Integration of 3-D and site survey seismic data in analysia of near- surface hazards to platform location at Dulang Field

ZURAIDA MAT ISA[1], HAMZAH YUNOS[2] & F.W. RICHARDS[1]
[1]Esso Production Malaysia Inc.
[2]PETRONAS Carigali Sdn. Bhd

Site survey work at Dulang, which is operated by Carigali in partnership with EPMI, was conducted by integrating data from the 3-D seismic survey, shot for exploration and field development purposes, with the site survey data, acquired specifically to address the seabed and near surface. This approach provides a quicker and more comprehensive interpretation than would have been achieved by the more conventional approach of interpreting the site survey data alone.

The 3-D seismic survey comprised about 1100 km of digitally recorded and proposed multichannel data, with a 75 m line spacing. The site survey comprised the following four data sets with a 100 m line spacing:-

- High resolution digital seismic data. The shooting parameters were designed for high resolution in the uppermost 500 - 1000 m. The source, a high resolution air gun array, gave frequencies from about 10 to 250 Hertz.

- Boomer data. Employing an implosive source, these analogue data, recorded on paper, had peak frequencies in the range 2-7 kiloHertz, which provided very high resolution but limited penetration (about 60 m into the seabed).

- Sidescan sonar data. These very high frequency analogue data were generated by transducers, which emit 105 kiloHertz pulses. The sidescan sonar imaged the seafloor obliquely, about 100 m on either side of the ship's track.

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 17, No. 6, November-December 1991

- Echo Sounder data. The echo sounder data provided detailed water depth information, using a high frequency transducer source.

The main hazard to platform location at Dulang was identified to be a Pleistocene channel, about 500 m wide, which cuts from near the seabed to about 80 m below the seabed. Soil borings showed the channel-fill to comprise dominantly stiff clays, but with significant organic material and some coarse clastics at its base. Generation of timeslices on the 3-D workstation enabled essentially instantaneous mapping of this channel and its associated point bar. With the additional resolution provided by the Boomer data, it was possible to identify rising gas plumes, sourced from biogenic degradation of organic matter, in the sediments at the channel margins. In concert with the sidescan sonar data, these could be seen to have caused up to 5 m seafloor depressions where they have reached the seabed. Evacuation of water and gas has caused proliferation and coalescence of seafloor pockmarks above the channel margins.

Two potential platform locations were identified on the basis of this interpretation, an optimum location (for drilling considerations) at the channel centre and an alternative outside the channel. Subsequent soil borings and engineering tests showed both locations to be acceptable, and the A platform was successfully installed at the optimum location without encountering any hazards.