GROUND SUBSIDENCE DUE TO OIL PRODUCTION, THE CASE OF THE COSTA ORIENTAL OF LAKE MARACAIBO, VENEZUELA

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ABSTRACT

Ground subsidence associated with oil production in the east coast (Costa Oriental) of Lake Maracaibo (COLM) in western Venezuela) was detected as early as 1929 and has reached as much as 6,4 m in areas of intensive oil production as of April 2004.

The topography of the area (low, swampy lands) prompted the need to protect inhabitants and oil industry installations from lake waters with earthen coastal dikes.

The progressive construction of these dikes was started in 1929 and is still in progress. These dikes, together with inner diversion dikes as well as a sophisticated drainage and pumping system, conform the Costa Oriental Protection System with the "polders" of Tia Juana, Lagunillas and Bachaquero, which correspond to the oilfields of the same names, collectively know as the Costa Oriental oilfields.

The coastal dikes are located in a seismic area of low to moderate intensity. Seismic geology and seismicity studies were carried out from 1985 to 1988. These studies showed a moderate seismic risk, mainly due to the possibility of liquefaction of a loose, saturated, silty sand layer in the dike foundation soils.

Mitigative measures, consisting of downstream berms, soil improvement by means of compaction piles in some sections, and the extension of the upstream riprap protection system have been implemented in about 25 of the total 47 km of coastal dikes.

The implementation of these mitigative measures has l increase the return period of the design earthquake from about 130 years to 3000 years, the return period typically used worldwide for the design of earth dams in seismic areas.

This project is a good example of what should be the appropriate interaction of natural disaster prevention with sound development plans prepared by the Venezuelan oil industry.