

**APPENDIX 2 ELGIN G4 SUMMARY OF WELL OPERATIONS EVENTS: 25 FEBRUARY - 26 MARCH**

Date	Time	Event
Notes		<p>1. The following is a summary of the information available. For the sake of clarity details of meetings and telephone conversations are not included.</p> <p>2. From 26 February to 05 March, there were concurrent well operations with Rowan Viking working on G8y suspension and the preparation of the intervention on G4. Offshore operations for this period have been described for both activities and are clearly labelled (G4 intervention and Rowan Viking on G8y)</p> <p>3. From 06 March there was only one well activity. Offshore operations described refer to the G4 intervention</p> <p>4. WCM = Wells Construction and Maintenance Department</p>
25/02	11:20	<p>A annulus pressure sudden drop from 563 to 440 bar(g) in 2 mins</p> <p>B annulus pressure rose concurrently from 33 to 266 bar(g)</p> <p>B annulus bled off immediately to 189 bar(g)</p> <p>C annulus pressure starting to increase sharply</p> <p>Note: C annulus communicating with A and B annuli</p> <p>Annulus management strategy by bleed offs of C annulus from 35 to 79 bar(g). 3 C annulus bleed offs to stay within operating window</p>
	16:40	<p>Meeting of WCM personnel in Altness office to review situation and to initiate Task Force.</p>
	19:00-24:00	<p>Daily Bleed offs: 0 A ; 1 B ; 3 C</p>
26/02		<p>Decision made to suspend G8y operations with Rowan Viking and to intervene on G4 (rig skidding required to allow rig up of wire line equipment)</p> <p>HSE informed of situation and of intention to intervene with Rowan Viking</p> <p>G4 intervention: Started preparation: isolated heat tracing and removed Permanent AMS spool on C annulus</p> <p>Note: A and B annuli responding to C annulus bleed offs</p>
		<p>Rowan Viking on G8y: RIH with DP to test cement plug</p> <p>Daily Bleed offs: 0 A ; 0 B ; 4 C</p>
27/02		<p>Interpretation of pressure events on 25 February 2012 completed. Concluded a probable deep A to B annulus communication (3000m most likely) and shallow B to C annulus communication (MLS most likely)</p>

Date	Time	Event
		<p>G4 intervention: Finalise rig up of G4 C annulus bleed off line to test separator through G9 production line</p> <p>Rowan Viking on G8y: RIH with DP</p> <p>Daily Bleed offs: 0 A ; 0 B ; 0 C</p>
28/02		<p>G4 intervention: Offloaded equipment and built access platform for G4 Xmas tree</p> <p>Rowan Viking on G8y: Tagged cement at 3975m and pressure tested</p> <p>Daily Bleed offs: 1 A ; 0 B ; 0 C</p> <p>Bleed off strategy changed to A annulus bleed off as 3 annuli responding</p>
29/02		<p>G4 intervention: prepared lift plan for G4 rig up. Inflow test of TR-SCSSV</p> <p>Rowan Viking on G8y: POOH with DP, start running with cement stinger for temporary suspension of G8y well.</p> <p>Daily Bleed offs: 2 A ; 0 B ; 0 C</p>
01/03		<p>Intervention programme issued (covering first part of operations: Lubricate and perforate)</p> <p>HAZOP study for the use of a chiksan constructed depressurisation route linking the C annuli of the Elgin wellhead platform (WHP) G4 &amp; G5 wells to the G9 well via the G9 Kill Wing Valve (KWV)</p> <p>Note: installation of this line was completed on 27 February 2012</p> <p>G4 intervention: Inflow test of tree valves. Offloaded equipment. Injected methanol and attempted to open TR-SCSSV without success</p> <p>Rowan Viking on G8y: RIH with cement stinger, circulation</p> <p>Daily Bleed offs: 1 A ; 0 B ; 0 C</p>
02/03		<p>G4 intervention: Offloaded wireline equipment, installed manual gauges on A, B, C annuli, THP and control line, prepare permits.</p> <p>Rowan Viking on G8y: Set cement plug 3974m to 3756m</p> <p>Daily Bleed offs: 2 A ; 0 B ; 0 C</p>
03/03		<p>G4 intervention: prepare permits, conduct prejob meeting, calibrated THP transducer</p>

Date	Time	Event
		Rowan Viking on G8y: Weight set cement plug at 3823m. Hung off 5" DP kill string in wellhead. Closed BOP: 5" MPR around DP and BSR above hang off tool. G8y suspension operations completed.  Daily Bleed offs: 1 A ; 0 B ; 0 C
04/03		G4 intervention: Injected methanol in tubing and depressurise to address suspected hydrate plug (not allowing the opening of the TR-SCSSV).  Rowan Viking on G8y: Nipple down diverter, preparation for skidding, skidding completed at 24:00  Daily Bleed offs: 1 A ; 0 B ; 0 C
05/03		G4 intervention: Backloading and offloading of equipment, removed scaffolding for installation of G4 mast.  Rowan Viking: cantilever skidded in 5.5m in to allow clearance for rigging up wire line on G4 well from weather deck. From now on Rowan Viking providing assistance to G4 intervention  Daily Bleed offs: 0 A ; 0 B ; 1 C
06/03		Pressure tested triple wire line BOP. Greased, flushed, function tested and inflow tested tree valves  Daily Bleed offs: 0 A ; 0 B ; 3 C
07/03		Rig up riser, pump in tee and BOP, pressure tested to 35/650 bar(g) with MEG. Erect mast and secure.  Daily Bleed offs: 0 A ; 0 B ; 2 C
08/03		Wire line run #1 and 2 to trouble shoot TR-SCSSV. Increased tubing pressure to 652 bar(g) to equalise across TR-SCSSV. Opened TR-SCSSV and confirmed open.  Daily Bleed offs: 0 A ; 0 B ; 3 C
09/03		Wire line run#3 with 3.4" drift, downhole T/T gauges and CCL. Tagged HUD at 4950m. Pulled and confirmed good data.  Daily Bleed offs: 0 A ; 0 B ; 1 C
10/03		Elgin G4 Intervention Program Amendment #1 to intervention programme issued with change from perforating to punches and displacement to brine  Prepare permit and paper work for connecting G4 tubing to rig kill line and G4 A annulus to choke line. Offloaded Expro chiksans

Date	Time	Event
		Daily Bleed offs: 0 A ; 0 B ; 1 C
11/03		Rig up Rowan Viking choke and kill lines to tubing and A annulus, and tested same
		Daily Bleed offs: 1 A ; 0 B ; 4 C
12/03		Lubricate tubing with 5bbls of 1.2 sg CaBr <sub>2</sub> brine.
		Daily Bleed offs: 1 A ; 0 B ; 1 C
13/03		Lubricate tubing with 24 bbls of 1.2 sg CaBr <sub>2</sub> brine. Wire line run#4 with tubing puncher, but unable to pass 85 mbrt, same problem with run#5 with additional weight bars. Wire line run #6 with bailer, took sample at 73 mbrt. Sample was white cold fluid identified as brine. Depressurise tubing through production test separator in steps from 523 to 25bar(g)
		Daily Bleed offs: 1 A ; 0 B ; 1 C
14/03		Risk assessment conducted onshore for "Displacing tubing & A annulus from brine to mud taking returns to Rowan Viking".
		HAZID conducted onshore: G4 production tubing & A annulus brine displacement to Elgin production HAZID.
		Lubricate tubing with 64 bbls MEG. Wireline run #7 with 2 sets P/T gauges to 4923m.
		Daily Bleed offs: 1 A ; 0 B ; 1 C
15/03		POOH with gauges (run #7) with station stops every 500m. 572 bar(g) and 174 C with 159 bar(g) at surface. Lubricate tubing with 11 bbls MEG. Ran 10ft tubing puncher (WL run#8)
	12:05	Punched tubing from 4904-4907m. THP pressure dropped from 384 to 153 bar(g) after punch.
	22:45	Started 1.2 sg brine circulation down tubing, taking A returns to production separator through G9 production line
		Daily Bleed offs: 1 A ; 0 B ; 3 C
16/03		Elgin G4 Intervention Program Amendment #2 to intervention programme issued to add tubing cut operations and final displacement to mud
	6:00	G4 intervention: Completed first circulation of brine 185 M <sup>3</sup> (1164 bbls) of 1.2 sg CaBr <sub>2</sub> brine including 10 m <sup>3</sup> (64 bbls) of viscosified brine were pumped down the tubing from the Rowan Viking cement unit, following a step down chart, at rates between 2 and 4 bpm. The circulation started on 15 March 22:45 and was completed on 16 March 06:00.

Date	Time	Event
		<p>Returned volumes were measured from the test separator: 165 M<sup>3</sup> liquids (123M<sup>3</sup> from water outlet, 41 M<sup>3</sup> condensate outlet) and 6696 SM<sup>3</sup> from gas outlet.</p> <p>No bleed off from the B and C annuli was required during the circulation. B and C annuli pressures remained quite flat during the circulation (B 65 to 57 bar(g) with 3 spikes at 73 bar(g) and C 59 to 62 bar(g))</p> <p>Both the THP and A pressures went down and reached respectively 49 and 52 bar(g) at the end of the job.</p> <p>THP and A annulus started increasing slowly from that point, with A annulus increasing faster than THP.</p> <p>Monitored pressures during the rest of the day</p> <p>Daily Bleed offs: 0 A ; 0 B ; 0 C</p>
17/03	13:30	<p>Monitored pressures.</p> <p>Performed circulation test with 80 bbls of 1.2 sg brine pumped down tubing with returns up the A annulus back to production test separator through G9 production line. Rate was increased from 1 to 4 bpm.</p> <p>No bleed off of B or C annuli during circulation</p> <p>Daily Bleed offs: 1 A ; 0 B ; 6 C</p>
18/03		<p>Ran Schlumberger power cutter on wire line (run#8) and performed firing sequence with cutter at 4894m. Retrieved cutter and confirmed misfire.</p> <p>Daily Bleed offs: 4 A ; 0 B ; 23 C</p>
19/03	18:00	<p>Ran Schlumberger power cutter on wire line (run#9) and performed firing sequence with cutter at 4894m. Retrieved cutter and confirmed cutter had fired.</p> <p>Ran Lead Impression Block (LIB) on wire line (run#10) to 4900m. No indication that tubing was cut when LIB at surface (no marks)</p> <p>Note: Attempt #2 to cut tubing; cutting fired but no surface indication that tubing was cut</p> <p>Daily Bleed offs: 6 A ; 0 B ; 2 C</p>
20/03		<p>Ran 10 ft tubing puncher (Wire line run#11) to 4902m, but had misfire</p> <p>Daily Bleed offs: 4 A ; 5 B ; 5 C</p>
21/03	11:00	<p>Ran 2x 10 ft tubing punchers (Wire line run#12) to 4880m, but had misfire.</p> <p>Decision made to stop wire line activities in order to proceed to killing operations.</p>

Date	Time	Event
		<p>Wire line run #13: Ran pressure and temperature gauges down to 4890mbrt, performed 10 min station and pulled to 4840 mbrt</p> <p>Second circulation to brine (17:00 to 23:00) 169.6 m<sup>3</sup> (1067 bbls) of 1.2sg CaBr<sub>2</sub> brine were pumped from the Rowan Viking at 4 bpm, with a constant back pressure on the A annulus at 115bar(g). A annulus returns were taken to production from G9 production line as for previous circulations and were mainly brine (no gas condensate). Sample taken from test separator at end of circulation: 121604mg/ltr chlorides, 1.2 sg. No bleed off of B and C annuli conducted during circulation.</p>
	23:00	<p>Ran gauges to 4900m without indication of tubing cut. Position gauges at 4844 mbrt for 6 hr station stop.</p> <p>Daily Bleed offs: 3 A ; 0 B ; 4 C</p>
22/03		<p>Pulled gauges (run #13) and retrieved data Preparation for displacement to mud.</p>
	14:00	<p>G9 ramped down and isolated at 14:00 Drained B annulus management drain (Knock out drum) to tote tanks,</p>
	15:15	<p>Displacement to mud: pumping sequence #1 (127 m<sup>3</sup>) Started pumping 2.05 sg NABM from Rowan Viking cement unit down tubing with A annulus returns routed to test separator through G9 production line. Rate increased to 3 bpm adjusting and stopping when required to bleed off annuli. Rate cut down to 2 bpm from 17:19 THP pressure went from 75 bar(g) to zero very shortly due to the free fall effect of the heavy mud. A annulus pressure increased from 98 bar(g) to 160 bar(g) with choke settings at 30/64" and dropped sharply when choke was increased to 42/64" (18:15 A= 110 bar(g)) and then 64/64" (A= 50 bar(g)). C annulus bled at 16:30 from 70 to 55 bar(g).</p>
	20:30	<p>B annulus pressure started a steady increase from 20:30 although the rate was cut to 1 bpm; B annulus was opened to knock out drum through the AMS with valves fully open from 22:00.</p>
	22:30	<p>Pumping interrupted at 22:30 (127 m<sup>3</sup> OBM pumped), as the knock out drum was full. Emptied to tote tanks. Test separator pressure reduced by 8 bar(g) down to 31 bar(g)</p>
	22:30	<p>Daily Bleed offs: 1 A ; 18 B ; 1 C</p>



Date	Time	Event
23/03	00:30	B annulus MOP increased from 100 to 150 bar(g).
00:30		Displacement to mud: pumping sequence #2 (2 m <sup>3</sup> , total 129m <sup>3</sup> ) Pumped another 2M <sup>3</sup> of 2.05 sg NABM down tubing. Stopped pumping at 00:45 due to level transmitter issues. Cumulated pumped volume 129 M <sup>3</sup> Very frequent bleed off required to manage pressure within windows after 01:00 (mainly C annulus)
23/03	~17:00	Reviewed G4 status and way forward: Line up G4 A annulus to Viking, prepare routing of G4 C annulus to Expro surge tank via G8y B, Pump a 5 M <sup>3</sup> stage, mobilise additional support (on 24 March) to assist with supervision, mobilise additional tote tanks.
~18:00		Elgin G4 Intervention Program Amendment #3 issued
20:30– 21:15		Toolbox talk at 20:30 in MCR with Elgin & Viking management. Toolbox talk on Viking Drillfloor with service personnel at 21:15
22:00		Lined up A annulus returns to Rowan Viking choke manifold and Halliburton surge tank. From now on A annulus returns routed to rig.
22:45		Displacement to mud: pumping sequence # 3 (6.5 m <sup>3</sup> , total 135.6m <sup>3</sup> ) Pumped another 6.5M <sup>3</sup> of 2.05 sg NABM down tubing. 1.2 sg brine returns observed from A annulus at Halliburton surge tank on Rowan Viking after 1.6 M <sup>3</sup> pumped. Stopped pumping at 23:30. Took samples from B and C annuli at regular intervals Daily Bleed offs: 0 A ; 6 B ; 57 C
24/03		HAZOP of pipe routing from G4 C annulus to Expro surge Tank located on WHP Weather Deck (through G8y B annulus management system) completed. Surge tank had been installed for G8y intervention
00:45		Displacement to mud: pumping sequence #4 (5 m <sup>3</sup> , total 140.6m <sup>3</sup> ) Pumped another 5M <sup>3</sup> of 2.05 sg NABM down tubing at 1 bpm, taking returns to Halliburton surge tank through Rowan Viking choke manifold. 1.2 sg brine returns observed from A annulus at Halliburton surge tank on Rowan Viking after 2.9 M <sup>3</sup> pumped, 1.4 M <sup>3</sup> brine returned. Stopped pumping at 01:15

Date	Time	Event
		Regular samples taken from B and C annuli
	09:30	Modification of mud volume in order to fill the B annulus. Additional instructions issued and tool box talk carried out.
	11:45	Took samples of 8 tote tanks on Rowan Viking deck showing traces of hydrocarbons. Unable to transfer to Rowan Viking pits
	13:15	Well Integrity Engineer arrived on board PUG/Rowan Viking to assist with monitoring of G4 operation.
	16:45	Completed installation of cross over line from G4 C annulus to G8y B annulus to allow bleeding off to Expro surge tank located on weather deck of EWHP.
	18:15	Sample taken from C annulus: brown viscous liquid. Tote tanks offloaded from Island Express to manage volumes from Permanent B annulus AMS.
	19:15	Sample taken from B annulus: brown viscous liquid 2 sg Sample taken from C annulus: brown viscous liquid 1.4 sg
	20:15	Displacement to mud: pumping sequence #5 (5 m <sup>3</sup> , total 145.6m <sup>3</sup> ) Pumped another 5 m <sup>3</sup> of 2.05 sg NABM down tubing at 1 bpm. Returns observed at Halliburton surge tank on Rowan Viking after 3.5 m <sup>3</sup> pumped, 0.8 m <sup>3</sup> returned analyzed as brine with condensate, flash point below 105 C.
	21:00	Mud flowing from G4 C annulus routed to G9 and Test Separator.
	21:15	Displacement to mud: pumping sequence #6 (9.9 m <sup>3</sup> , total 155.5m <sup>3</sup> ) Pumped another 9.9 m <sup>3</sup> of 2.05 sg NABM down tubing at 1 bpm. 6.2 m <sup>3</sup> returned to Halliburton surge tank. Emptied surge tank and analyzed as brine with condensate, flash point below 105 C. Stopped pumping at 22:15 Offloaded 5 tote tanks from Island Express and backloaded 5 full tote tanks.
	21:30	Start of plugging of filters and level control problems of Production Water system on PUG.
		Mud started to flow from B annulus causing trips of pump 6-G-1210 used for transfer to tote tank. Start to inject wash water @ 4m <sup>3</sup> /hr
	22:30	Mud volume to be pumped increased to 230 m <sup>3</sup> in order to have mud in B and C annulus (until mud reaches top of C annulus)
	23:30	Displacement to mud: pumping sequence #7 (17.5 m <sup>3</sup> , total 172.8m <sup>3</sup> ) Started pumped another 17.5 m <sup>3</sup> of 2.05 sg NABM down tubing at 1 bpm.



Date	Time	Event
25/03		Daily Bleed offs: 0 A ; 3 B ; 18 C
00:00	to 02:45	Displacement to mud: pumping sequence #7 (Continued, total 175.3 m <sup>3</sup> ) Returns observed at Halliburton surge tank after 5.6 m <sup>3</sup> , analyzed as 1.2 sg brine with flash point lower than 105 C. Opened choke on Viking choke manifold at 02:15 as B rising Unable to pump out fluids fast enough from knock out drum (B annulus). Cut rate to 0.5 bpm as B annulus rising Stopped pumping at 02:45, after 17.5 m <sup>3</sup> . 2.8m <sup>3</sup> returned at Halliburton surge tank, 1.2 sg brine with flash point below 105C.
05:00		Lined up C annulus to Expro surge tank on EWHP weather deck (through cross over line to G8y B system) Island Express unable to come alongside EWHP, due to fog and venting, to offload/ backload tote tanks B annulus sample: 1.83 sg mud with no flash point at 05:15 C annulus samples from 21:30 to 05:15: gas with spurts of mud
06:00	to 08:45	Bled C annulus to Expro surge tank on EWHP platform. Pumped out Expro surge tanks to tote tanks to maintain capacity Note: This is the only time when the C annulus was bled off to the Expro surge tank 6 tote tanks and 1 skip (TWMA) were filled with mud. Note: 1 of the 6 tote tanks had been made available after transferring MEG to another tank
08:15		Unable to take A returns to Viking pits due to hydrocarbon contents.
08:45		Lined up C annulus back to test separator across G9 production line. Routing of C annulus was changed to allow Island Express to approach in order to offload tote tanks (gas was vented from Expro surge tank) Bled C annulus to production process, pressures increasing
09:30-	10:35	Reviewed G4 status with all parties involved, and to consider mud discharge to sea.
10:45		No indication of level in Test Separator due to mud. (G4 C lined up to G9 and Test Separator)
11:00		G4 B annulus lined up to Annulus Knock Out Drum and tote tank. 1 tote tank filled. No further tote tanks available. Rate of C annulus bleed off is arounds 20 bbls (per bleed off) of mud with gas. C annulus left fully open to process through G9 in an attempt to reduce pressures.

Date	Time	Event
	11:45	Hose connected to allow Annulus Knock Out drum to be flowed to sea.
	12:00	Decision taken to bleed A annulus to Halliburton surge tank B annulus bleed down route fully open to knock out drum. Knock out drum full.
	12:05	OIM called Duty Manager to advise deterioration in status.
	12:20	OIM called Duty Manager to advise shut-down and "Emergency".
	12:28	Attempt to bleed off A annulus to Rowan Viking to attempt to reduce pressure in G4 B and C annuli -- gas and some liquid at Halliburton Surge tank.
	12:29	Mud starting to flow from Wellhead.
	12:30	Confirmed high high gas resulting in GPA and 6ESD1 (cascades to 8ESD2 and 5ESD2)
		Daily Bleed offs: 1 A ; 3 B ; 6 C