used for surface application

AgroRemed

Benefits of AgroRemed

- Remediation is carried out ***in situ***.
- Generally requires no excavation or transportation of contaminated soil
- No excessive usage of water for cleanup
- No waste for disposal
- A reduced carbon footprint remediation solution

AgroRemed

SpillRemed (Industrial)

- Effective for contained open water oil spills
- Reduces free oil content in
  - Lagoons
  - Metal recycling plants
  - Maintenance shops at sea ports
  - Airport maintenance shops
  - Oil water separators at oil terminals, production facilities and waste-oil treatment plants

SpillRemed (Industrial)

1. Bioremediation of contained open water fuel oil spill

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

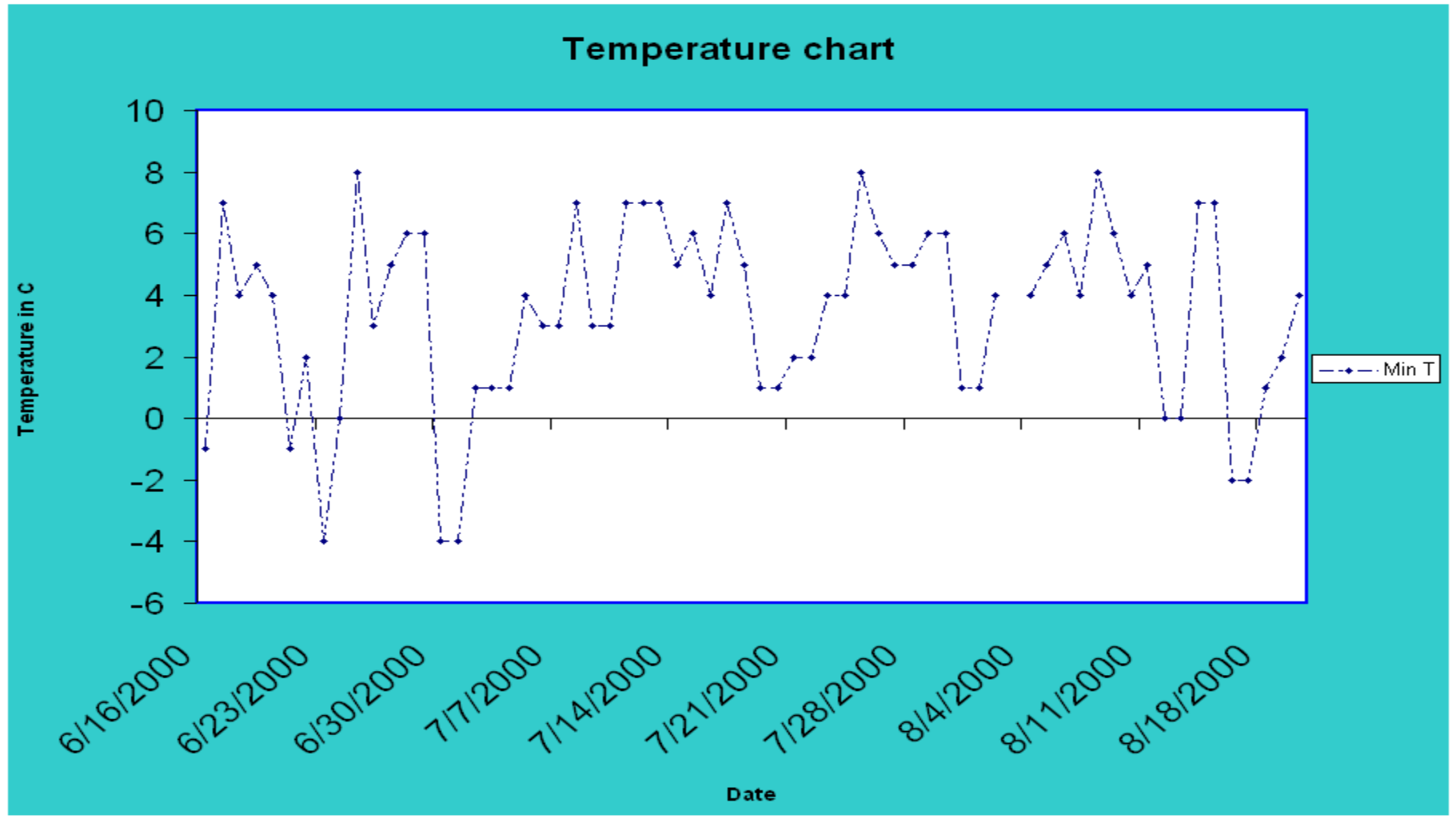
1. (contd.) Cleanup of spill in a berm in Canadian mine.

Before application of SpillRemed (Industrial)

6 Weeks after water was clear and discharged

SpillRemed (Industrial)

1. (contd.)Temperatures during trials in the mine in Canada



2. Oil water separator at local airport in Trenton, NJ

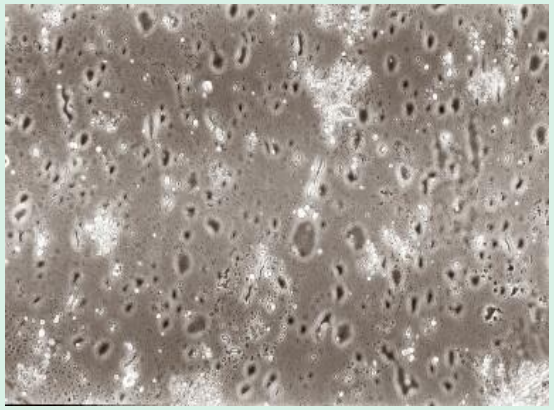
Oil water separator in maintenance hangars

Opening of storm water culvert

The system at the airport is a gravity based oil water separator which allows oil which is lighter that water to separate on top and clear water is discharged into waste water treatment plant before release. The oil on the surface is treated with SpillRemed (Industrial) routinely to remediate before the water is released into the treatment plant thus eliminating possibilities of release of oil.

3. Oily waste in maintenance plant in a port in New Jersey

Oil water separator



Dense population of bacteria TPH 286 ppm (oil)

Reduced Population of bacteria TPH 25.8 ppm (no oil)

The maintenance shop at the South jersey Port cleans and pressure washes port vehicles on a daily basis and collects a large amount of waste water containing oils and greases and dirt and grime in the oil water separator sump shown on the left. The oil is removed with the help of absorbent socks and pads which are sent for disposal. SpillRemed (Industrial) was added and in 1 week oil was reduced and with reduction of oil, bacterial population was also reduced as food was not available.

Customer testimonial

"We are extremely impressed with the performance of your product. Sarva Bio Remed did an excellent job in removing the petroleum hydrocarbons from water as indicated in the test results."

Joe Balzano, Executive Director & CEO, SJPC, NJ

SpillRemed (Industrial)

SpillRemed (Marine)®

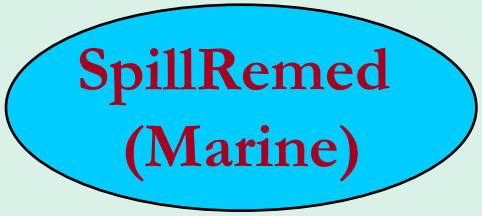
Disclaimer: SpillRemed (Marine)® is on the US EPA's NCP Product Schedule. This listing does not mean that EPA approves, recommends, licenses, certifies or authorizes the use of SpillRemed (Marine)® on an oil discharge. This listing means only that data have been submitted to the US EPA as required by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

Consortium of bacteria from Alaskan waters

- SpillRemed (Marine)® is the first product in the line of our spill cleanup products
- Bacterial consortium was isolated from Alaskan water from Prince Williams Sound
  - Experienced one of the largest oil spill in United States
  - Even as recently 1999, waters of Prince Sound William supported a healthy population of oil degrading bacteria

Certification SpillRemed (Marine)

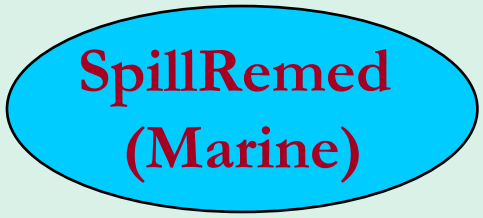
- Included in the National Contingency Product list of US EPA that authorizes use for
  - Open water spills
  - Shore line cleanup



- License is also given by the State of California Fish & Wildlife for open water oil spills
- Classified as ‘very good’ for pre-treatment of birds by Tri state Bird Research Institute, DE USA

Application of SpillRemed (Marine)

- SpillRemed (Marine) is effective in treating following oils
  - Weathered oil
  - # 6 Fuel Oil
  - Hydraulic oil
  - Diesel
  - Aviation fuel



- Does not contain Genetically Modified Forms

Effectiveness as a bioremediation agent

- Study 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

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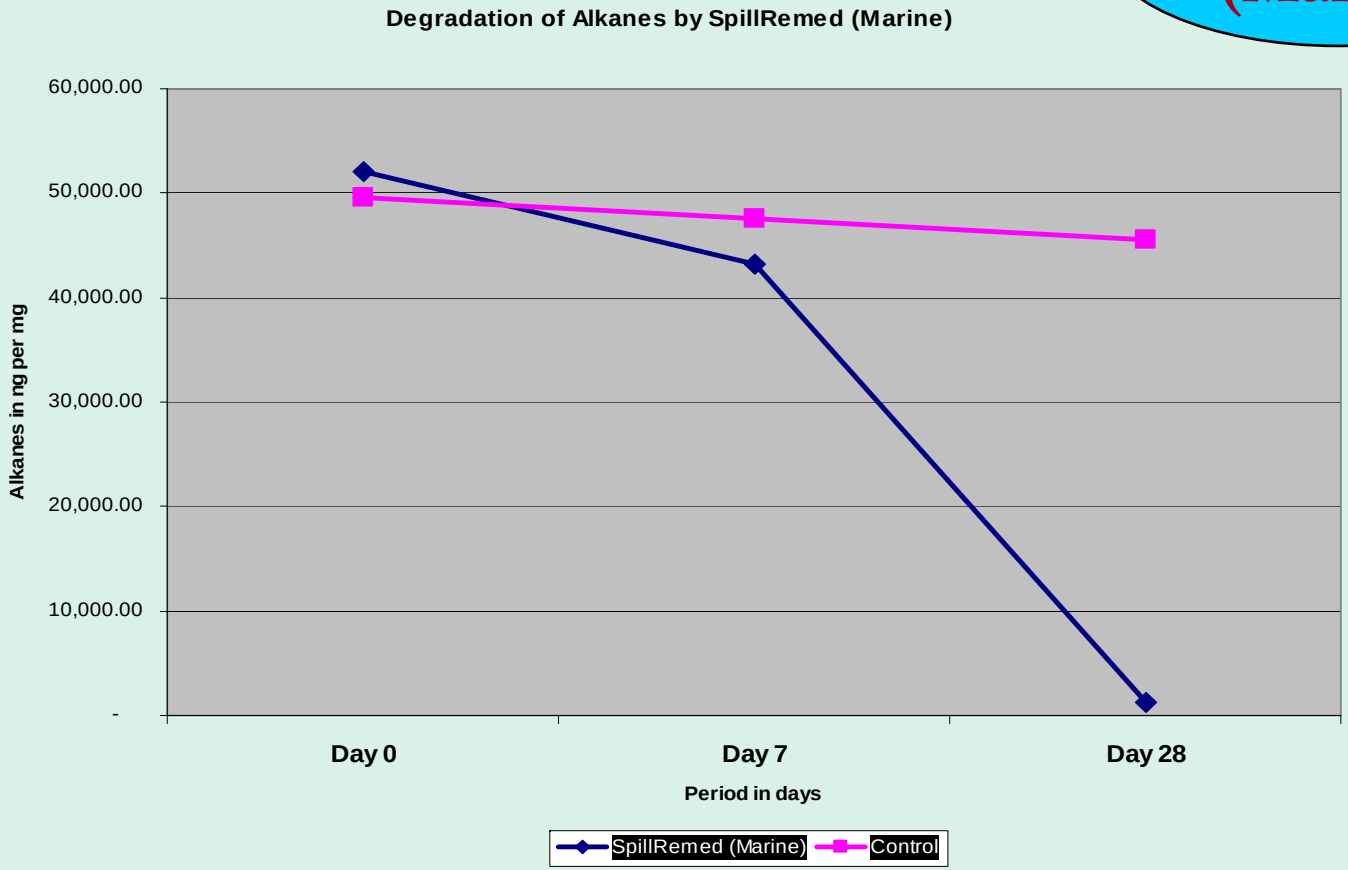
SpillRemed (Marine)



Reduction of aromatics by SpillRemed (Marine)

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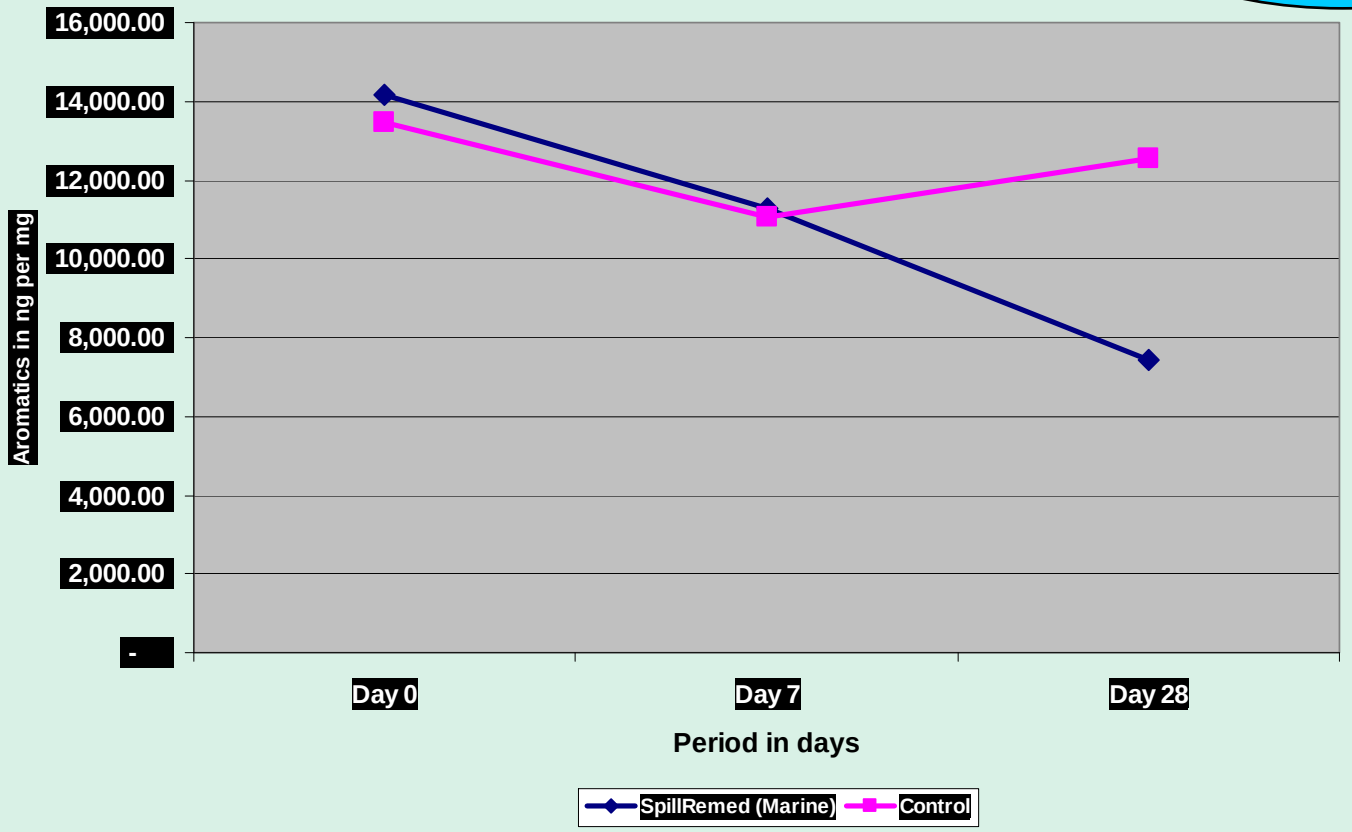
SpillRemed (Marine)



Bacterial Growth During Evaluation of SpillRemed (Marine)

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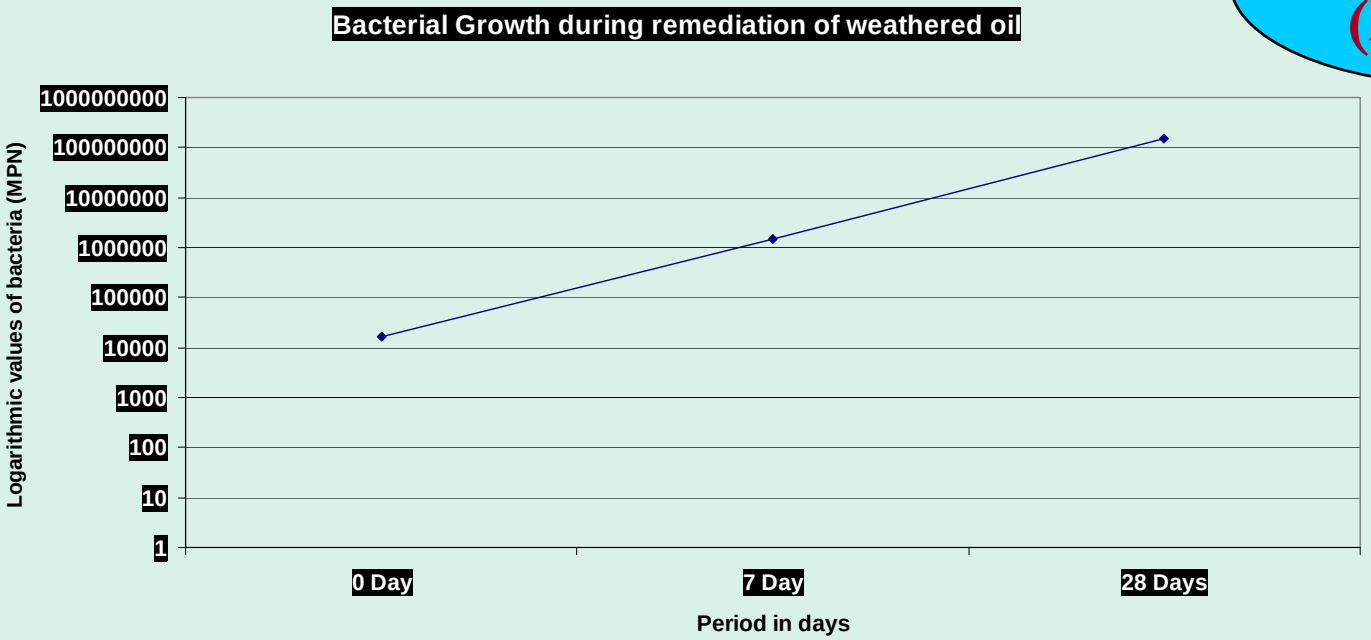
SpillRemed (Marine)



Features and benefits

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- 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
  - Strong correlation of bacterial growth to oil degradation
- Restores the ecosystem
  - Use of SpillRemed reduces toxicity of fuels thereby allowing for growth of protozoan and other marine fauna and flora

SpillRemed (Marine)

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BilgeRemed

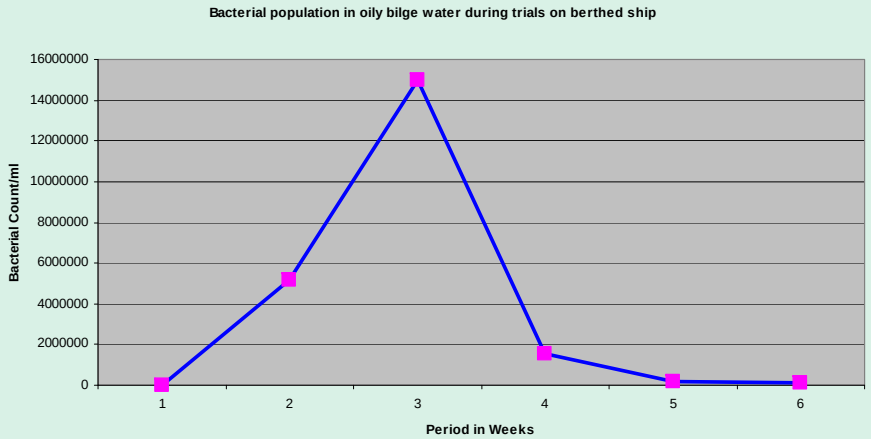
BilgeRemed for oily bilge water on board boats and ships

- BilgeRemed treats fraction phase
  - Oil forms a film over water and forms a fraction of total volume of oily bilge
  - Water forms the bulk phase

- BilgeRemed treats fraction phase - less expensive
- No disposal of waste
- Compatible with existing pollution treatment systems like Oil Water Separators (OWS)

1. Trials on a berthed ship

- The trials were carried out on a M/v Cape Wrath berthed in port
  - Operation of OWS prohibited
- TPH reduced to 5.3 ppm during trial period of 5 weeks



Bacterial population peaked when oil concentration was high and reduced when TPH was 5.3 ppm

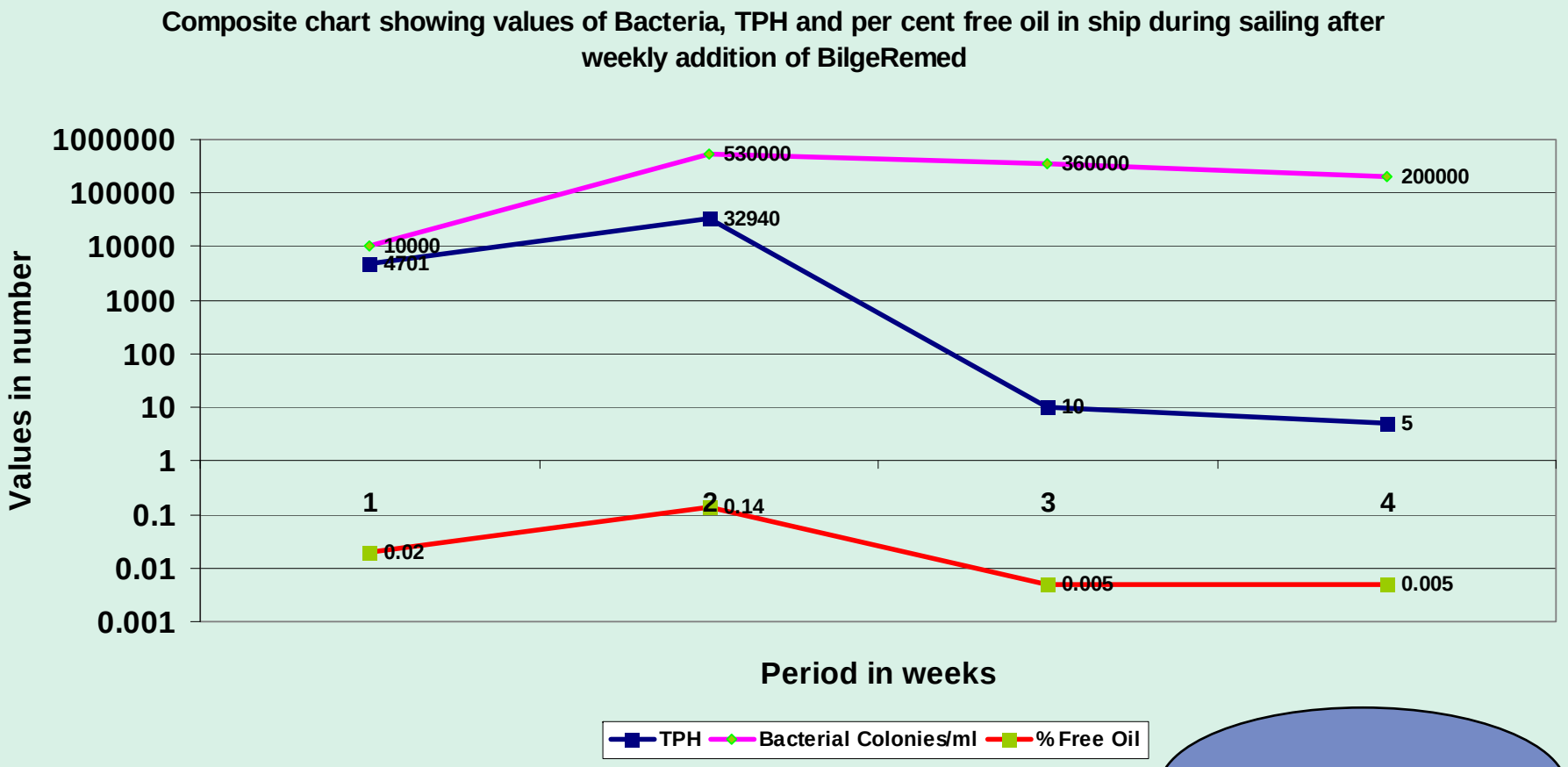
BilgeRemed

2. Service trials on a ship during sailing

- M/v Swift Arrow was nominated by a KGJS for trials during sailing
- The duration of sailing was 4 weeks
- BilgeRemed was added weekly
- Conditions were cold during sailing
- At the end of 4 weeks TPH was 5.0 ppm and discharge water was very clear

BilgeRemed

Values of bacteria, TPH and free oil after treatment with BilgeRemed



BilgeRemed

Benefits of BilgeRemed

- On-oil on-site low energy ‘end-of-chain’ solution
- Effective against complex mixtures of oils in short time period
- Eliminates Transportation and disposal
  - Reduces liability
- Minimizes supervision
  - Ideal for pleasure boats, ships & tankers
- Compatible with the existing oil water separators
- Reduces accidental unintentional release
  - Protection of marine environment

Bioremediation of free product in ground water

- HydroRemed treats free product in ground water
- Treatment of groundwater is performed in two stages
  - Bioremediation of contaminated soil: the source
  - Bioremediation of groundwater: the effect
- Direct addition to ground water when soil is not accessible for treatment by
  - Injecting into monitoring wells
  - Adding before passing through
    - oil water separator
    - carbon filter
  - Direct addition if groundwater is shallow

Application of HydroRemed

- Levels of oxygen decrease with depth of water
  - Bioremediation is an oxidative process requires oxygen
  - In certain cases HydroRemed is saturated with air before injection.
- Population of bacteria was reduced by a factor of 10 under low oxygen conditions in seven days
- HydroRemed is added weekly to replenish the lost population of bacteria

1. Shallow ground water

- HydroRemed was
  - sprayed on the gravel and soil beneath the slab
  - added directly into the monitoring wells Both Gasoline Range Organics (GRO) and Diesel Range Organics (DRO) were found below the detectable levels as stipulated by PADEP
- The case was finally closed by PA DEP after monitoring the ground water for a year.

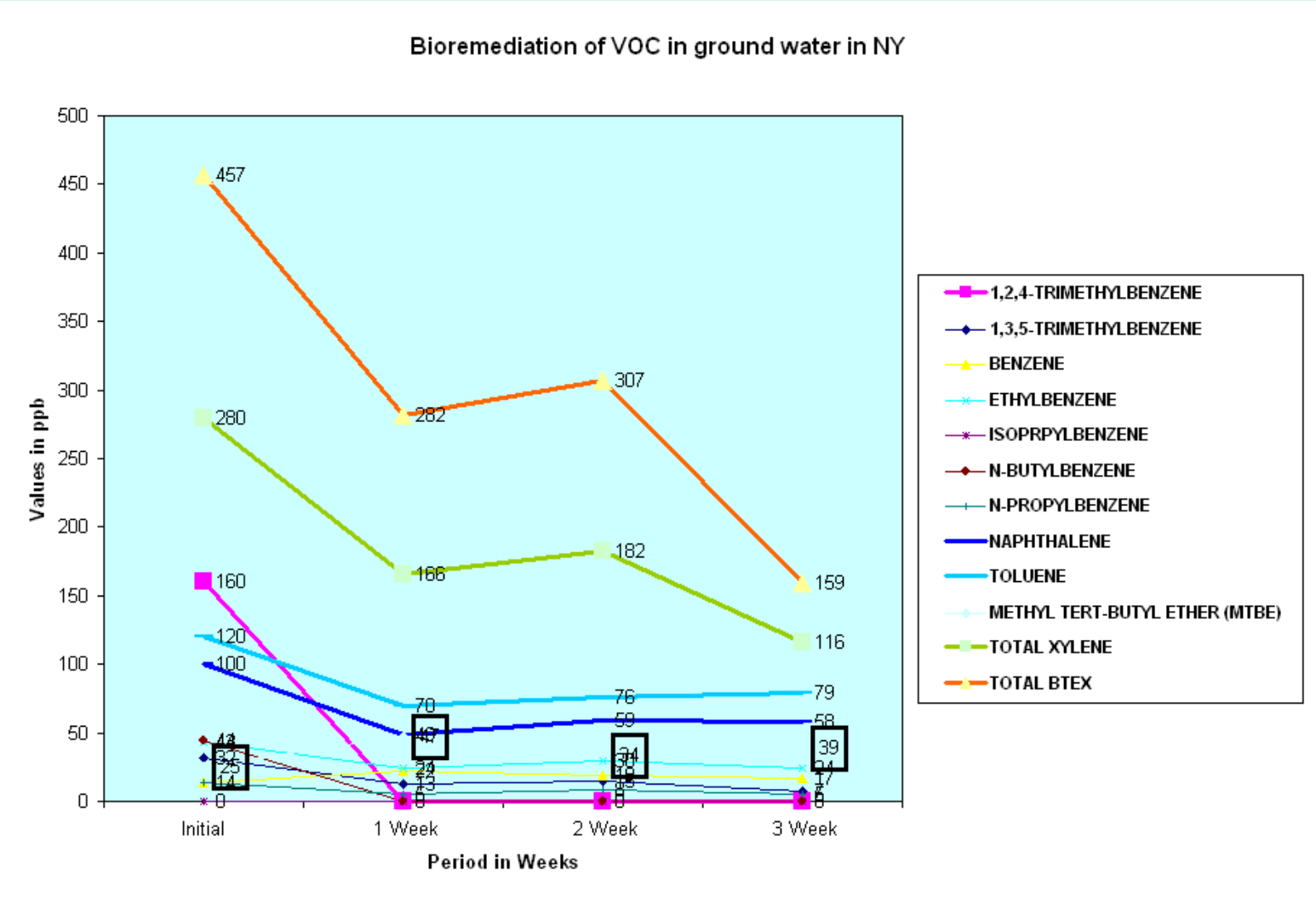
2. Treatment of ground water at multi rise buildings – New York

- Source of contamination was not known, presenting a challenge in trying to treat the pollution at source.
- Other available methods were tried for cleanup as directed by New York City Dept of Env Conservation
- Bioremediation of groundwater using HydroRemed was finally accepted by DEC
- Injection wells were drilled at the site as seen in the picture below.
- HydroRemed saturated with air injected 1 gallon per week per well.

HydroRemed

2. The site

Results of the treatment



Benefits and advantages

- Available in a ready to use liquid form
- Reduces VOCs effectively and permanently
- Both shallow groundwater and deep wells can be treated
- Used in conjunction with pump and treat process and with pretreatment before OWS

HydroRemed

Summary of advantages of biodispersion technology over other process

	SARVA BIO REMED PRODUCTS	NORMAL METHODOLOGY
Time Period	• 3-4 weeks	• 12-16 weeks
Operations	• In-Situ • Causes minimal disturbance to site operations	• Removal of Contaminated ground/Water Required • Major disturbance to site
Skills Required	• None - simple ready to use as supplied	• Qualified Operators for excavators / lorries etc
Working Hours	• Bacteria works 24/7	• 8 Hour shift
Transport	• None required	• Expensive Hazardous waste.
Disposal	• None	• Expensive Waste disposal.
Capital Expense	• None	• Heavy machinery such as excavators, Lorries etc
Environment	• Removes Toxic Fume almost Instantly	• No cure until removed
Health & Safety	• Minimal risk assessments	• Major Construction requirements

Acknowledgments

- Some pictures borrowed from Huffington Post

Contact

1. USA: Satya Ganti, Sarva Bio Remed, LLC, 11 North Willow Street, Trenton, NJ 08608 Phone: 609-695-4922
2. Brazil: Paulo Fernandes, Rua Rocha, 187 cj 124, Sao Paulo, 01330-000, Brazil. Phone:55-11-8221 4281
3. Europe: Steve Lucas, GKL Solutions Ltd., 26 Holbrook Road, Fareham, Hampshire PO16 0TL (UK) Phone: +44 (0) 5601 290745
4. Chile: Felipe Soto R., Python E.I.R.L. Santiago.