Title	Offshore Technology Report 1999 048: Explosion Pressures Evaluation in early project phase
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Executive Summary	Designing topsides structures and equipment to withstand credible explosion events is an essential part of the route towards inherently safer designs. One of the main factors inhibiting the design process currently is the lack of detailed geometry information early in design phase: ie prior to start of construction. If congestion due to small items is not allowed for when undertaking explosion pressures analysis design pressures will be severely under-estimated. Figure l illustrates the schedule problem, ie the explosion pressures are needed to perform the design but the design is needs to be defined for the explosion pressures analysis. This study involved a FLACS sensitivity study performed by Gexcon at CMR on a complete and fully detailed module to see how the assessed explosion pressure progressed in relation to the development of the CAD geometry model. Explosion pressures were found to grow by a factor of 30 from the stage where the basic equipment and boundaries was defined through to final inclusion of all detail. At east half the congestion is rectangular (mostly secondary structure). The rise in pressures due to addition of piping 2" and below was 25%. This was simple open geometry. For larger geometries a larger increase may be expected. The study has been carried out in three phases. In the second phase in 1996 a method for accounting for growth in explosion pressures due to yet-to-be-added equipment was developed. This method involved adapting a similar module for which complete equipment information is available, performing on its geometry data base a similar exercise to that applied in the case study. The growth factors determined for the similar module would then be applied to the partially completed new module. During the second phase an alternative method for accounting for shortfall of detail was identified but not at that time investigated. With this method the steps are: 1. To quantify the shortfall of small-item congestion in the geometry model. 2. To implement representative artificial congestion into the geometry model prior to performing explosion pressures analysis. Over the past 18 months the method has been applied on about 10 projects in UK and overseas and has been found to be effective, more effective than the growth factor method advocated in phase 1 and 2 of the study. Building the CAD model is done jointly by the Engineering Contractor and the explosion pressures consultant and gives the opportunity to improve the inherent explosion performance of the design. The difference between pressures predicted in early design and those predicted when the actual CAD geometry model was commonly found to be in the range 10 - 30%, ie within the accuracy band of the prediction technique. This compares with orders of magnitude difference when artificial congestion is not implemented. A third study phase was therefore undertaken to bring the advocated methodology into line with industry practice. Whichever method is used to account for unidentified congestion during design development, the operating safety case should be based on or checked against an explosion pressures analysis made using the final detailed geometry model with all

	piping down to 1" or less included.
Table of Contents	