

Cleanup at Mandirituba Power Sub Substation

In 2006, the Mandirituba power energy substation belonging to COPEL had many incidents of vandal attack on the unused equipment. As a result more than 15 transformers were damaged and the soil was heavily contaminated with transformer oil (Figure 1 and 2).



Figure 1 & 2. Mandirituba Power sub Substation and the transformers

Analysis of the soil showed high contamination of soil with an average TPH value of 7,847 mg of transformer oil/ kg of soil covering an area of about 500 m² (5382 sq ft). Moreover, the interval of significant time between the incident and the remedial action indicated movement of the transformer oil into deeper layers of soil and may even affect the quality of the ground water. The Table 1 shows the values of TPH at the site results.

Table 1. TPH of the soil because of the incident.

Point	TPH in Surface (mg/kg)
1	8794
2	22777
3	7808
4	602
5	806
Average	8158



Table 2. TPH of soil at a depth of 1.5 meters

Points	TPH at 1.5 meter (mg/kg)
1	105
2	2021
3	86
4	47
5	0
Average	452

The utility company COPEL suggested on-site treatment as a remediation method, thereby avoiding transporting high volumes of contaminated soil. It was recommended to use of bioremediation for the cleanup and AgroRemed BR CTBA developed with local microbial source from Brazil by Sarva Bio Remed, LLC, USA was considered suitable when compared with the other available methods of cleanup.

Bioremediation of the Contaminated Soil

The treatment of the Mandirituba power energy substation was initiated in February 2007. The project was similar to the Municipal Grounds project at the Fazenda Rio Grande except the area of contamination was larger. Treatment of soil was carried out by excavation and since the total area and the depth were greater, it was decided to divide the area in squares and treat each square one after the other. The first square was excavated and this resulted in 10 piles/stacks of soil (Figure 2). AgroRemed BR CTBA was applied on each stack uniformly after taking the samples of soil before treatment (Figure 3).

At the end of 4 weeks, fresh samples from each stack were collected and sent to LACTEC for analysis. The results were very promising and the value of TPH was almost 500 mg/kg as required by the local regulations (Tables 3 and 4). The excavated soil was replaced in the ditches and monitoring of the soil was continued till end of 2007.

The results are given below and as observed, the TPH values after 4 weeks were near the stipulated values and site was refilled with the same soil.



Figures 2 and 3. Excavation of contaminated soil and piled up as stacks.



Figure 4. Application of AgroRemed



Figure 5. Soil filled back in the pits



Table 3. Results of TPH in the stacks before the treatment.

MANDIRITUBA (Stack Before)	
Point	TPH (mg/Kg)
Mount 1	827
Mount 2	2492
Mount 3	527
Mount 4	1612
Mount 5	3507
Mount 6	142
Mount 7	412
Mount 8	858
Mount 9	3706
Mount 10	308
Average	1408

Table 4. Results of TPH in the stacks after 4 weeks of treatment.

MANDIRITUBA (Stacks After)	
Point	TPH (mg/Kg)
Mount 1	242
Mount 2	911
Mount 3	518
Mount 4	1117
Mount 5	988
Mount 6	618
Mount 7	320
Mount 8	194
Mount 9	335
Mount 10	127
Average	524