The risk analysis examined each oil transferring component of the LOOP deepwater port, from the floating hoses that connect the tanker at an SPM to the main oil pipeline connecting the marine terminal to the mainland. For each of these components, the analysis considered all credible accident scenarios that could violate its oiltight integrity. These scenarios included adverse weather, overruns by surface vessels, propeller and anchor damage, material defects or failures, maintenance mishaps, and corrosion leaks. For each scenario the leakage rate, detection time, and consequential oil spillage were determined.

The risk analysis also looked at tanker spill scenarios where LOOP might be solely or jointly responsible for accidental spills from a tanker.

Scenarios based upon damage caused by acts of war, God, or third parties were not evaluated because a deepwater port is not liable for such spills.

## 9. LOOP's Pipeline System

LOOP's pipeline system is designed to transfer crude oil at rates up to 100,000 bph (barrels per hour). However, the actual transfer rate at any given time is dependent upon the cargo pumping capacity of the discharging tanker. Most of the tankers calling at LOOP cannot discharge at the maximum rate; LOOP estimates that the maximum transfer rate actually occurs less than 10 percent of the time.

The pipeline system consists of two floating hoses that connect the tanker to a single-point mooring (SPM) buoy, and a buried 56-inch diameter seafloor pipeline that connects the SPM to the LOOP pumping platform. There are three SPMs at the LOOP marine terminal (but only one at a time actually transfers oil). A 21-mile, 48-inch diameter seafloor pipeline connects the pumping platform to the Fourchon booster station (located 3 miles inland from the beach) and then to the Clovelly Dome storage facility (another 23 miles away). The pipelines are constructed of 1/2-inch-thick steel. Offshore, the tops of the pipelines are buried at least 4 feet below the seafloor; as the pipeline approaches the beach it is buried even deeper.

The two floating hoses are approximately 1,100 feet long; their volumetric capacity is 570 barrels each. The SPM pipeline is 8,150 feet long; its volumetric capacity is approximately 25,400 barrels. The main oil pipeline is approximately 18 miles long from the marine terminal to the beach; its volumetric capacity is 213,000 barrels. During a transfer operation, the total pressurized pipeline fill from tanker to beach, including the SPM and pumping platform components, is approximately 240,000 barrels (the two other SPMs are not pressurized and are isolated by control valves). By way of comparison, the total cargo capacity of the EXXON VALDEX was 1.6 million barrels.

However, there is no credible accident that can split open any pipeline along its entire length and completely spill its contents. A more creditable scenario is a local rupture or fracture of the pipeline. High leakage rates can only occur while the pipeline is pressurized during transfer operations, when the internal oil pressure is considerably higher than the external mud and seawater pressure. The leakage rate will depend upon (1) The cross-sectional shape and area of the rupture, and (2)the internal or external pressure differential, which may be 200 to 450 psi (pounds per square inch) depending upon how far offshore the leak occurs. The total amount of spillage will depend upon how much time elapses before the leak is detected (or suspected) and the pipeline is shut down and depressurized.

## 10. LOOP's Leak Detection System

LOOP's main oil pipeline (from the offshore marine terminal to the Clovelly Dome storage facility 45 miles away) is computer-monitored by a Supervisory Control And Data Acquisition (SCADA) system which provides flow volume and leak detection service. LOOP's SCADA system consists of 140 temperature, pressure, density, and other sensors that provide oil flow data from three field sites along the pipeline: the marine terminal, the Fourchon booster station, and Clovelly Dome. Each field site has two redundant SCADA computers. Although one computer is designated as primary and the other as backup, both computers are on-line simultaneously and independently process all data. In addition to performing normal data processing, both computers also monitor system integrity to detect any component or system malfunctions (including cross-checking each other several times per minute). Electrical power to the computers and sensors is from uninterruptable power sources (UPSs). The field site computers communicate with the computers at the LOOP Operations Center via microwave transmissions. The SCADA system can immediately detect any pipeline malfunction or anomaly and trigger alarms at the Operations Control Center. The Operations console is manned around the clock with two persons (Oil Movement Controllers, OMCs) whenever oil transfer operations are occurring. From the Operations console,

the OMCs can shut down the pipeline by remotely closing various control valves and tripping pumps off-line.

The pipeline sensors are scanned every 3 to 5 seconds by the SCADA computers, which immediately compare them to allowable high and low values. A major rupture of the pipeline system will cause out-of-bounds readings at several different sensors, and trigger alarms at the Operations Control Center.

To detect smaller leaks that do not cause out-of-bounds readings, the SCADA computer also continuously compares the actual metered inflow volume at the marine terminal with the estimated flow volume at various points in the pipeline (as calculated from the sensor data), looking for volumetric discrepancies. Short-term discrepancies of 50 cubic meters (314 barrels) in 13 minutes or 80 cubic meters (503 barrels) in one hour will trigger an alarm. Even smaller leaks will be detected on the basis of long-term discrepancies of 200 cubic meters (1,257 barrels) in 48 hours, based upon the metered inflow at the offshore terminal and the metered outflow at Clovelly Dome. This threshold is the limit of the line surveillance sensitivity.

LOOP investigates a discrepancy by performing calibration checks of the sensors and meters. If these do not reveal any malfunctions or resolve the imbalance, then a special pipeline overflight will be initiated to visually search for any leakage. If necessary, the pipeline can also be pressure-tested in conjunction with the overflight. A pressure test would consist of stopping the oil flow, statically pressurizing the pipeline to 200 psi, and monitoring the pressure for a minimum of 1 hour. Any loss in pressure would indicate a leakage. In its 12-year operating history, LOOP has never had to pressure test the main pipeline due to a volumetric flow discrepancy. (The pipeline has been pressure-tested twice for other reasons not related to volumetric discrepancies, and the floating hose and SPM sections of the pipeline are routinely pressuretested as part of post-maintenance integrity verification before being put back into service).

In addition to the SCADA system, LOOP also conducts weekly overflights of the entire 45-mile pipeline right-ofway for visual detection of any leaks and to ensure that no unauthorized third-party activity (ashore or afloat) is occurring which may damage the pipeline. Such activity might be a dredging operation in the marshes or an oil drilling rig being positioned in the vicinity of the LOOP pipeline.

The floating hose and SPM seafloor pipeline section between tanker and