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Benefits and Burdens of OCS Activities on States, Labor Market Areas, Coastal Counties, and Selected Communities

Supplemental Study Component

Social and Economic Impacts of the Sinking of Petrobras-36 (P-36) Deepwater Oil Platform

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Background Information

Petrobras

Petrobras was founded in 1953 as a state-owned company after the government decided that all natural resources were the property of the state. Previously, all petroleum products had been imported into Brazil. At the beginning of Petrobras' establishment, there were not many new reserves that were found. This problem compounded the national debt that already existed as a result of the absence of private oil companies investing in the country (Deloitte Touche Tohmatsu, 2002). Since Petrobras was the only oil company in Brazil, it incurred all the exploration risk.

The two international oil crises of 1973 and 1979 severely affected Brazil's economy- mainly due to an increase in import costs. Petrobras was ordered to find more oil. An extensive exploration program began in the late 70's and early 80's that included moving exploration activity into deepwater areas. The discoveries made particularly in the Campos Basin produced lucrative oil fields. In 1988, Article 177 of Brazil's constitution was passed, prohibiting foreign investment in the hydrocarbon industry. This secured Petrobras' monopoly, which in turn secured the state's monopoly on the oil industry (ibid).

In 1997, the 44 year monopoly that Petrobras had held effectively ended when Brazil opened the industry to outside private companies through a series of licensing rounds. The government saw an opportunity for private companies to invest in Brazil, and the result was successful exploration, drilling, and production. Because Brazil's oil consumption grows about 6% every year, and consumes more oil than it produces, exploration is constantly increasing. Petrobras remains the largest oil company by far in Brazil, and is considered to be one of the world leaders in deep and ultra deep water exploration and drilling. Petrobras has used this advantage to partner with many of the outside companies that explore and drill in Brazil.

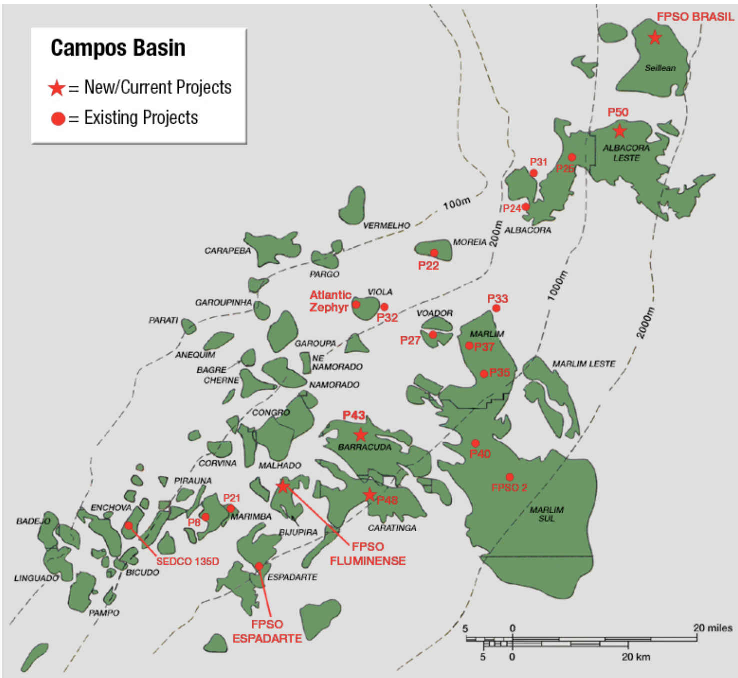
The growing importance of deepwater exploration efforts to a world population that increases consumption annually has led to massive investments by the drilling companies. There have been many large investments and cost overruns made by companies in an effort to have rigs capable of drilling in 10,000 feet of water in the many recently discovered ultra deep oil fields. The impact of these immense simultaneous investments is a push for these companies to earn rates of return that were expected when these rigs were originally commissioned (Coneybeare, D., 2000).

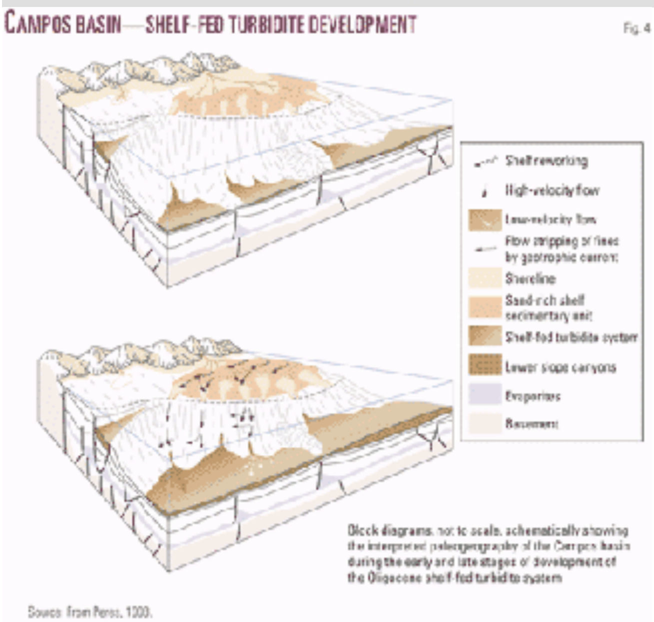
Campos Basin

Most of Brazil is under laid by a Precambrian shield covered by sediment from the Paleozoic and Mesozoic ages. Large thicknesses of sediments have accumulated in Cretaceous basins toward the margins of the shield, which is where the greatest prospectivity lies (i.e. Campos Basin). Brazil contains one of the world's largest sedimentary areas. With 6.5 million km squared in onshore (57.5%), and offshore (42.5%) areas that make up 29 main basins. It is believed that 75% of the country's undiscovered reserves will be found offshore in deep and ultra deep waters.

The diversity in the geological characteristics of Brazil's basins makes exploration and drilling a difficult task for any oil company that operates off its shores. The prolific Santos and Campos Basins were formed in the early Cretaceous period during the breakup of the land that is now South America and Africa. The Santos Basin contains significant exploration risks at this point, due in large part to the poor porosity of the sediment.

The Campos Basin is the country's largest producing region, with 44 total fields, and includes five major fields; Roncador, Albacora, Marlim, Marlim Sul, and Albacora Leste. The Campos Basin has excellent porosity, and is in fact one of the world's most prolific turbidite basins (ibid). The discovery of heavy oil is common in the Campos Basin, which now represents about 80% of the country's oil production. The discovery of the Roncador field, the world's deepest field to date, happened in 1998 and proved to be an important discovery for Brazil and Petrobras. This field is estimated to have reserves of more than 3 billion barrels.





Macaé

Until the oil discovery in 1977, Macaé was primarily an agricultural area, with sugarcane being its biggest economic resource. When oil began to be discovered in the Campos Basin, the effects on the city were immediate. Population growth boomed, with the population soaring from 40,000 in 1980 to 120,000 in 2000. This unequal growth has caused the city to struggle with basic urban services. When Petrobras established Macaé as their center of operations, they also established a system of royalties in the area that provided much needed infrastructure and also led to some of the districts in Macaé to form their own independent municipalities. Because of the petroleum industry in Macaé, and particularly, the advanced technology in that region that exists as a result of the pioneering deepwater activities, Macaé has become one of the top 10 cities in the world for foreign investments- mainly in the form of technological and petrochemical. The city's infrastructure challenges have always presented some difficulty for Petrobras to maintain, and the city is heavily dependent on the success of the oil giant.

<u>The Platform</u>

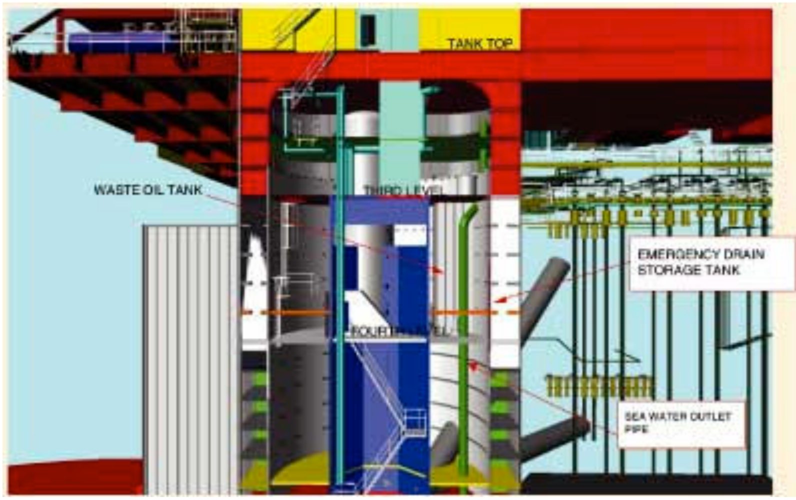
The Petrobras 36 (P-36) was built in Italy in 1994 and was owned by the UK's Midland Scottish Research. It was initially designed to drill oil between 100 and 500 meters below sea level, and was built as the largest semi-submersible platform in the world. It was acquired by lease to Petrobras in 1997, and was intended to operate in the Marlim Sul field. With the discovery of the world's deepest field in 1998- Roncador, the platform was converted into a structure that not only had the ability to operate at a depth of 1360 meters, but also had production capabilities. The production plant that was installed on the platform made the platform the first drilling rig with production capabilities. It had a capacity for processing 180,000 bpd of oil, 720,000 cubic meters per day of gas compression, and 24,000 cubic meters of water injection.

The platform upgrade was carried out in a shipyard in Quebec, Canada by Canada's Davie Industries. In 1998, the Davie shipyard declared bankruptcy, which caused some upheavals in the work schedule. During May of 1999, Petrobras entered into a contract with a division of Maritime for completion of the project and delivery of the resources. Petrobras claimed that there were errors and delays in the delivery which caused them $144 million in loses. Maritime, however, claimed that the platform had been delivered on time and to contract specifications, and filed a lawsuit against Petrobras for not fulfilling their contract obligations. The adaptation project was initially estimated to last 80 days with a cost of $400 million dollars, but instead took 540 days, and cost over $500 million dollars. The equipment that needed to be added to the platform was 3 thousand tons, raising its gross weight to 31.4 thousand tons. On October 1999, the 31,400 ton platform was loaded onboard a structure of the ship Mighty Servant I, and began an 18 day voyage to Brazil. In order to transport such a large vessel, a system known as "dry tow" was employed. The Mighty Servant's structure was extended by 30 meters to fit the platform, with the extension being submerged in order to haul the rig above it. After a few months in Guanabara Bay, the platform was installed in the ultra deep waters of Roncador field near the Rio de Janeiro State Coast.

The permanent production system that was positioned in the field was comprised of two floating units that would act together. These were the P-36, and the P-47. The P-36 would drill, process, and treat the oil, and then transfer it to the P-47 storage platform via three pipelines totaling a distance of 86 km. The oil was stored there for later transportation to the mainland by shuttle tankers.

Main details of P-36

Constructed:	1994
Converted:	1997
Water depth capacity:	1360 meters (4,462 feet)
Length:	112, 776 m (370,000 feet)
Width:	95,580 m (313,582 feet)
Height:	119,150 m (390,912 feet)
Length (hull):	83,104 m (272,651 feet)
Breadth (hull):	68,580 m (225,000 feet)
Unloaded weight:	31,400 tons
Maximum displacement:	56,503 tons
Accommodation capacity:	115 people
Producing wells:	21 (+2 spares)
Water injecting wells:	5 (+2 spares)
Oil export lines:	3
Gas and fuel export lines:	2
Gas Compression system:	7,200,000 cubic meters/day
Oil exportation:	28,600 cubic meters/day
Lift gas capacity:	2,000,000 cubic meters/day
Water injection rate:	24,000 cubic meters/day
Production capacity	180,000 bpd (at time of accident)



The Accident

Report of the Event

At 12:20 a.m. on March 15th, 2001, there was an explosion that took place on P-36 that shook a column of sustention of the P-36. The sensors had sensed a strong gas odor, and the emergency brigade was set in motion. All operations of the platform were suspended. At 12:24 a.m., another explosion occurred which was stronger than the first, and immediately killed one of the employees. Evacuation of the platform ensued, with exception of emergency personnel.

Between 12:35 and 12:40 a.m., there was a 3rd explosion, and between 1:00 and 7:00 a.m. employees were transferred 12 kilometers away to the P-47. One hundred fifty one victims were given first aid, and then transferred via 11 participating ships to the city of Macaé for further treatment. The remaining emergency team tried to control the fire, but evacuated upon realizing that the platform was sinking. Ten more were killed in the accident, their bodies trapped in the vessel.

Over the course of the next few days, technicians tried to save the tilted platform while divers injected nitrogen and compressed air in the columns of the platform in an attempt to prevent it from sinking. Six days later, the P-36 sank. With it, 1,200 cubic meters of diesel oil, 300 meters of oil, and 9 bodies also sank. The total number killed in the accident was 11, which brought the total number of workers killed in Petrobras platform accidents to 81 in less than three years.

Investigation of the Accident

The technical causes of the accident were listed as a series of events initially triggered by a blockage of an emergency drain tank which was related to the production process. This tank was blocked by a valve and normal drain operations were not working because the drain pump had been withdrawn for repairs. However, before the blockage occurred, the valve had let some oil, gas, and water through for about an hour, overfilling the compartment. It was not known whether a worker had left the compartment door slightly open, or another mechanism caused it to have the opening. As a result of this overfilling, the tank's hull could not support the mounting pressure, and broke. This unleashed a larger amount of gas which crushed water pipes inside the column, and the column began to flood.

At that point, the rig's ballast operators injected water into the opposite column to try to level the platform, which was later considered to be an action that most likely led to its ultimate sinking. Ventilation shafts then took the water to other compartments, and two watertight tanks were flooded through check doors which were erroneously left open. The progressive flooding caused the rig to list further, and finally sink to the bottom of the ocean, despite attempts at that point to save it (Rigzone, 2001).

Following the explosion and consequent sinking, investigations were launched in an effort to uncover the non-technical factors that led up to the accident. Among other things, the investigatory commission of the P-36 accident, overseen by the Norwegian shipping classification group Den Norske Veritas, concluded that the accident was a "result of a chain reaction involving many people and processes" (Rigzone Newsletter, 2001). The ANP (National Petroleum Agency), Brazil's regulatory agency, conducted their own independent study which drew many of the same conclusions as the investigatory commission. The ANP put out a report which was 34 pages long and listed over 20 problems leading to the accident- including faulty valves and tanks, and inadequate training, supervision and coordination (Rigzone, 2001).

According to statements made at a Brazilian senate hearing following the accident, rig managers had issued repeated internal bulletins saying that a malfunctioning part needed to be replaced in order to alleviate a gas pressure problem. The rig managers decided not to temporarily shut down the platform P-36 while it waited for the replacement part. At the hearing, Petrobras CEO Henri Philippe Reichstul testified that he wasn't notified of the gas pressure problem until after the accident. He said that the rig managers made the decision to continue oil production, which they had the authority to do. This statement was corroborated by Jose Coutinho Barbosa, the director of exploration and production at Petrobras, in an interview given to the Joinville newsletter on March 23, 2001. Coutinho stated that a bulletin informing on the problem of pressurization of the system vent of the platform was written by the supervisor of production of the P-36, Helium Menezes Galvão, and directed to the section manager on land, Claronildo de Covas Saints. According to Coutinho, each technician had the authority to order the stop of production of the platform in the case that they concluded a problem. The information was excluded from the system after the accident for the controlling generality, Carlos Eduardo Bellot.

According to Coutinho, this was done with the intention of preventing modification of the text (Joinville Newsletter, 2001).

The question remains then, if these managers each had the authority to temporarily halt production, why would they not do so in the light of information they had regarding the pressurization problem? Mauricio Ruben, director of the Oil Workers Federation (FUP) comments that "any Petrobras manager would have a hard time shutting down a rig that represented 6% of Brazil's oil production….especially when he knew that boosting oil input was the company's number one priority" (Kepp, 2001). Ruben and others postulate that the managers very likely were reacting to the new success standards in place at the oil giant since Reichstul took the reigns of the company in 1999. Since then, production has jumped in large scales, and as recently as one month before the accident, Reichstul announced a $29.4 billion (U.S.) program which was aimed at increasing output almost 50% by 2005.

During this fervor, the Brazilian government- who owns approximately 98% of the company's stocks- had little motivation to scrutinize the oil giant's practices. In 2000, their $5.5 billion in net profits accounted for more than one fourth of the government's 2000 budget surplus, and was five times bigger than their 1999 production levels (Kepp, 2001).

Another reason for the urgency in production push was due to discrepancies in contract fulfillments between Petrobras and its equipment manufacturer, Maritima. The delay of parts and equipment shipping that occurred had profit-bearing effects on Petrobras. This can be illustrated in a similar case involving the Stolt Offshore production company: Stolt purchases its equipment with local currency, but makes its profit in U.S. dollars. Because of the discrepancy caused by fluctuation of value, the timeliness of delivery of equipment is crucial to the profit margin of the company (U.S. Securities Exchange Commission, 2000). The case between Petrobras and Maritima, in which the latter failed to adhere to its deadline in delivering equipment to Petrobras, is an illustration of this pattern, and the negative impact on profit margin that the company incurred as a result created another factor in urgency of production.

This production push, however, is not the only factor involved in the increase of the number of accidents and spills that Petrobras has seen in recent years. Environmentalists, labor leaders, engineers, and safety specialists point to Petrobras' failure to invest in worker training and safety programs, in addition to their well-known practice of hiring less trained and less expensive contracted labor from outside the company. Also cited was the new technology used in P-36 of combining the production process with the drilling process on deep sea platforms (the committee found that a valve of an emergency drain tank triggered the chain of events leading to the blast on the platform).

Among the recommendations that the investigation committee made after the accident were to reduce the bureaucratic workload of managers and supervisors in order to allow them to focus on operations, and that manufacturers and operators abstain in the future from putting any vessels linked to the production process inside the support columns of pontoons (Rigzone, 2001, corroborated by Offshore Magazine, 2001). However, the practice of including production with drilling is increasing, due to the large capacity of oil that can be obtained more quickly.

Using some comparative analysis in order to explain some of the commonly accepted practices in offshore technology, one case that can be cited is the *Piper Alpha* accident in the North Sea. In the investigation of this accident, it was found that a widely accepted system for rating the safety of oil platforms is the concept ALARP (as low as reasonably practicable). ALARP states that high standards of safety are extremely costly, and that absolute safety cannot be achieved in offshore drilling processes (Basu et. al, 2001). There are some shortcomings to this concept however. One of these is inadequate historical data, and another one is the difficulty in statistically categorizing human error. This poses an obvious dilemma then when 80% of all platform accidents are attributed to human error.

The initiating event of the P-36 was more global than local in that it was an explosion of a non-structural component that damaged the structure of the vessel to the extent that watertight integrity was compromised. In most cases of semi submersible failure, the causes have been either structural failure which is due to extreme fatigue loading, or a ballast system failure. In most of the latter cases it was not a single failure, but an initiating event which was contributed to- the contributing factor often being bad weather (ibid).

The data required in order to accurately explain the probability of system failure in a semi submersible structure is generally not available. This is due in large part to an incomplete analysis of the interaction between structural and non-structural components which are being increasingly practiced by the industry (ibid).

In fact, the structural reliability analysis (SRA) which a lot of offshore companies employ, is quite incomplete for the new technology that exists on these platforms of incorporating production and drilling. SRA applies to buildings as well as offshore vessels, and treats only the loads on a structure and the resistance of the structure within a framework. So, when SRA is applied, it is typically narrow in scope (ibid). Since some of the ultimate failures are a result of multiple component failures- of which only some may be structural in origin- the SRA may not address all potential problems of the structure. The inadequate analysis particularly includes interaction between structural and non-structural components (such as those used for the production process). While still incomplete, the SRA was developed primarily due to the poor safety standard of offshore oil drilling and production rigs in the past half century.

Effects of the Accident

Immediate Financial effects

Petrobras spent about $100 million dollars in its efforts to save the $450 million dollar rig. Total damages resulting from the loss of the rig were estimated at approximately $1billion.

Consequent Results at Petrobras

When P-36 sank, it was the latest in a recent history of major accidents for the oil company. As a result, licensing regulations for the oil giant to operate have become more stringent. In November of 2001, there were long delays in receiving the environmental license necessary to install its new production platform, the P-40. In fact, with regard to that platform, Petrobras was fined $3.9 million for laying the underwater pipelines for the rig long before obtaining the license. The delay that the licensing caused created a forecasted decrease in output of 2 to 3 percent, and a loss in production and profits of about 4 % for the year. Also, as a result of the string of accidents and spills in the course of his 3 year leadership of the company, Henri Philippe Reichstul stepped down as CEO, citing personal reasons (Reuters, 2001).

Since 2001, the company has increased exploration and drilling, in an attempt to achieve the ability to produce the majority of Brazil's oil. They have installed new platforms in the Campos Basin (with production capability), and have entered into a controversial pipeline project in the Amazon. They have also begun ultra deepwater exploration in other territories- most notably off the coast of Africa.

Victims of the accident and their families

Eleven workers died in the accident, with 9 of the bodies being unable to be retrieved from the platform that sank. 11 indemnification lawsuits were filed by the families of the workers. According to Brazilian law, (article 159 of the civil code), Petrobras may only make indemnification payments that have been legally justified. That is, reparations cannot be made until proof of blame is found (Petrobras PR Department, 2001). The indemnity proceedings were carried out by the relatives of the victims, and Petrobras agreed to pay the relatives in one single installment- the salary payments for life. These ranged for each family from R$22,000 to R$70,000. There was controversy regarding the 9 bodies trapped in the platform, which carried a possible per day fine for the company if not retrieved.

Ecological damages

Petrobras was fined by Ibama (Brazilian Institute of Protection of the Environment) the amount of $8.9 million U.S. for spilling 316,000 gallons of oil into the ocean after the P-36 sank. As a result of the same accident, there was a blowout on April 13 which spilled another 6,600 gallons of crude oil into the ocean. Ibama also fined Petrobras another $890,000 U.S. for an "inappropriate" use of detergents to break up one of the spills. Petrobras was subsequently ordered to pay the fines (USA Today, 2001).

An oil spill can have a number of direct and indirect effects on fisheries as well. Valuable fish and shellfish areas may be closed for fishing for certain periods of time because of the risks of the catch being tainted by oil. Therefore, the fishing sector can suffer a heavy loss if consumers are either stopped from consuming, or unwilling to buy fish or shellfish from an area that has been perceived to be contaminated by an oil spill (Global Marine Oil Pollution Information, 2003).

Social and Economic effects

Immediately following the accident, the FUP staged slowdowns, and Petrobras shares plummeted 6.8% on the São Paulo stock exchange, weakening the already low Brazilian real. (Muello, 2001). Brazil's oil demands also exceed its production by about 50%. Because of this, Petrobras, who has the monopoly of oil production and refinement in Brazil, needed to import more expensive oil from overseas in order to offset the loss of local fuel output. This meant using dollars to buy the oil, which put more pressure on an already struggling local economy (Dovkants et al. 2002). Insurance costs rose to $39.1 million (U.S.) per year as opposed to $7.3 million (U.S.) per year just the year before. The biggest cause of the insurance increase was the P-36 accident (Poltz, 2001).

In fact, the offshore insurance market has been worsening in recent times (as recently as March 2003) due to a number of problems in the market, including the p-36 platform disaster, which was a major blow to the insurance industry and affected the availability of capital. Aside from the increase in price of insurance costs, a more accurate description of how these costs affect the tax payers in the long run is as follows; Because of the capital market tightening up as a result of the weakening local economy, insurance premiums are being driven up, and there is a number of exclusions that are consequently written into insurance policy. Because a number of companies have subsequently gone out of business (e.g., Reliance, Amwest, and Frontier), there is more pressure on the remaining providers who are forced to write more bonds. These costs are then taken on by operators of the projects that go forward, and tend to trickle down to oil and gas prices. When the states and federal government increase bonding requirements, a capacity strain is put on the insurance companies. In cases where a bond can't be written, the operator must put up cash to cover the requirements, which can be very costly. This also taxes the resources of operators, leading to more defaults and orphaned wells. Ironically, this process worsens the situation that bonds are designed to improve. When the bonding prices are too high, the taxpayers end up with more of a burden in the long run (National Petroleum Agency report, 2003).

On a more local level, the area mostly affected by Petrobras' Campos Basin activities is the northern part of Rio de Janeiro State. In less than two decades, that state's economy has shifted from being primarily based on agriculture to being primarily based on oil production. The biggest city in the region is Macaé, which produces 80% of Brazil's oil. This city experienced a population growth of 40,000 in 1980 to 120,000 in 2000. A daily mobility of about 35,000 workers linked to Petrobras has always presented a major challenge to the city's maintenance, which relies heavily on the success of the oil company. The region receives royalties from Petrobras' oil production, which are important to the infrastructure of the region. Disasters that occur in relation to Petrobras' oil production severely affect the economy of Macaé and its delicate infrastructure. When programs and royalties have to be cut back on an already strained local economy, the effect on the population can be devastating.

The social and economic impact of spills can continue for future generations due to the ripple effects through the economy of people losing their jobs (Cousteau, J-M, 2002). An example of this is that after the accident, the number of Petrobras employees dwindled from about 62,000 to 34,000. This was due in large part to the indemnity payments made to the victim's families, and education aid that was offered to the children of the deceased workers.

Recent history of major spills at Petrobras

1984- 34 people killed in an oil explosion and fire on offshore platform.

January 2000- one million liters of oil from a Petrobras tanker polluted Rio de Janeiro's Guanabara Bay resulting in a $28 million fine.

July 2000- 4 million liters of crude oil spilled from a broken pipeline into the Iguaçu River resulting in a $110 million fine.

March 2001- P-36 platform sinks killing 11 workers and spilling 322,600 gallons of crude oil into the ocean.

May 2001- Petrobras' Paulinia pipeline ruptured dumping 220,000 liters of fuel oil into a residential neighborhood in Sao Paulo.

Oct. 2001- A sunken tanker spilled 103,000 gallons of an oil product into the Paranagua Port area.

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