1. OVERALL CONCLUSION

The results of sensitivity analysis are being taken into account when setting design overpressures for each explosion area and in the design of explosion relief panels.

The following general conclusions and observations follow from the results of this sensitivity analysis:

- It should be noted that several of the sensitivity studies were performed at an early stage of the platform design. The numerical values calculated in the sensitivities (e.g. $1 \times 10^{-4}$ pressure and gas cloud sizes) may therefore be different from the current design values. However, the conclusions of the sensitivity studies (e.g. the recommendations for safest design) are still assessed to be valid. The sensitivity studies in this TDN should therefore be seen as documentation on how various input parameters influence the explosion risk.

- Sensitivity analyses reported here are based on an earlier set of explosion results. Since then, design basis overpressures have reduced significantly due largely to revised Loss of Containment frequencies. The reasons for this are discussed in the Loss of Containment TDN, Ref. /1/. This has been taken into account when drawing conclusions from the sensitivity analysis results reported here.

- The HVAC optimization study (summarized below in Section 3.1, and detailed in Annex A) recommends to change the HVAC configuration from being shut down upon gas detection and automatically re-started after 10 minutes with 12 air changes per hour to continuously run HVAC upon gas detection and ramp it up to 20 air changes per hour in terms of the explosion risk. The explosion loads in the P01 Manifold and P05 Gas Compressor modules have decreased significantly from changing the HVAC philosophy.

- Overpressures are sensitive to explosion relief panel parameters i.e. relief area; overpressure at which relief panels open; panel weight (e.g. ice accumulation can increase panel weight). The effect of variations in these parameters has been established for one particular explosion case but the results cannot be extrapolated for other cases. The results show that relief panel parameters can have a significant effect on explosion overpressures and the sensitivity of explosion results to variations in relief panel parameters will need to be considered for each explosion area.

- Clearly the frequency of release of flammable gas and volatile liquids will have a significant effect on the frequency of explosions. The potential for changes in leak frequencies as the design develops will need to be considered when establishing the design basis overpressure for each area.

- The presence of water droplets (e.g. from deluge or water based explosion mitigation systems) at the time of explosion reduced design basis overpressures by: 11% (200μm droplet size), 26% (600μm droplet size), 38% (1800μm droplet size). However, passive means of mitigating the effects of explosion overpressure, primarily by the design of barriers to withstand credible explosion loads (i.e. prevent escalation into adjacent areas) are preferred.

- Clearly the likelihood of ignition of flammable gas clouds can have a significant effect on explosion risk and therefore design overpressure. On an area by area basis the efficiency of
electrical isolation is being reviewed with Electrical. The results of these reviews will be factored into the setting of explosion design overpressures.

- Design basis explosion overpressures are not sensitive to the following other sensitivities assessed:
  - Moving gas lift manifold away from Wellbay relief walls
  - Change in blowdown delay time in the range 1-4 minutes
  - Effect of change in amount of hot work in the range 25 – 100 hours per year in a given area
  - Number of gas detectors above 9 per explosion area
  - Moving the gas lift manifold out of the Wellbay area
  - Reducing the cut-off hydrocarbon release rate from 0.05 to 0.01 kg/s
  - Number of pumps in manifold area.

- Overpressures are sensitive by combining modules; the explosion loads in P09 Separator module will increase by approximately 79% if the module is combined with P02 Export Pump module. The increase in explosion loads in P02 will be even higher than the increase seen in P09 if the two modules are combined.