

The Rio dos Padres case study – Working in a dangerous area and minimizing the impact of clean-up activities on the environment.

In April 2001, a truck accident in the Brazilian Atlantic rainforest in Morretes, Parana State, caused a 30,000 liter fuel oil spill in a pristine water river. A quick response was necessary to collect oil from the river before the next rain. The river, running along the mountains valley is dangerous, stony, hard to walk on and rain causes its' level to raise rapidly and its' flow to increase, endangering the workers during the cleaning operations. To minimize risks and response time, oil was swept downstream and collection was then made in an advanced point where a dam was built in an easy access location. The decision proved to be satisfactory, reducing operation time. Oiled stones were cleaned one by one after the free oil collection. Workers selection was an important item; they had to be able to exit the area on their own if it rained, and go to safe points. It was an atypical fast water situation where the scenario changes significantly along the river and even alpinism techniques had to be employed.

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The accident

In April 2001, a tank truck carrying fuel oil collided with a soy bran truck, the oil tank ruptured and all its 30,000 liter of fuel was discharged. The oil contaminated the road and run to the rainwater sewer. The sewer discharged the oil to the roadside, into the rainforest and then to a pristine river in this forest.



Fig 1 – The tanker truck in this casualty.



Fig 2 – Tank rupture detail.

The location

The road crosses the Serra do Mar, the mountain chain that separates the coast of the state of Parana from its higher lands, called the first plateau. The road is located in the mountain slope, inside the rainforest, which is a very well protected, preserved and natural area. The accident location is 27 miles far from Curitiba, the state capital.

The regional topography is very difficult, the terrain inclination is very high, the soil slippery, the vegetation dense, and the river rocky with almost no walking area or shores. The road transit is intense, with little extra parking space and the return point far from the accident spot. The altitude difference from the road to the river is around three hundred and fifty meters.



Fig. 3 –Serra do Mar in a view from the road.



Fig. 4 – Road and truck accident.

The oil path

The oil path can be divided in five principal sections:

- 1 – The road, one hundred and fifty meters of the road surface where the oil ran.
- 2 - The “tracks”, one-mile length, very steep, beginning in the roadside and descending through the forest to the river. This section is one mile long.
- 3 – The rock wall, about one hundred feet high, is the transition between the tracks and the river.
- 4 – The “dos Padres” River, near two miles of rocky and steep river in the mountains groove.
- 5 – The “dos Pintos” River, a low inclination, larger and moderate speed river, the “dos Padres” is its tributary.

Immediate facts

Immediately following the accident, the road police and the road controller used part of the bran, from one of the trucks involved in the collision containing soy bran, to absorb the spilled oil. They also tried to block, unsuccessfully, the oil flow in the sewer drains. Due to

the high terrain slope, the oil rapidly ran into the forest and through four tracks reached the river. Our company was called to help in the response in four hours.

The first response

Our response began with forty employees in the first day and reached five hundred and twenty workers including engineers, technicians and other professionals in the next 48 hours. The equipment included two helicopters, four vacuum trucks, two general-purpose trucks, light cars, boats, booms and other equipment.

The road

The first job was to finish the road cleaning. The oil on the road was absorbed with the second trucks' soy bran, sawdust, lime and peat powder, all material was removed from the road surface with shovels and hoes. Contaminated material was conditioned in plastic bags and sent to a petroleum refinery for treatment.



Fig. 5 – Road cleaning and decontamination.



Fig. 6 – Road cleaning and decontamination.



Fig. 7 – Rainwater sewer inlet.



Fig. 8 – Sewer discharge to the forest.

The rainforest

As soon as our company team arrived to the spill site, a group went into the forest to evaluate the extension of the contamination. This first incursion in the forest was very difficult, there were no tracks, the group had to use the water paths where the oil had drained to the river as tracks, and they named them “tracks”. The inclination in these tracks were very steep the final portion, before getting to the river was almost vertical, the mountain descend was made using ropes. At the end of this section, the “tracks” ended in cascades on a rock wall.

The most important contamination was in the river, the Rio dos Padres. This river set in the groove formed by the mountains, has an intense slope, runs between rocks, and, as the first “tracks”, had never known human presence before the accident. The oil reached the river and ran on its surface contaminating rocks, shores and vegetation. There was no injury to wildlife and fishes, the impact on the vegetation not significant. The rivers water was not used for human consumption.

The last part began at the mouth of Rio do Padres into Rio dos Pintos. Rio dos Pintos, unlike “dos Padres”, runs on a flat path, easy to reach, alongside a road, it is slow and shallow.



Fig. 9 – Example of one “track” entering the forest.



Fig. 10 – Partial view of the rock wall.



Fig. 11 – Rio dos Padres typical view.



Fig. 12 – Rio dos Padres typical view

The response preparation

The situation needed an immediate response action. Thus, in the first moments forty people were in the response team. During the next two days, two hundred and sixty workers were put at the site. The number of responders rose gradually to five hundred and twenty in the first week, most of them from contractors. The two main attack fronts were the “tracks” and the river.

The first concern was the workers selection. The ones who had to go into the forest and river must have good physical capabilities. As said before the site had very difficult conditions, and in case of rain it would get worse, the “tracks” getting more slippery, muddy and soft, the river could raise the water level and flow speed very rapid and dangerously. The main river risk being the “cabeça d’água” or “water head” which is a very rapid inundation going down as a big wave that can be five feet high. Even with good weather, the site topography, the distances and the warm to hot season would require healthy and strong people for the job.

Two field bases were positioned, the first one in the roadside, close to the truck collision spot, in this base the company installed a radio communication system, although regular and satellite telephones were used. The second was placed beside the Rio dos Padres mouth in the Rio dos Pintos, this second base had room for the unified command, response team meeting and control room, cafeteria, warehouse, fuel storage and other installations. The two bases had medical assistance installations and ambulances.

Part of the team was trained in booming techniques and only this group handled the booms. All working fronts had job safety technicians to evaluate the safety conditions of the sites, job and workers. All risks were considered, the necessary safety equipment was used in all fronts. Some of the most significant risks were falling in the tracks or river, heat stroke and sun burn, poisonous snakes and insects. In some places, especially in the first days of the response the work was conducted 24 hours a day.

The unified command was composed by representatives from our company, Civil Defense and from the State Environmental Agency. There was not a responsible party in this case, our company, by contract with the truck owner, played his role, since they were carrying the oil for our company.



Fig. 13 – Operational base on the roadside.



Fig. 14 – Operational base on the roadside.



Fig. 15 – Operational base close to the river mouth.



Fig. 16 – Operational base close to the river mouth.

The response techniques

The road

Road cleaning has already been described. The clean-up was conducted with standard procedures.

The tracks

In the “tracks”, the oil was absorbed with sawdust and/or peat powder, packed in plastic bags, and then carried manually up hill; most of the way with rows of men and passing the bags hand to hand up hill, once walking up the hill was very exhaustive. Some residue bags

were too fluid; these bags were packed into buckets to protect against rupture by impact on trees or rocks. At the first working base, at the roadside, the bags were packed in containers and removed for treatment and final disposal at a petroleum refinery. The equipment utilized in this site included shovels, backhoes, plastic bags, buckets, ropes and wood sticks as anchor points. Where possible, in the tracks, small dikes were built to contain the oil. All the hardware and material had to be small and light enough to be carried into the forest without damage to the environment. Although slow and difficult, these techniques were effective and had very good results, technically leaving no oil in this portion of the forest. The cleaning of this section finished in one week.



Fig. 17 – Workers cleaning one of the “tracks”.



Fig. 18 – Worker carrying bag with oil recovering material up hill.

The wall

The tracks finished at a vertical rock wall, around a hundred feet high. The wall was soaked with oil and workers were rock climbing to clean it using high-pressure water jets. At the bottom of this wall, the team built a pool to contain the wash water and recover the oil. The pool was made of sand bags, coated with plastic sheet and drained at the bottom. The oil could then be recovered from the surface of this pool with cans and absorbent material as booms and pads. The oil was conditioned in sealed light drums and carried up hill to the roadside base.

No chemical product was used to wash the rock wall, since it could contaminate the river. The pool water was drained at the bottom into portable oil-water separators and from them to the river.



Fig. 19 – Ready to climb the rock wall.



Fig. 20 – Pool for containment of the wall wash water.

The response on the “dos Padres” River

The “do Padres” River was a singular challenge. Fast water, rocky, steep, virgin, pristine and set inside a natural and closed forest the river demanded an unusual response. Booming was impossible in almost all river extension. The team had to find an alternative point to get into it and this was an unpaved road more than 10 miles turn from the accident site,

from this point to where the spill reached the river, the distance was more than two miles inside the river, in a no less than two hours walk.

Human action in this place would cause damage to the river and the forest. The collected material could not be carried inside the wood without damage to the environment. The river channel was too dangerous to move carrying weight and tools. Timing at this point, was critical for the response.

Sweeping the river was then proposed to the State Environmental Agency. They decided to try a pilot test. We bought some brooms and used them to sweep the surface of the water and rocks. The rocks were already stained with oil, brooms would not cause any additional damage or add difficulty. The water flow carried the oil down river. The test proved successful and then brooms were used in the steep portion of the river. To collect the oil, the response team had luck on their side. Right at the section where the unpaved road ended, which was the best access point to the river, there was a buried oil pipe crossing the river, to avoid erosion and damage to the pipe this portion of the riverbed was covered with cemented rocks forming a square profile. At this point, a dam with bottom draining was built using sand filled bags. The increase in the water level reduced the water speed enough to permit oil to coalesce and float. Containment and absorbent booms and other regular material and equipment could then be used to contain and recover the oil. This location was also safe to work, had good access and some local people had their houses in the neighborhood. The main operational base was placed at this location to provide office space to the response team and unified command, cafeteria, storage and parking area, chemical toilets, medical post and other needs.

The team removed the oil from the river using regular recovery equipment as cans, separator drums and vacuum trucks. All free oil was removed in less than a week, just

before a storm created a “water head” that vanished half dam, at this time there was no free oil in the river.

The river rocks still had oil stains, the best solution to clean them was to rub each one with absorbent pads and synthetic cotton. The rocks were all hand cleaned one by one on the river and put back on their original place. This job took a month to finish. The cleaning cloths were sent to burn on a co-processing plant.

The material used to clean this rocky portion of the river, were brooms, absorbent pads and others that were light, easy to carry to work places and back, easy to pack, did not contaminate the working site, did not leak oil, and let no residue in the water. No chemical product was used on the river and its rocks cleaning.



Fig. 21 – Oil stained portion of Rio dos Padres.



Fig. 22 – Workers in the Rio dos Padres.



Fig. 23 – The dam close to Rio dos Padres mouth in Rio dos Pintos.



Fig. 24 – Upstream view of the dam.



Fig 25. – Manual cleaning of river rocks.



Fig. 26. – Manual cleaning of river rocks.

The response in the “dos Pintos” River

This river had standard response techniques, with the use of containment and absorbent booms, absorbent pads, vacuum trucks for oil recovery. This response does not require any further comments or description.



Fig. 27 – Rio dos Pintos containment point.



Fig. 28. – Booms on Rio dos Pintos.

Special cares

The two operational bases had medical posts had ambulances. The workers or other team members who would go into the tracks or dos Padres River had a specific health check up before entering these sites.

The team had social workers who together with the municipal authorities gave orientation and assistance to the population in the two rivers region.

The rivers waters were periodically analyzed to check for the possible contamination by the oil from the spill. No abnormalities were found.

Conclusion

The innovative technique of using brooms to clean the river associated with the dam proved to be a good alternative. It abbreviated the river cleaning time, caused no damage to the environment, the associated equipment were standard and easy to obtain and use, the brooms, all made of natural fiber, could be easily disposed in co-processing plants or

fragmented and disposed in a land farming site. No special training was necessary to the team. After the cleaning finished no additional recovery was necessary to the sites.

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