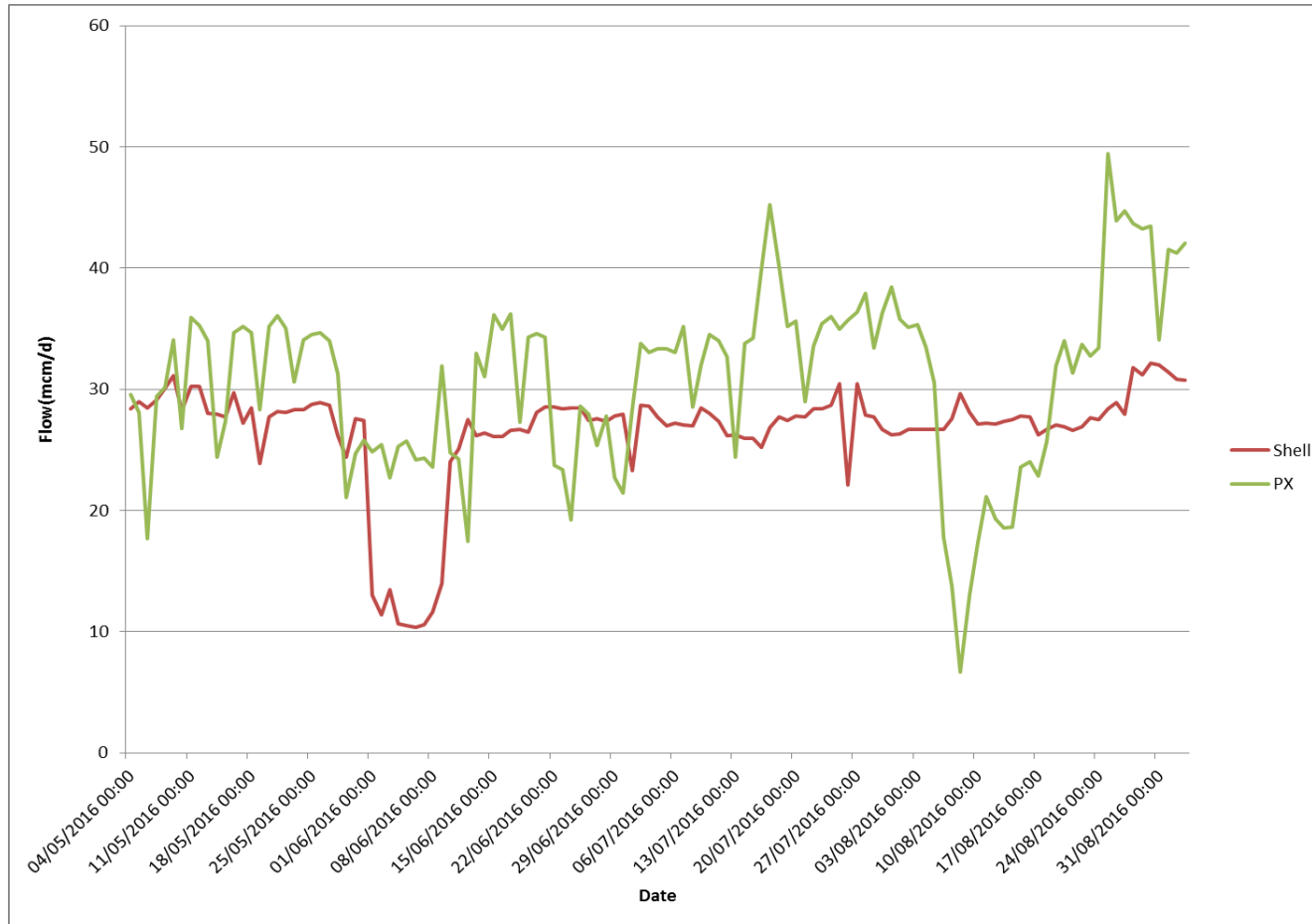


Modification 0607S: National Grid NTS Actions Update

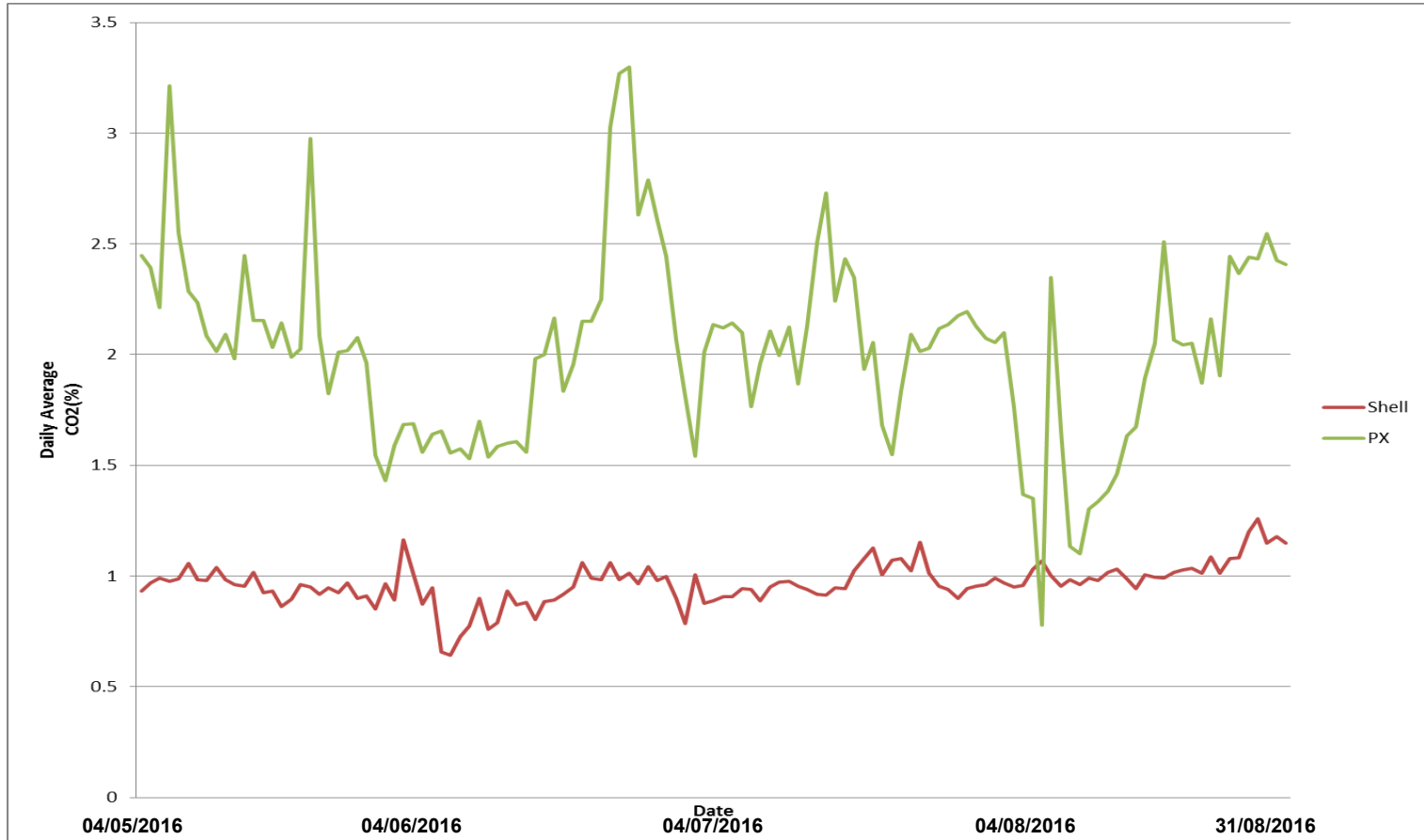
28th February 2017

Action 0101 (a) Historic Summer Flow Data By Sub Terminal

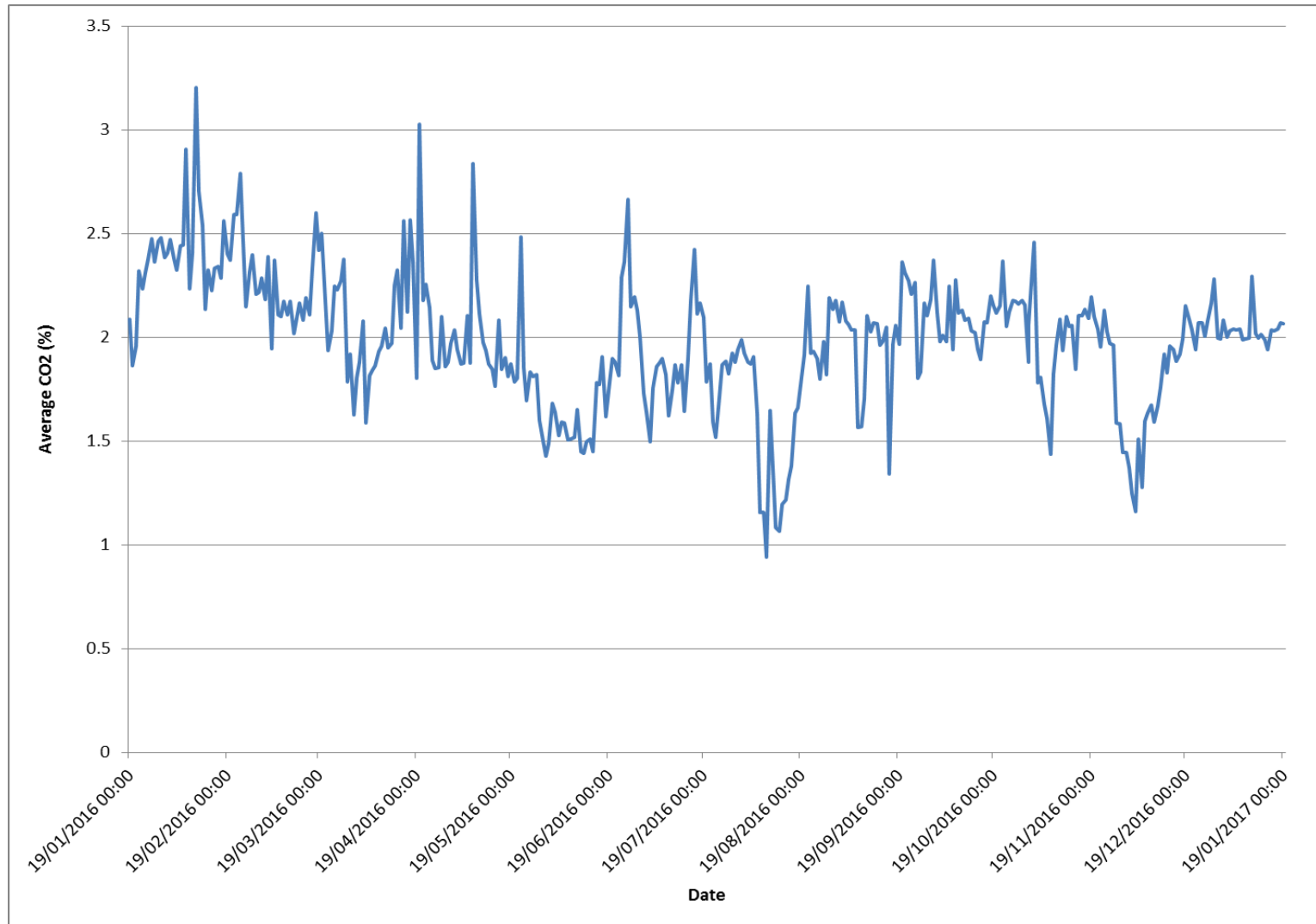


Note: At the time of publication of these slides, National Grid NTS had not received approval from the DFO to publish data for the Apache entry point. This data will be added should such approval be provided.

Action 0101 (a) Historic Summer CO₂ Data By Sub Terminal



Action 0101 (a) Average daily CO₂ content entering NTS pipelines at St. Fergus



Action 0101(a) National Grid NTS Analysis of BP Scenarios

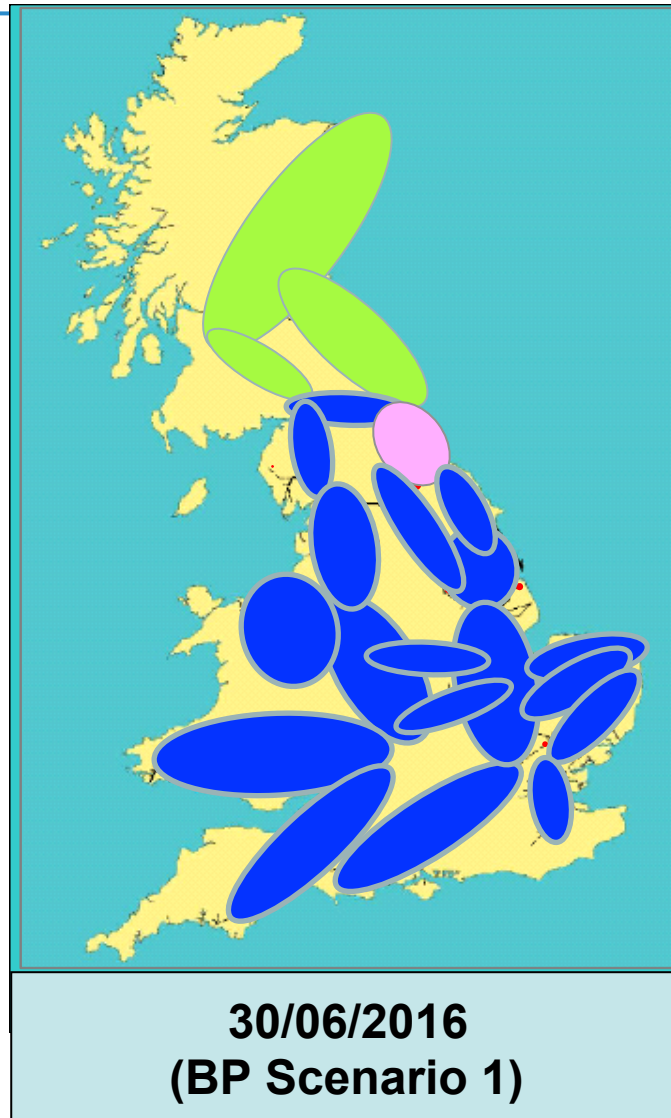
- National Grid NTS has taken the inputs to the four BP scenarios and calculated the CO₂ content that would be expected on the pipelines leaving St Fergus terminal
- The results below demonstrate that National Grid NTS' calculations align well with BP's

30th June 2016 (172mscm/d)							
Scenario 1		Scenario 2		Scenario 3		Scenario 4	
BP Results	NG Results	BP Results	NG Results	BP Results	NG Results	BP Results	NG Results
3.65	3.65	3.78	3.79	3.66	3.66	3.87	3.88


Action 0101 (b): 'Heat map' analysis

- Two 'heat map' schematics are provided:
 - The first shows the penetration of aggregate flows of St Fergus gas into the NTS, assuming entry flows are equal to those presented in BP's analysis, scenario 1
 - SAGE: 20 mcmd
 - SEGAL: 18.3 mcmd
 - Vesterled: 8.2 mcmd
 - Frigg: 30 mcmd
 - Scenario 1 was selected because this contains the highest flows of all BP scenarios and is thus a 'worst case' from the BP scenarios
 - Supplies from other NTS entry points are proportionate to the 2016 FES for that demand level


Heat Map Analysis 1




>75%
St Fergus
Gas



50% to 75%
St Fergus
Gas



25% to 50%
St Fergus
Gas

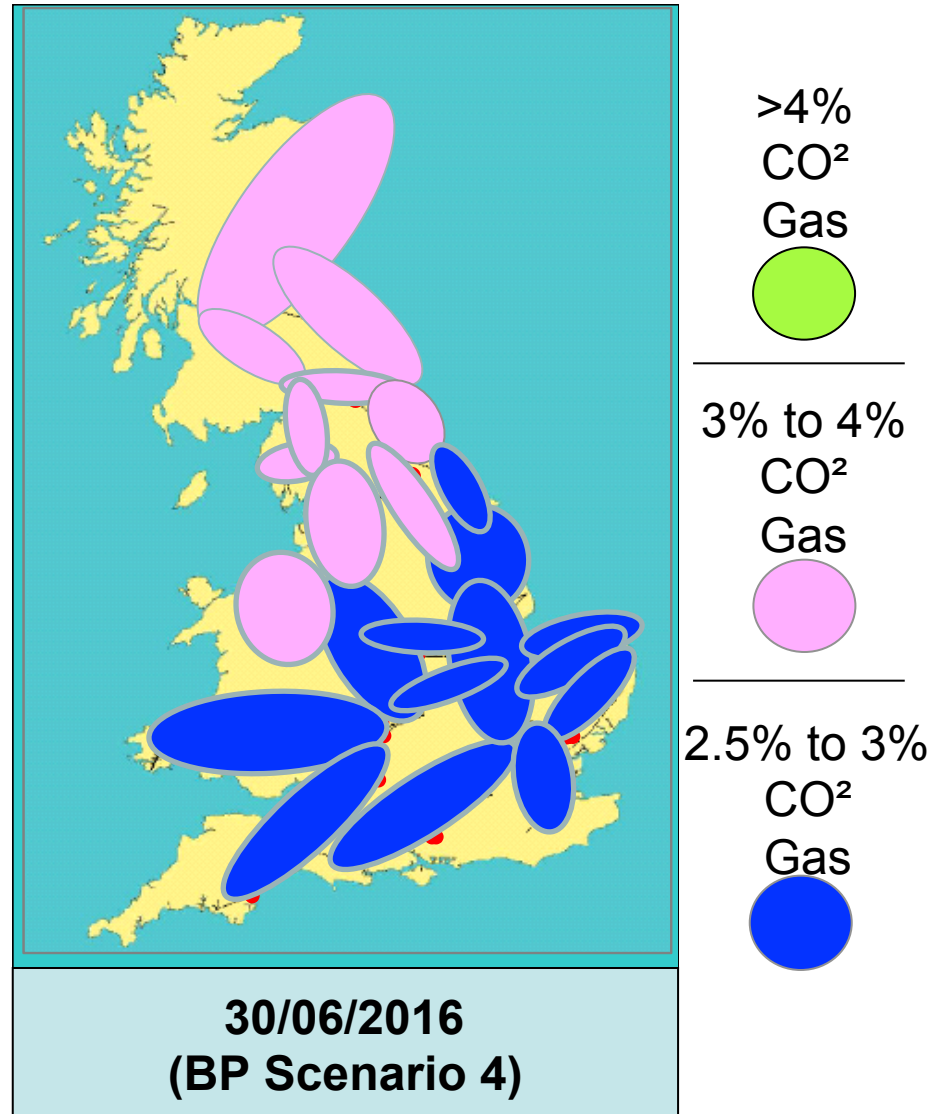


Action 0101 (b): 'Heat map' analysis

- The second 'heat map' schematic shows the levels of CO₂ on the NTS, assuming
 - St Fergus sub-terminal flows and CO₂ content are equal to BP's scenario 4 (giving a 'worst case' CO₂ entering the NTS from the four BP scenarios)
 - This scenario shows a blend of 3.87% CO₂ entering the NTS, therefore no NTS direct connect receives any gas in excess of 4% (Action 0101 c))
 - Supplies from other NTS entry points are proportionate to the 2016 FES for that demand level and deliver gas at their CO₂ limits*

* Teesside terminals have been assumed to flow at 4%

'Heat Map' Schematic 2



Other Actions

- 0105 Operating arrangements
 - BP, NSMP and National Grid NTS are currently exploring whether operational procedures could be used to manage short term off spec CO₂ levels as an alternative to the Modification
- 0107 EU Standard on Gas Quality
 - A statement has been provided for the meeting in mark-up form from that included in the 0498/502 Workgroup Report

Other Actions (Cont'd)

- 0108 Assessment of NTS operational risks
- From an NTS integrity perspective, National Grid NTS would want to:
 - Assess the impact on pipeline corrosion rate of higher CO₂ gas if water was present in NTS pipelines
 - Confirm that the CO₂ levels on the NTS passing a salt cavity storage facility will not have a higher pipeline corrosion rate
 - Assess any impact of higher CO₂ levels on compressor start-up
 - Assess any impact on compressor running associated with a rapid change in CO₂ (such as might be expected with a trip)