

Cranfield University Risk Analysis for Shell International Limited

General Risk Assessment

In early 2005, Shell International Limited obtained the rights to participate with the National Oil Corporation of Libya in the exploration and production of Liquefied Natural Gas in the major oil and gas producing Sirte Basin region of Libya. During the Second World War parts of this area were heavily defended by the Axis Powers of Germany and Italy using very large numbers of landmines. An indeterminate number of mines and unexploded ordnance (UXO) remain today representing a potential risk to Shell's planned seismic work.

In June 2005 Cranfield University (CU) and ArmorGroup Services Limited undertook a General Mine Action Assessment of the areas of seismic interest to Shell to provide information and advice to assist Shell develop a strategy and plans to mitigate the risks from the remaining ordnance to people, vehicles and equipment during seismic surveys. Limited threat information was available and Shell only had access to a mine/UXO map based on a combination of UK information and an OASIS Oil Company Trace dated 1965.

Historical data from various sources were collected and analysed by CU in the UK. Meetings were held in Tripoli with Shell and relevant Libyan Governmental and commercial agencies and organisations, and a field assessment of a sample of potentially hazardous areas in the areas of seismic interest was conducted. Based on analysis of the information and data gathered, the risks to people, vehicles and equipment were derived, and proposed recommendations on mitigation measures were provided to Shell.



A range of recommendations were provided including a requirement for adherence to IMAS, MoUs with relevant national bodies to define roles and responsibilities concerning clearance of mines and UXO, the use of accredited organisations, the requirement for further focused technical survey to better define the problem, and Explosive Ordnance Disposal trained personnel to accompany all seismic work in areas of high risk.

Quantitative Risk Assessment

During the seismic acquisition surveys in 2005 and 2006, a range of ordnance was encountered by mine survey and seismic teams. The condition and threat levels from ordnance varied widely from live and fully functional, to completely inert rusted remains.

Whilst there had been no casualties from contact with ordnance, and Shell mine survey contractors and quality management staff were satisfied with the approach to mitigating the threat to seismic operations, Shell invited CU to conduct a further quantitative risk assessment to assist with planning for future 3D seismic operations to provide added confidence.

The CU quantitative assessment of the likelihood of harm was established by: calculating the 'footprints' of a range of 'at risk' vehicles and people undertaking seismic acquisition activities; predicting the areas to be covered during these activities; and assessing the anticipated density and distribution of anti-tank mines, anti-personnel mines and UXO, based on records of ordnance found to date provided by the mine survey teams and seismic contractors. The analysis was further augmented by assumptions provided by a panel of experts facilitated by the University.

By using classic statistical methods, operational analysis and spatial GIS analysis, CU established the likelihood of harm by calculating the probability of a vehicle or person coming into contact with ordnance; the probability of a vehicle or person initiating the ordnance; and the probability of experiencing different levels of damage if the ordnance was initiated. The analysis included an assessment of the mitigating factors resulting from the use of landmine and UXO survey teams prior to the deployment of seismic survey teams.

The method used by CU overcame a number of challenges, such as the limited time scale available, and the absence of reliable historical data, and an absence of a standard methodology for addressing such a situation. The study resulted in the provision of useful, meaningful and relevant findings to assist Shell in the overall assessment of risk to personnel and contractors working in Northern Libya.

Whilst this methodology was specifically developed to address the Shell requirements in Libya, the approach taken has applicability to the wider mine action sector for addressing the complex issue of risk.