

PROJECT PROFILE

MEDGAZ PIPELINE SEISMIC AND GEOHAZARD ASSESSMENT

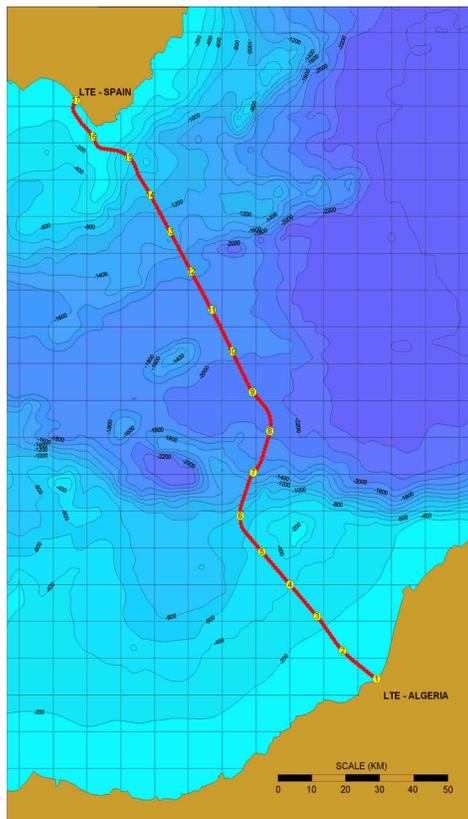
Intec Engineering performed the front-end engineering design (FEED) for the Medgaz Pipeline between Beni-Saf, Algeria and Ramblas de Morales, Spain. The pipeline route crosses the Mediterranean Sea in water depths up to 2,160 meters, and crosses a number of faults and submarine landslides.

D'Appolonia was responsible for the geohazard evaluation for this project; the primary technical issues associated with this effort included:

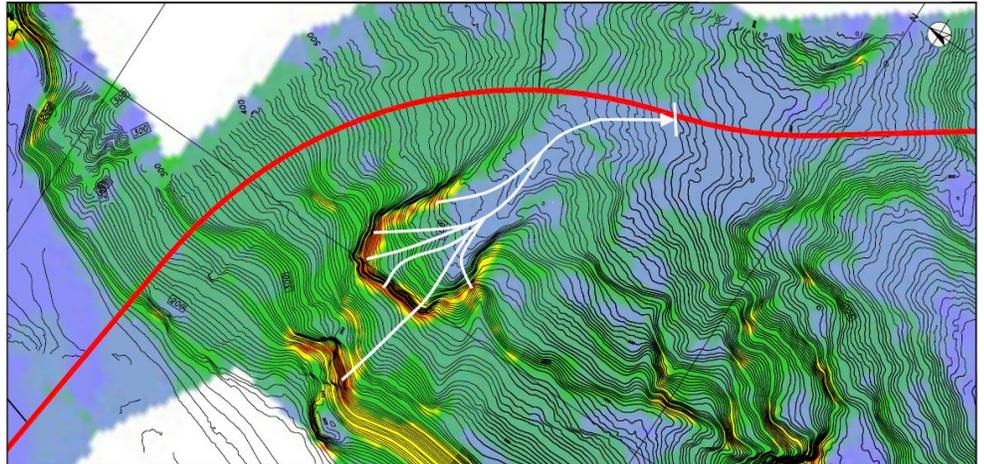
- seismic hazard
- fault rupture hazard
- landslide risk

The work provided the basis for selection of a route that minimized geohazard risk, particularly in continental shelf break slope areas. Residual geohazard risks were determined to be at acceptable levels for pipeline construction and operation.

A number of faults are present along the pipeline corridor. Local faults may control seismic design criteria and may



Medgaz pipeline route.



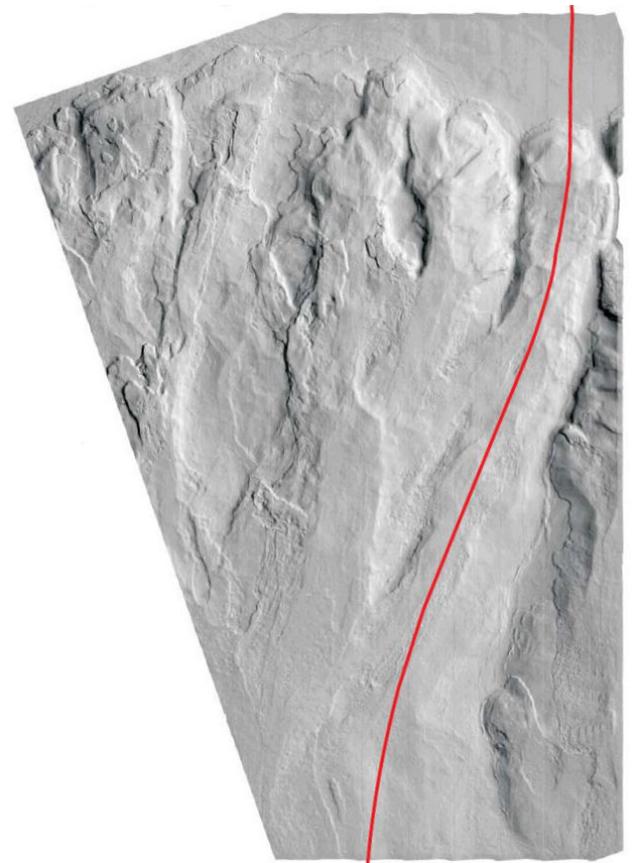
Typical submarine landslide runout trajectory.

be important for both surface rupture hazard and as a triggering mechanism for slope failure. A detailed review of the geophysical data, including both the Medgaz surveys and available deep seismic reflection profiling was used to identify the presence of potentially active faults along the line. Estimates of the time of last movement of the faults were based on the seafloor sediment drape covering recent offsets.

Seismic design criteria for the project were developed using a probabilistic hazard assessment analysis. A composite earthquake catalog was developed for the project considering available national and global catalogues, as well as historical records of seismicity in the area. Probabilistic seismic hazard analysis integration was used to define design ground motions. A deterministic analysis was used to constrain the results at long return periods.

The most significant geohazard identified during the project was the potential impact of submarine landslide runouts on the pipeline. A geomorphologic evaluation of existing

landslides along the corridor was performed in order to identify critical failure modes, slope angles, and runout distances. Geotechnical analyses were then performed to provide quantitative estimates of the factor of safety of the submarine slopes under both static and seismic conditions.



Landslide complex in the vicinity of the pipeline route.