

# **“Report on On-Site Bioremediation Of Oily Waters At The Maintenance Facility Of South Jersey Port Corporation, Camden, NJ”**

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Submitted by

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# **“Report on On-Site Bioremediation Of Oily Waters At The Maintenance Facility Of South Jersey Port Corporation”**

## **Executive Summary**

A report is submitted on the project undertaken at the instance of South Jersey Port Corporation (SJPC) for introducing an environment friendly solution to their oily wastewater situation. The project as proposed by Mr. Joseph Balzano Executive Director & CEO of South Jersey Port Corporation is a very important step in application of bioremediation.

Discharge of oily wastewater is a continuing problem for transport maintenance facilities. SJPC was cited on a number occasions regarding effluent discharge from the port maintenance facility in spite operation of the Oil Water Separator. Mr. Balzano felt that a totally environment friendly bioremediation solution could possibly be a better approach to reduce the concentration of oils and greases.

The sump at the maintenance facility receives large amounts of warm water that is charged with detergent, for pressure cleaning different types of vehicles at 3000 psi to remove grime, grease and oils from the engines. The facility collects oily wastewater 3 to 4 times in a day and discharges it directly into the waste stream after passing through the oil water separator.

Treatment option chosen was to add 5 gallons of SpillRemed (FW) to the main sump before Oil Water Separator. SpillRemed (Fresh Water) was added periodically to coincide with the three-week turn over interval.

Oily waste water was analyzed before and after treatment with SpillRemed (FW). Although there were initial concerns about the reported levels of toxic metals, the performance of SpillRemed (FW) was not affected because the results showed that bacterial remediation reduced the TPH content by 90% in eight days. Microscopic evaluations showed that even under the high pressures for cleaning of the vehicles, the bacteria remained attached to the oil layer and were not washed in the water. Population of oil eating microbes (POEM) decreased correspondingly with the reduction of oil.

Other studies showed that SpillRemed (FW) was effective in removal of oil from the absorbent material.

We recommend that the trials be continued for a period of 12 months to:

1. Extend trials for at least one year to establish the reproducibility of the results.
2. Optimize the treatment protocol.
3. To validate the environmental impact of bioremediation technology for maintenance facilities.
4. To eliminate overhead costs associated with down time of the facility under the current regimen.

It is our judgment that the adoption of these recommendations could impinge significantly on the cost of operations at the South Jersey Port Corporation maintenance facility.

# **“Report on On-Site Bioremediation Of Oily Waters At The Maintenance Facility Of South Jersey Port Corporation”**

## **Introduction**

A meeting was arranged by Mr. Joe Constance of the New Jersey Department of Commerce to discuss possible applications of SpillRemed at the South Jersey Port Corporation offices. The meeting was attended by Mr. Joseph Balzano, Executive Director & CEO, Mr. Joe Constance, Ombudsman, NJ State and representatives of Sarva Bio Remed, LLC, Trenton, NJ and Mr. Bill Kelly of the Maintenance Facility. It was agreed that South Jersey Port Corporation would employ SpillRemed for bioremediation of waste oil on a trial basis in their maintenance facility. Mr. Bill Kelly, Foreman of the maintenance facility, coordinated the project.

## **Project**

The project proposed here was *on-site bioremediation* of oily wastewaters for a three-month field trial at the South Jersey Port Corporation’s Maintenance facility using SpillRemed (Fresh Water).

## **Background**

Bioremediation has been defined as a process of stimulating growth and activity of indigenous microorganisms that naturally feed on spilled hydrocarbons, which is achieved by addition of fertilizer compounds. The process takes a very long time and is hence restricted as an accepted practice for shoreline clean up after a major oil spill (Bragg et al, 1992).

Sarva’s biodispersion products were developed on the basis of a patented technology. It is fast acting and does not require any addition of nutrients. This opens up a wide range of applications primarily for on-site treatment. These products have following properties which are relevant for bioremediation of oily waste water generated at the maintenance facility because they are 1) available in a ready to use (RTU) liquid form and are easy to dispense; 2) they are Non-corrosive to metal parts of Oil Water Separators; 3) safe to handle by maintenance staff and requires no specialized training, 4) does not leave any build up of residue requiring recycling, 5) Environmentally safe, 6) provides option for using product for other applications in the facility, and 6) Can be re-used after breaking the seal and requires no special storage conditions.

Major concerns of the protocol were as follows:

1. Will the bacteria be able to survive in the presence of toxic metals?
2. Will they be able to consume oil when water is flushed under such high pressures?
3. Will the process of bioremediation be satisfactorily completed in short period?
4. Can SpillRemed be able to clean the absorbent material free of the oils and greases?
5. Can SpillRemed clean the metal troughs leading to sump?
6. Can bioremediation be a complimentary process to the physical process by Oil Water Separator?

## Goals of the project

The current project was being undertaken to meet the following objectives.

1. Fast bioremediation of oily waste water
2. To remediate oily water at the site itself.
3. To promote clean water discharge in the municipal waste stream.
4. Promote clean waters free from oil pollution
5. Minimum overheads and peace of mind

## Description Of Site

A project was undertaken to remediate oily wastewater in a sump fitted with an oil water separator (Figures 1 to 3). The current regimen uses an Oil Water Separators composed of absorbent material and diapers. The sump receives large amounts of warm water, charged with detergent, for pressure cleaning different types of vehicles handled by the port. Water is applied at a pressure of 3000 psi to remove grime and grease and oils from the engines. The facility collects oily wastewater almost 3 to 4 times in a day. Water from the sump is then discharged directly into the waste stream after passing through the oil water separator.



Figure 1. Showing the general outline of the oil water separator system.



Figure 2: Oily water sump showing absorbent material and diapers for removal of the oil from water.



Figure 3. Showing the metal trough and the walls of the channel covered by residual oil released during washing. Cleaning of the trough and channel requires 2 days of operating time.

### **Experimental Design and Methods**

Some concerns were voiced that often the values of oil in discharge exceeded permissible limits set by the town. The port authority was keen in improving the quality of wastewater to meet these requirements by finding a way to reduce the residual oil content. The oil absorbent material is changed every three weeks with a down time of

two days every time. One of the objectives to be met is that bioremediation of oily wastewater should occur within these time limits.

Initial water analysis showed that the wastewater contained inorganic salts of metals that may be toxic to bacteria. Average values for some of these are: cadmium, 0.004 ppm; chromium, 0.01 ppm; copper, 0.02 ppm; lead, 0.01 ppm; nickel, 0.2 ppm and zinc 0.036 ppm. Therefore another objective was to determine if SpillRemed would work under these conditions.

Five (5) gallons of SpillRemed (Fresh Water) was added into the sump compartment containing oily water surrounded by the oil absorbents. The first addition of SpillRemed (FW) occurred one week prior to the scheduled change of the absorbent material. Initial water sample was withdrawn from the above compartment and subsequently analyzed for Total Petroleum Hydrocarbons (TPH).

Another sample was collected on 8<sup>th</sup> day of the trial from the same compartment and was again analyzed for TPH. The system was then refreshed with new absorbent material.

## Results

Results showed that even in the presence of metals of toxic nature, the bacteria continued their normal activity of dispersing the oil and consuming the same.

SpillRemed is an oleophilic formulation and hence the bacterial population was expected to be concentrated in the oil layer. Even under the high pressures for cleaning of the vehicles, the bacteria remained attached to the oil layer and were not washed in the water. Bacteria breakdown the oil into smaller droplets and each one of these is surrounded by a dense population of bacteria (Figure 4).

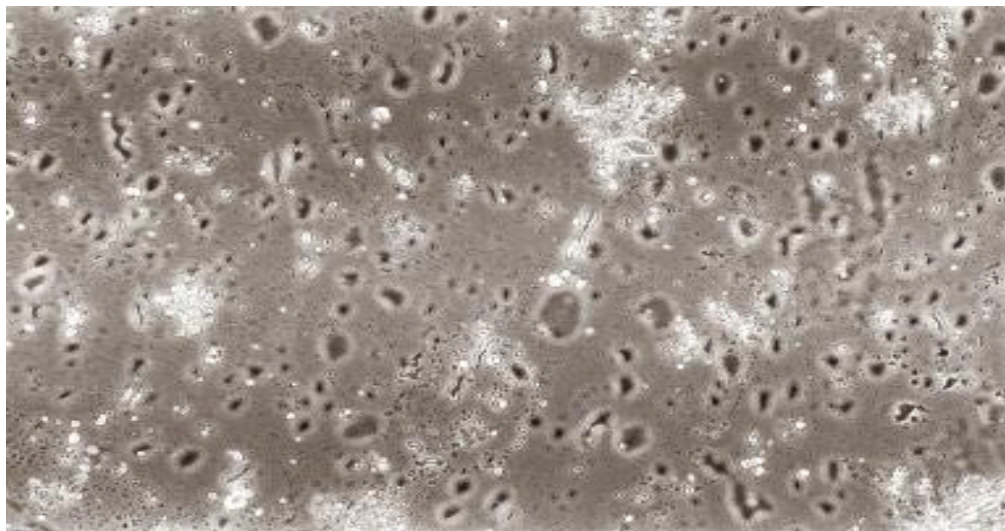


Figure 4. Dense mass of bacteria is seen surrounding dark oil droplets dispersed due to biodispersion by SpillRemed FW.

The oil-eating bacteria consume this oil and increased their population. However, once the oil is consumed, the bacteria are unable to find any source of food and died a natural death. This is seen in the microphotograph showing the reduction in bacterial population in the water after 8 days (Figure 5).

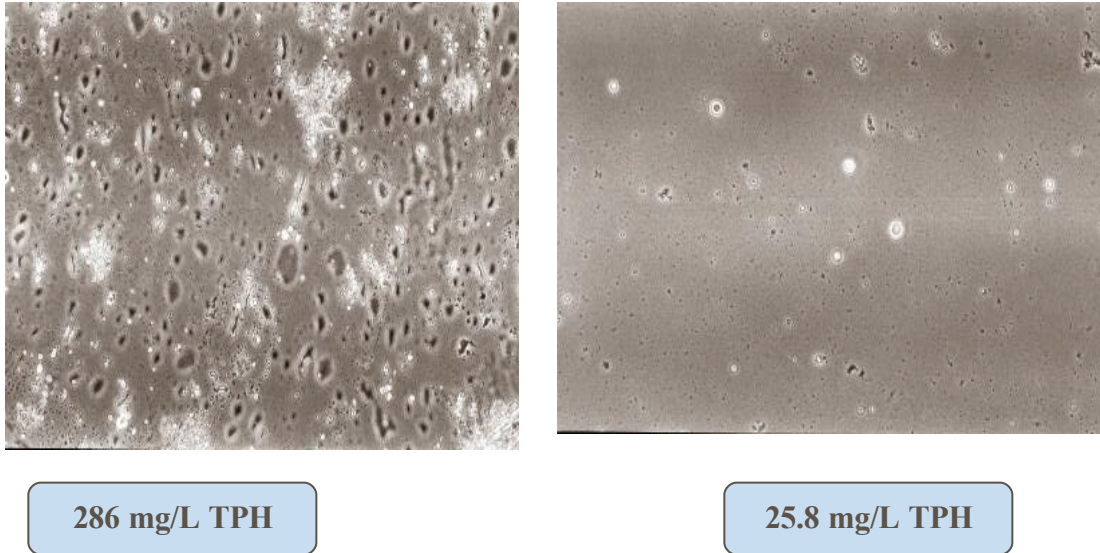


Figure 5. Shows the density of bacterial population in waters with high and low levels of oil indicating that bacteria will not survive if oil is absent.

The TPH values of the water were 286.0 ppm at the start of the trial and when analyzed after 8 days, the value was 25.8 ppm. Thus there was 90% reduction in the hydrocarbon content due to bioremediation by the bacteria in biodispersion products. This indicated that the bioremediation of the oily wastewater could be accomplished in very short time required for the user. This increases its applicability to oily ballast water on tankers and also for bilge water on shore based reception facilities.

A separate experiment was conducted using heavy thick sludge oil as test oil for determining the ability of bacteria in desorbing the oil absorbed on cotton applicator along with a control without any addition of SpillRemed. Within 48 hours, the sludge oil was found on the surface of the water in tubes containing SpillRemed whereas there was no change in the control. The bacterial population seemed to be growing and the cotton base expanded due to the absorption of water indicating that SpillRemed had the ability of cleaning the oil adhering the absorbent material used in oil water separator.



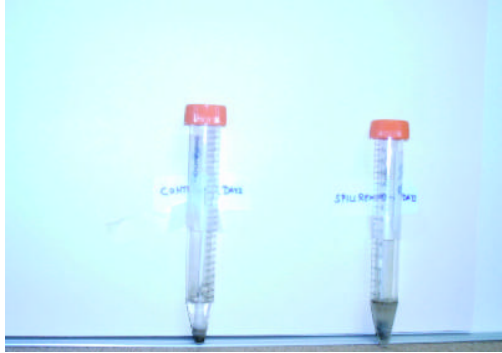


Figure 6. Tubes showing release of oil by SpillRemed FW from absorbent material (right) when compared with control (left).

The entire test show that both bioremediation and the physical process of oil water separators are complimentary and can be used for effective reduction of hydrocarbons in the wastewater entering the town wastewater stream.

## Discussion

This is the first report demonstrating the utility of bioremediation approach for the remediation of oily wastewater at source. In addition the results indicate that the bioremediation using biodispersion technology occurs in less than 8 days that is a distinctive advance over the earlier bioremediation approaches. The entire project cost less than \$200.00 for the product and one hour of operator time for application. This equates an estimated cost savings more than \$2000.00, based on the 2 days of lost operation time due to the standard practice of shutting down the facility.

## Conclusions

Most of the concerns and expectations of the user have been met. In fact, the results show that the treatment is effective in cost and time. An important finding is that the bacteria remained attached to the oil droplets throughout the course of the treatment. This is a direct consequence of the action of Sarva's proprietary oleophilic matrix that forms the core of our technology. Another observation is that bioremediation was not hampered by prior addition of detergents to the pressure wash water. In summary:

1. Biodispersion products can even be used under dynamic flow conditions.
2. Bacteria are not lost under high pressure cleaning procedure.
3. No reduction in the bacterial activity in the presence of metals of toxic nature.
4. Oil is broken down into smaller droplets indicating biodispersion.
5. Bacteria remained attached to the oil droplets till oil is consumed.
6. Reduction in the bacterial population occurs along with reduction of oil.
7. 90% reduction in TPH value was recorded in 8 days time.
8. Compatible with industrial oil water separators.
9. Bacteria are non-pathogenic and the products have no toxicity to aquatic life

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10. Cost effective solution.

## **Recommendations**

We recommend that the project be extended and the scope is widened to include:

1. Use of SpillRemed for oily wastewater in the sump for a period of 1 year to thoroughly evaluate the cumulative effects of SpillRemed on the wastewater stream.
2. To examine the action of SpillRemed on the oil absorbent material in facilitating the release of entrapped oil to reuse the material.
3. Add SpillRemed during pressure washing water to remove oil adhering to the channel, the grating as well as the trough of the shop floor.

## **Acknowledgements**

We appreciate South Jersey Port Corporation for giving us an opportunity to demonstrate our environment friendly bioremediation technology. We express our thanks to Mr. Joe Balzano and his team for their active cooperation and technical support in completion of this project.

## **References**

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