

# Bioremediation of Soils Contaminated With Transformer Oil in Brazil

Satya Ganti  
President & CEO

# Cleanup at Atuba, Brazil

- COPEL is the state owned company supplying utility to customers in Parana State
- They stock transformer oil for maintenance at Atuba in the city Curitiba
- Due to unsafe storage and cleanup practices the soil is heavily contaminated
- Area adjoins river Parana hence State has declared it as Area of Permanent Protection (APP)
- Excavation is not an option



# Development of AgroRemed BR

- Bioremediation was considered as a solution for the cleanup
- The regulators wanted product to be developed from local species
- We agreed with the decision and isolated a new consortium of bacteria from the local site in Atuba
- The new product is AgroRemed BR CTBA

# Criteria for Selection of AgroRemed

- Available in a ready to use liquid form
- Non invasive treatment
- No major excavations required
- Environmentally safe
- Restores soil productivity and promotes healthy growth of vegetation
- Met the requirements of the regulators

# Levels of contamination in soil

- A total area of 18,400 m<sup>2</sup> was identified as the area of concern
- Analysis of the soil was carried out by managers of the project, LACTEC
- The analysis showed that Total Petroleum Hydrocarbon (TPH) content was high in many areas and in one hot spot it was 766,965 ppm
- The contamination was more at 1 meter BGS and appreciably low at surface and 2 m BGS

# Strategy for Cleanup

- At a joint meeting of SBR, LACTEC and COPEL, it was decided to target hot spots
- Pump and Treat using the rain water was accepted as a strategy for cleanup
- As the site is APP, it was decided not to add AgroRemed directly to the soil
- Soil flushed rain water was collected in drums for treatment with AgroRemed

# Construction of Irrigation canals



# Laying of Canals below 1 m



# Installing Collection Pipes



# Site After Completion of Canals



# An Array of Treatment Tanks



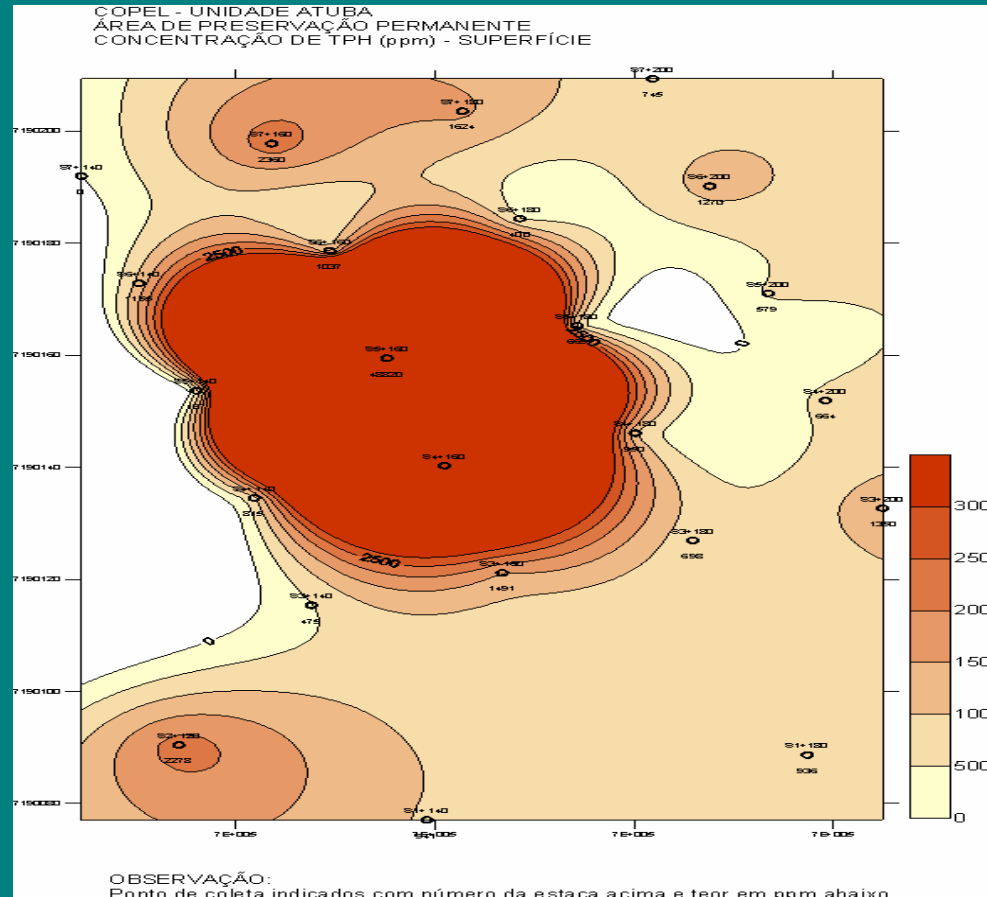
# Soil Flushed Water Treated with AgroRemed BR



# Results after Pump & Treat

TPH Values (in ppm) in soil before and after						
Source	Surface		1 Meter		2 Meters	
	Before	After	Before	After	Before	After
S2 + 120	2278	490	349	774	617	12
S3 + 200	1350	741	1243	344	1893	73
S5 + 160	48820	92	1149	113	1778	585
S6 + 180	400	89	766965	72	637	32
S7 + 200	2278	4	349	91	617	0

# Contour Map After Treatment



# Conclusions

- Treatment of soil flushed with rain water AgroRemed BR was effective
- The TPH levels of the soil at the hot spots were reduced to an accepted values
- The TPH of the soil with 766,694 was reduced to 72 ppm
- TPH values at other hot spots was also reduced effectively

# On-Site cleanup with AgroRemed BR

- The contamination of soil with transformer oil is recorded from other substations
- Most of the places the transformers are stored in unsafe places
- Spills are a recurring feature in these places
- Most of these are not restricted to APP
- These sites can be treated with direct application of AgroRemed BR

# Transformers Stored at a Substation



# Cleanup at a Municipal Garden

- At a municipal garden in Mandarituba, oil spilled from a transformer due to act of vandalism contaminating 500 m<sup>2</sup> of soil
- COPEL was required to clean the site
- The soil was stacked in a biopile
- AgroRemed BR was sprayed on the surface of the biopile
- The soil was analyzed for VOC and the values were found to be acceptable
- The project was closed and the soil was reused

# Soil Contaminated With Oil



# Excavation of Contaminated Soil



# TPH of the Contaminated Soil

## TPH of Soil near the transformer after spill

Sampling location	June, 2006	July, 2006
Front of the pole	8309	0
Behind the pole	3280	802
Left of the pole	5494	0

# Migration of oil in soil

- Values of TPH recorded immediately after the spill and one month later showed that the surface of the soil contained less oil after 1 month
- Movement of oil indicated that it could contaminate the ground water
- COPEL decided to use AgroRemed BR for on-site remediation and prevention of contamination of ground water

# Excavation of soil

- Based on the observations it was decided to excavate the soil to a depth of 3 meters and pile up in 4 stacks
- The samples collected from the remaining soil did not show high values of TPH
- End point to be less than 50 ppm after treatment as the site is used by children
- This is to be supported with GC analysis for Volatile Organic Carbons

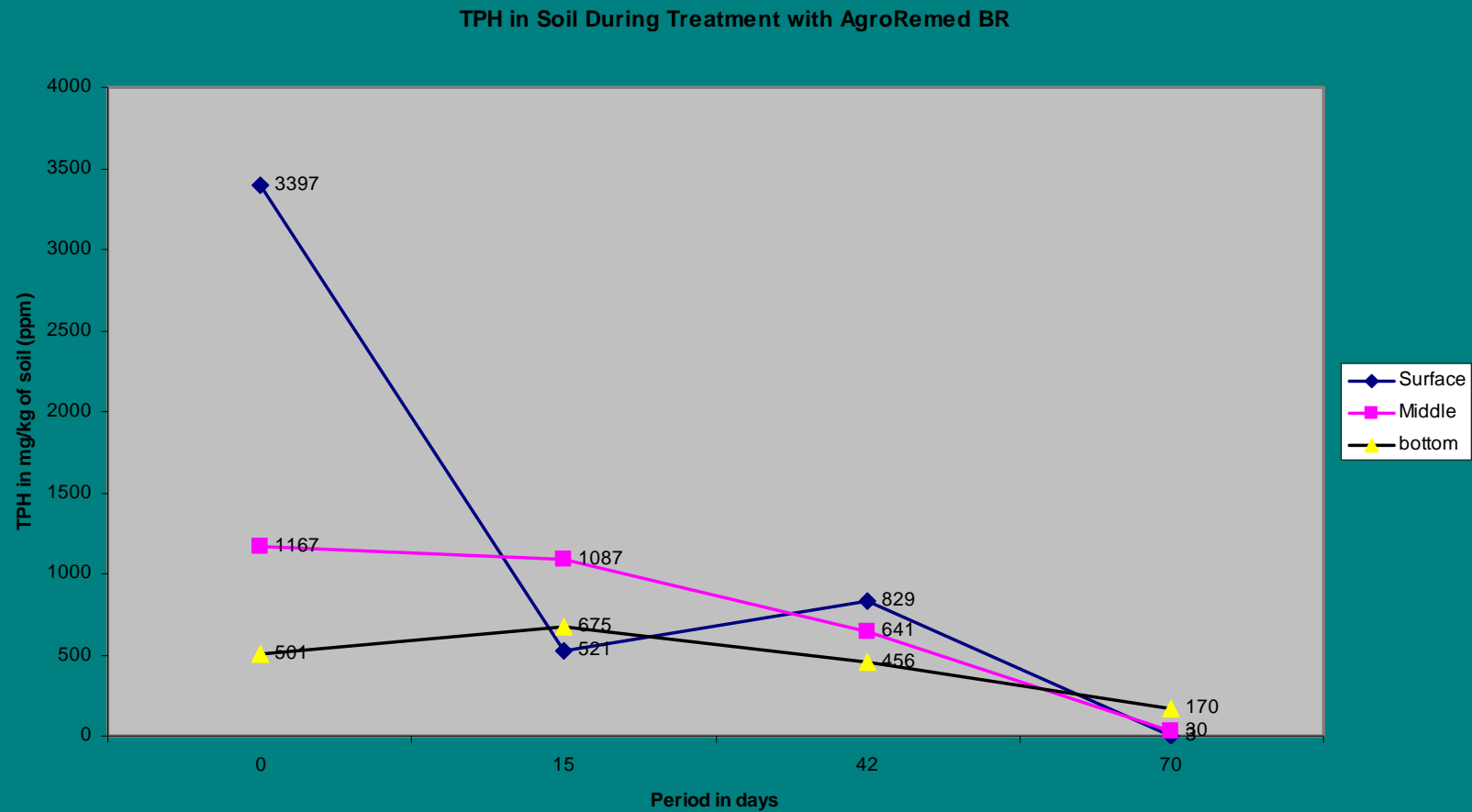
# Excavation of Soil



# Treatment of Stacks of Soil



# TPH Values with respect to time



# TPH & BTEX Values after Treatment

Values of TPH, BTEX and PAH in the stacks of soil after treatment with AgroRemed BR

Stack No.	TPH in mg/kg	Benzene in mg/kg	Toluene in mg/kg	Total Xylene in mg/kg	PAH in mg/kg
1	55	< 0,5	< 0,5	< 0,5	< 2,0
2	485	< 0,5	< 0,5	< 0,5	< 2,0
3	184	< 0,5	< 0,5	< 0,5	< 2,0
4	313	< 0,5	< 0,5	< 0,5	< 2,0
5	0	< 0,5	< 0,5	< 0,5	< 2,0
6	14	< 0,5	< 0,5	< 0,5	< 2,0
7	113	< 0,5	< 0,5	< 0,5	< 2,0
8	74	< 0,5	< 0,5	< 0,5	< 2,0
9 and 10	40	< 0,5	< 0,5	< 0,5	< 2,0

# Site Refilled With Soil Safe for Park



# Conclusions

- AgroRemed BR was effective in reducing TPH in soil by more than 90% in 15 days time.
- The values were determined for almost 10 weeks to record decrease below 50 ppm
- After 10 weeks, samples tested for concentrations of BTEX and PAH and were found to be within acceptable values
- The project was closed