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Using airborne measurements and modelling to determine the leak rate of the Elgin platform in 2012

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On the 25th March 2012 the French multinational oil and gas company Total reported a gas leak at the Elgin gas field in the North Sea following an operation on well G4 on the wellhead platform. During operations to plug and decommission the well methane leaked out which lead to the evacuation of the platform. Total made immense efforts to quickly stop the leak and on the 16th May 2012 the company announced the successful "Top kill".

The UK's National Centre for Atmospheric Science (NCAS) supported the Total response to the leak with flights of the Facility for Airborne Atmospheric Measurements (FAAM) BAe-146 aircraft. Between the 3rd of April and the 4th of May five missions were flown. The FAAM aircraft was equipped with a Fast Greenhouse Gas Analyser (FGGA, Model RMT-200, Los Gatos Research Inc., US) to measure CH4 mixing ratios with an accuracy of 0.07 ± 2.48 ppbv.

The measurement strategy used followed closely NOAA's during the Deepwater Horizon (DWH) spill in the Gulf of Mexico in 2010. The basis of the method is to sample the cross-wind structure of the plume at different heights downwind of the source. The measurements were then fitted to a Gaussian dispersion model which allowed the calculation of the leak rate.

The first mission was flown on the 30th March 2012 only 5 days after Total reported the leak. On this day maximum CH4 concentrations exceeded 2800 ppbv. The plume was very distinct and narrow especially near the platform (10km) and it showed almost perfect Gaussian characteristics. Further downwind the plume was split up into several filaments. On this day the CH4 leak rate was estimated to be 1.1 kg/s. Between the 1st and 2nd mission (03/04/2012) the leak rate decreased significantly to about 0.5 kg/s. From the 2nd flight onwards only a minor decrease in leak rate was calculated. The last mission - while the platform was still leaking - was flown on the 4th of May, when the leak rate was estimated to be 0.3 kg/s.

The FAAM aircraft measurements delivered time-critical, actionable information that accurately quantified the Elgin leak rate and contributed directly to safe and successful operational decision making.