Oil Spill Prevention and Response Planning for Caspian Pipeline Consortium (CPC)

David Fuhr
Regional Manager – Marine Terminal

Caspian Pipeline Consortium is the first joint venture pipeline in the Former Soviet Union. This pipeline serves as an example of mutually advantageous international cooperation between governments – Russia, Kazakhstan, and Oman – and among major international oil companies. Ten companies from six countries combined forces to implement this $4.6 Billion investment project in Russia and Kazakhstan. The CPC is a multinational consortium, with the Russian government holding 24% of the company's shares, Kazakhstan 19%, and Oman 7%. U.S. oil company Chevron Corp. has a 15% stake; Lukarco BV has a 12.5% stake, Rosneft/Shell Caspian Ventures Limited 7.5%, Mobil Caspian Pipeline Company 7.5%, Agip International (N.A.) NV 2%, BG Overseas Holding Limited 2%, Kazakhstan Pipeline Ventures LLC 1.75% and Oryx Caspian Pipeline LLC 1.75%.

The CPC pipeline is 1510 km long extending from the Tengiz oil field in Kazakhstan to the Marine Terminal outside of Novorossiysk on Russia's Black Sea Coast. There are 5 pump stations, 2 in Kazakhstan and 3 in Russia with a current capacity of 30 million tons of oil per year, or approximately 650,000 BPOD. Crude oil is injected into the pipeline at Tengiz, Atyrau and Kropotkin, by twelve different shippers.

One of the primary objectives of CPC is to operate in an environmentally friendly manner. This translated into prevention of spills. The first way that CPC prevents the spills is due to its design characteristics. The CPC pipeline was built using state of the art technologies and equipments. International standards in engineering, construction, operations and environmental safety were applied during the project development. The CPC environmental protection measures which are unique to this region accounted for 12 percent of the total construction budget. Some of the construction methods used to prevent spills included use of horizontal directional drilling for the majority of the river crossings. This puts the pipeline below the surface and minimized the potential for damage to the pipeline. The Volga River crossing is 1,359 meters long, it lies 60 meters below the surface and 30 meters below the bottom wash out level. All pipe used in the crossings have wall thickness varying from 50 to 100 percent more than the normal pipe thickness for the rest of the pipeline. All river crossings are equipped with remote operated block valves on both sides of the rivers, so that in case of a leak, flow can be stopped and the sections isolated to minimize any potential spill.

The entire pipeline is controlled and monitored using SCADA system. A high speed fiber optic cable is laid along the pipeline route which permits the SCAD system to monitor nearly 30,000 data points on an instantaneous basis. The SCADA system is based at the Marine Terminal and operated by two dispatchers, one for the pipeline, and the second for the tanker loadings.

At the Marine Terminal Tank farm, which is located in a class 9 seismic area, potential spill or leaks from the tanks are reduced to a negligible probability as the foundation structure virtually rules it out due to a multi-layer compaction sand and gravel cushion, solid hexotextile reinforcement, all covered with a high density polyethylene (HDPE) membrane to prevent oil from penetrating the soil, and thickened walls made of corrosion-treated steel. Each tank is surrounded by the normal bund wall; in addition a perimeter of dykes captures all runoff and prevents any discharge in the unlikely event of failure.
For the Marine Terminal loadings, Single Point Mooring (SPM) systems were chosen as they were felt to be the safest. These prevent potential collisions between ships and docks and allow

the vessels to move with any changes of weather which could damage the ships. There are currently 2 SPM's in operation, both approximately 5 kilometers offshore. The Russian Federation has declared the area around the Marine Terminal and SPM's a restricted area which prohibits any vessel not engaged with the loading from entering the area. This greatly reduces the possibility of the pipelines that are running from the shore to the SPM's being damaged from anchors or fishing equipment. In the event of a leak in the offshore section of the pipeline, a system of pumps is installed to evacuate the oil in the line back to a tank at the Shore Facilities. Due to the differential pressure of the seawater outside of the line and the oil inside the pipeline, there would be minimal oil leakage except in catastrophic failure.

The second method to prevent spills is proper maintenance. The pipeline is catholically protected, and this is continually monitored using the SCADA system. If the cathodic protection readings show trends that are outside the set points, alarms are sound and the section of line is inspected to find the cause of the alarm. Also the pipeline is inspected annually using smart pigs to locate any defects and possible internal problems. The offshore loading system of hoses connecting the subsea pipeline to the SPM and also the hoses from the SPM that are used to connect to the tankers are replaced at regular intervals. These hoses are double carcass type to prevent leaks; however, CPC tends to error on the safe side on these replacements as destructive test of hoses that were replaces showed that the burst pressure of the inner lining of the hoses was five times the maximum working pressure after recommended service life. CPC also conducts an annual survey of the subsea line using a remote operated vehicle (ROV). This ROV survey also does a potential survey of the sacrificial anodes to ensure that the cathodic protection is active.

The third method to prevent spills is inspections and security patrols. There is a large number of illegal taps to the pipelines in this region, and they are the highest risk to causing oil spills along the CPC pipeline. CPC utilizes leak detection software to ensure the integrity of the pipeline during normal operations. This leak detection software has been fine tuned now that leaks can be pinpointed within 1 kilometer range. By use of this leak detection software, CPC has greatly reduced the number of taps into our system, and thereby reduced the potential for spills. CPC also has a network of video surveillance along the pipeline and critical areas that is continuously monitored. There are also random patrols along the pipeline and frequent aerial surveys to identify if any activity is being done that is not approved and may impact the pipeline. Continual patrols by our vessels in the restricted area also insure that no entry into the area is attempted. Finally, as tankers calling on CPC are part of the risk of spills, CPC utilizes a vetting system to ensure that only safe and mechanically sound vessels call on our terminal.

These methods have been very successful. In 4½ years of operation, 85 Million tons of oil (670 Million bbls) has been transported and in 2005 there was 1 spill of 28 bbls of oil spilled onshore, all due to illegal taps, and no spills or leaks offshore.

As shown CPC has taken great efforts to prevent spills, but as we all know accidents can and do happen. CPC has committed a lot of time and resources to developing a system for spill responses along the pipeline. This system consists of several parts including equipment, personnel, training and drills.

The terrain along the pipeline is varied, from the coast flood plain of the Caspian Sea, to wetlands around the Ural, Volga and Kuban rivers, to flat agricultural area and finally the crossing of the Caucasus Mountains ending at the Black Sea. Due to this such varied terrain, the response system for the CPC pipeline is staged along the route of the pipeline near critical points. Each location has a contingency of personnel and equipment for specific for that location. The

equipment chosen for each site fits the terrain for the potential response. For instance, along the flood plains and wetlands, all terrain vehicles are available, in the agricultural lands and mountains, all wheel drive vehicles are chosen. Staged near each major river crossing is a series of river booms and boat to deploy them. Each site also has a package that contains such items as skimmers, pumps, portable tanks, and sorbant material and booms, just to list a few.

CPC utilizes a Geoinformation System database (GIS) to store and process a large body of information of the pipeline route. This database contains digital maps such as topographical and pipeline route also land use maps. The GIS interface allows our response teams to properly plan the response strategies.

For the offshore spill response, CPC has a system of 13 response vessels including one specialty oil spill vessel. These 13 vessels along with the corresponding booms and other equipment have a theoretical capacity to contain a spill of 1500 tons. There is also a set of shore protection booms as we are operating near 2 popular resort beaches on the Black Sea. For maximum effectiveness of boom deployment, CPC is currently utilizing PISCIS II oil spill modeling software in cooperation with the Novorossiysk Maritime Academy. This is software that utilizes actual current, wind, and sea conditions along with specific characteristics of the crude oil, and predicts the behavior of the spill. Placement of the ships and booms is then simulated to show the most effective method of spill containment. CPC maintains a weather monitoring station on one of the SPM's that provides that actual weather conditions in the event of a spill.

All of this equipment is great, but if the response teams are not familiar with it, then any response may be delayed or less than effective. To this effect CPC regularly conducts drills utilizing various scenarios. In 2005, CPC conducted drills along the pipeline. CPC also participates in Regional drills, such as the annual drill in the Port of Novorossiysk.