A  Immediate response

1  Immediately following the Uncontrolled Release, which commenced at 7.23am CST on 21 August 2009:

   (a) control of the response to the oil spill resulting from the Uncontrolled Release was transferred by PTTEPAA to the Australian Maritime Safety Authority (AMSA), pursuant to the National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances; and

   (b) and in accordance with standing policies and procedures within the PTTEPAA Emergency Response Plan – PTTEPAA’s Emergency Response Group (ERG) was mobilised. The ERG is a standing panel of PTTEPAA personnel who respond to emergencies. Throughout the response to the Uncontrolled Release, about 30 PTTEPAA staff were on roster to ensure that the ERG operated 24 hours a day, 7 days a week (3 * 8 hour shifts). Each ERG shift team comprised a duty ERG Leader, operations coordinator and recorder. The ERG monitored PTTEPAA’s offshore operations relating to the Uncontrolled Release and efforts to bring it under control. The ERG was used to coordinate vessels and aircraft to support AMSA’s response to the oil spill resulting from the Uncontrolled Release, the drilling of the relief well and environmental response activities.

2  Following the Uncontrolled Release, PTTEPAA contacted ALERT Well Control (ALERT). ALERT is an international oil and gas well control engineering specialist. PTTEPAA contracted ALERT to provide specialist advice on possible options to contain the Uncontrolled Release and on implementation of the elected option and to provide specialist engineers to assist with the implementation of the operations to contain the Uncontrolled Release. ALERT’s first recommendation was for equipment and vessels to be sourced and mobilised to provide deluging capability.

3  The ALERT team arrived in Perth, from their base in Singapore, on 22 August 2009. After preliminary discussions with first-hand witnesses of the Uncontrolled Release and an
assessment of photographs of the WHP/West Atlas, ALERT recommended, in addition to the use of deluge, the implementation of simultaneous well control activities comprising surface capping and relief well operations.

4 On 22 August 2009 arrangements were also put in place by AMSA to apply dispersant to the oil slick to hasten natural dispersion processes. Dispersant is best applied from aircraft after the slick has widened and thinned but within 12 hours or so of its formation.

5 A specialist C-130 Hercules dispersant spraying aircraft was mobilised by PTTEPPAA from Singapore. It began operating from Darwin and was used by AMSA for dispersant spraying. AMSA also contracted aerial dispersant operator, Australian Maritime Resources Pty Ltd (AMR), who flew single-engine spraying aircraft out of the Truscott aerodrome in Western Australia, the closest despatch point for fixed wing aircraft to fly to the West Atlas. The Lady Gerda - an offshore support vessel engaged by PTTEPPAA - was also used to spray dispersant.

6 As from 3 September 2009 two other offshore support vessels were used to undertake at-sea oil recovery using an offshore boom and a skimmer.

7 On 22 August 2009, NOPSA issued:

(a) prohibition notice No 0222 which prohibited any work being done that required personnel to be at any workplace at the WHP facility (including an associated offshore place to the facility which includes a support vessel carrying out operations adjacent to the WHP) as it considered any such activity posed a threat to health and safety; and

(b) a prohibition notice which prohibited any work being done that required personnel to be on the West Atlas facility (including an associated offshore place to the facility which includes a support vessel carrying out operations adjacent to the West Atlas) as it considered any such activity posed a threat to health and safety.

8 The letters enclosing these prohibition notices confirmed the notices would only be lifted if NOPSA was satisfied that the risks to safety of such personnel had been comprehensively assessed and that control measures were in place to reduce the risks to a level that is as low as is reasonably practicable (ALARP).
As mentioned earlier, ALERT recommended deluging. The purpose of delugging was to dampen the *West Atlas* and WHP to lessen the consequences should a fire occur. The plan was to equip two supply vessels with deluge pumps and mobilise them to the site.

On 27 August 2009, a HAZID was undertaken in relation to the Deluge Option.

On 7 September 2009, a Deluge Safety Case was submitted to NOPSA. Between 7 and 11 September 2009, NOPSA raised a significant number of questions in relation to the Deluge Safety Case.

On 11 September 2009, NOPSA issued PTTEPAA with a revised Prohibition Notice No 0223 which continued to prohibit work that required personnel to be at any workplace at the WHP facility (including an associated offshore place to the facility which includes a support vessel carrying out operations adjacent to the WHP) other than to the extent of implementing fire fighting in relation to the *West Atlas*/WHP in the event of a fire.

Also on 11 September 2009, NOPSA requested a revision to the WHP facility’s safety case addressing the initial investigative activities to assess the condition of the facility, activities associated with the implementation of well control barrier(s) into the H1 Well and activities to verify the integrity of the facility. NOPSA stipulated that this revised safety case, if and when accepted by NOPSA, would only take effect after PTTEPAA had demonstrated at least one effective well control barrier in the H1 Well.

Given the above events on 11 September 2009 and following discussions with NOPSA, PTTEPAA took the view that:

(a) due to NOPSA’s role in the regulatory regime (which is confined to safety) NOPSA would prioritise the safety of personnel above both the environment and property damage considerations; and

(b) it was unlikely that NOPSA would approve any work that required personnel to be at or near the WHP or *West Atlas* other than for fire fighting purposes.

Consequently PTTEPAA decided not to proceed further with the Deluge Option. PTTEPAA did maintain one deluge-capable support vessel at the Montara field throughout its response to
the incident in order to provide contingent fire fighting capability in the event of ignition of the Uncontrolled Release.

C Capping Option

16 The option of capping the H1 Well was also considered. This is normally an alternative initiative to a Relief Well. In this case the task would have involved placing personnel onto the WHP and the *West Atlas* while the Uncontrolled Release continued.

17 At the time of the Uncontrolled Release, the cantilever of the *West Atlas* derrick was skidded across the Helideck of the WHP. The hatch in the WHP Helideck above the H1 Well was open, leaving a clear path for the well fluids to pass through the gap, where it was impinging on the Underside of the drill floor and causing collection of a gas cloud in the bottom of the drill derrick. Hydrocarbon liquid fallout was leading to a pooling of oil on the WHP Helideck which was draining overboard.

18 The process of capping the H1 Well would have involved attempting to skid the cantilever of the *West Atlas* inboard so that the well flow was no longer hitting the underside of the *West Atlas*. When the well flow is discharging vertically it is in a safer and more controlled condition. With the cantilever retracted, it would have provided access to the casing that was the source of the Uncontrolled Release. Then a wellhead would have been lifted and placed in position, securing the casing. Next a casing blow out preventer (BOP) would have been placed into position on the wellhead and closed. This would have stopped the flow. With the flow stopped, kill weight Mud would then have been pumped into the H1 Well to push the remaining gas back into the reservoir. Finally, mechanical plugs would have been set in the H1 Well to secure it.

19 The Capping Option would have required a significant number of personnel to be on the *West Atlas* and WHP and involved a number of risks, the greatest being retraction of the cantilever. Personnel wearing breathing apparatus would have had to enter the gas cloud under the *West Atlas* cantilever to:

(a) connect hydraulic hoses to skid the cantilever to centre; or

(b) remove the locking mechanism to allow the cantilever to skid.
PTTEPAA ruled out the Capping Option for the following reasons:

(a) there was risk of fire given the theoretical composition of the hydrocarbons (gas/condensate) flowing from the H1 Well and the resultant flammable atmosphere engulfing the area where personnel would have had to work – and the presence of personnel and equipment and operation of equipment for capping operations significantly increased the risk of introducing an ignition source;

(b) following a HAZID of the Capping Option, PTTEPAA did not consider that risks to personnel met the requisite ALARP standard (there was a real risk of a fatality); and

(c) therefore and given NOPSA’s effective rejection of the Deluge Safety Case, which involved placing personnel closer than 2km from the WHP in order to apply the deluge, PTTEPAA anticipated that NOPSA would refuse a Safety Case revision for the Capping Option, as the risks to personnel did not meet the ALARP standard.

D Sub-sea Options

Two options were considered to control the H1 Well using subsea technology:

(a) fabricate a machine to crush the casing and block off the well flow; or

(b) cut the casing and to cap it underwater.

These options were ruled out within about 3 weeks of the Uncontrolled Release for several reasons:

(a) crushing the casing would have required a machine that would weigh about 15 metric tonnes and this would have been very difficult to manoeuvre with a Remote Operated Vessel (ROV) - a ROV was necessary as it was considered unsafe to put divers in the water proximate to the WHP;

(b) while the diamond wire saw and another derivative - a large hole saw - that could have been used for the cutting option could have been deployed by the ROV, cutting and capping the casing was considered unlikely to stem the well flow and could potentially complicate other interventions;
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(c) a support vessel for the ROV would have to have been within 800m of the WHP and West Atlas;

(d) there was an ever present risk of a fire;

(e) PTTEPAA assessed the safety risks as severe and that the risks could not be mitigated to the point where it was ALARP, particularly when considered against the other option of a relief well which did not involve putting personnel on the WHP; and

(f) given NOPSA’s rejection of the Safety Case for Deluge (other than for fire-fighting) which involved placing personnel closer than 2km from the WHP in order to apply the deluge (prior to a fire), PTTEPAA anticipated that NOPSA would refuse a Safety Case revision to permit either of the Sub-sea options given the potential risks created by having personnel in close vicinity to the WHP and West Atlas.

E Relief Well Option

23 On 23 August 2009 PTTEPAA decided to drill a relief well (while continuing to examine the technical requirements and safety risks in relation to the alternative Capping Option).

24 In summary, the plan was to:

(a) drill a conventional well towards a point in the H1 Well about 100m above the 244mm float shoe (Relief Well);

(b) drill the Relief Well past the H1 Well and use vector magnetic passive ranging to enable the Relief Well to be plugged back and sidetracked to intercept the H1 Well;

(c) once the H1 Well had been penetrated, circulate drilling fluids (Mud) to stem the Uncontrolled Release; and

(d) install cement plugs using the Relief Well and/or mechanical plug using wireline equipment at the WHP.

25 To put the Relief Well operations in perspective, the Relief Well team was tasked with locating and intersecting a section of 244mm diameter casing, located approximately 2,700m below sea level.
To drill the Relief Well it was necessary to locate another drilling rig. Between 21 and 23 August 2009 PTTEPAA conducted enquiries and investigations with a number of drilling rig owners/operators to determine whether a drilling rig could be contracted.

A jack-up rig, the *West Triton*, located in Batam Indonesia (owned by Atlas Drilling, who operated the *West Atlas*) was not under contract and could be made available to drill the Relief Well. Given the availability of the *West Triton*, on 23 August 2009 PTTEPAA contracted the *West Triton*. Personnel were immediately dispatched to Singapore to prepare the *West Triton* for the relief well operation.

While the *West Triton* was being prepared, PTTEPAA continued to pursue and evaluate the other rig options to see if another rig would be available earlier than the *West Triton*. Three other rigs were considered for use:

(a) a jack-up rig, the *Ocean Shield*, operated by Diamond Offshore, which was working for ENI Australia (*ENI*) at the Black Tip field in the Joseph Bonaparte Gulf in the Timor Sea at the time of the Uncontrolled Release:

(i) ENI was on a tight program to enable them to produce first gas and meet its contractual arrangements to the Power & Water Corporation, in the Northern Territory. The *Ocean Shield* was engaged in operations that would not allow for it to be made available immediately. There would be a point in the future at which time it would be possible to release the rig, but that would compromise ENI’s ability to meet its contractual commitments. Even in the event the rig was released at this future time, it would have only allowed the rig to be at the Relief Well location within days of the anticipated arrival of the *West Triton*;

(ii) ENI discussed the requirement for indemnities to be provided by PTTEPAA for the use of the *Ocean Shield* in light of ENI’s contractual arrangements with Power & Water Corporation. PTTEPAA asked for ENI to come back with a proposal in writing. When PTTEPAA followed up with ENI the Blacktip drilling programme had reached a stage where the *Ocean Shield* was not able to be released for a number of days which would put its forecast
timeframe for arrival at the Montara field beyond the forecast timeline for the West Triton’s arrival at the Montara field;

(iii) consequently, investigations into using the Ocean Shield were not further pursued.

(b) a jack-up rig, the Ensco 104, operated by Ensco, which was working for Conoco Phillips at Bayu-Undan in the Joint Petroleum Development Area (JPDA) at the time of the Uncontrolled Release:

(i) this rig could not be released due to the stage that the drilling programme had reached. As with the Ocean Shield, there would be a point in the future at which time it would be possible to release the Ensco 104, but by that time, it would have only allowed the rig to be at the Relief Well location within days of the anticipated arrival of the West Triton;

(ii) consequently, investigations into using the Ensco 104 were not further pursued; and

(c) a semi-submersible rig, the Songa Mecur, which was contracted to TOTAL in Dampier and due to start work for Woodside about a month later. It was decided the Songa Mecur was not appropriate for the following reasons:

(i) as it is a floating rig it required anchoring which is likely to have necessitated anchor handling vessels being located close to the WHP within the gas plume;

(ii) critical magnetic ranging data is best gathered from a fixed platform (rather than a floating platform) as each time the Target is missed, several days are required to make another attempt and there is greater propensity to miss from a floating platform; and

(iii) once the Target casing was intercepted it was necessary to rapidly pump a large amount of Mud into the H1 Well. ALERT initially advised that approximately 2,700bbls of Mud would be needed for the H1 Well kill. While the Songa Mecur had Mud carrying capacity of 2,700bbls, the amount
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of Mud required for the H1 Well kill was revised up several times, with
hydraulics modelling specialists, Add Energy (who were experts assisting
ALERT), finally indicating that 3,400bbls of Mud would be needed to stop
the flow.

29 The West Triton left Singapore on 27 August 2009, less than a week after the Uncontrolled
Release and arrived at the site on 11 September 2009.

F Formal applications, revisions and approvals

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<tr>
<th>Date</th>
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| 28 August 2009  | Atlas Drilling submitted to NOPSA a revised safety case for the operations stage of the West Triton in relation to operations on the Montara H1 ST1 RW1 relief well, comprising Doc No HSE SCR WT 00001, Rev 0, dated 28 August 2009 and the West Triton Safety Case Revision 1, dated 21 December 2007. | 7 September 2009
 |
| 1 September 2009| PTTEPAA sent NTDRDPIFR an application for approval to drill the Relief Well (Montara H1 ST1 RW1) in accordance with its drilling program entitled “Montara H1 ST1 RW1 Well Operations Management Plan WOMP Document Number TM-CR-MON-G-150-00009, Revision 0”. | 10 September 2009
 |
| 2 September 2009| PTTEPAA provided NTDRDPIFR with addendums to the:                                      | 10 September 2009
 |
|                | - Environment Plan for the Montara Development Installation and Commissioning activities in licence areas AC/L7 and AC/L8, (documents number TM-CR-GEN–G-091-00002, April 2008 Rev O and TM-CR-GEN–G-091-00002, | NTDRDPIFR accepted revisions to environment plans |
|                |                                                                                         |                                                                                         |
June 2009 Rev 1) This addendum covered the proposed water deluge operations at the Montara wellhead platform and West Atlas drilling rig; and

- Environment Plan for Exploration and Production Drilling activities in licence areas AC/ L7 and AC/L8 (document number TM-CR-GEN–G-091-00001, October 2007 Rev 0). This addendum covered the drilling activities for the relief well Montara H1 ST1 RW1,

and applied under Regulation (17)(1)(a) of the WOMP Regulations to the department as Designated Authority to accept the addendum as a revision to the plan.

3 September 2009 PTTEPAA (referring to AMSA’s confirmation by letter of 22 August 2009 of the transfer of control of the oil spill response to it using the National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances National Plan pursuant to Part 9 of the EPBC Act), notified AMSA that PTTEPAA was granted approval to drill and operate wells in the Montara development area for the purpose of oil production; and that this Approved Action was subject to conditions including that PTTEPAA must submit and adhere to an Oil Spill Contingency Plan.

It stated further that:

- Section 134 (1) of the EPBC Act states that if another person (AMSA) is authorised to undertake any part of the Approved Action on behalf of another PTTEPAA then the
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<tr>
<td>7 September 2009</td>
<td>PTTEPAA submitted document to NOPSA entitled “Montara H1 ST1 Well Release Response - Case for Safety Revision 2”, dated 7 September 2009 describing its risk assessment in relation to proposed operations to carry out water deluge (and contingently fire-fighting) operations utilising equipment and personnel on support vessels located near the Montara Wellhead Platform facility, by way of an application by PTTEPAA for NOPSA’s agreement to the NOPSA Prohibition Notice ceasing to have effect to the extent that any person is placed at or near the facility for the purposes of those proposed operations.</td>
<td>11 September 2009</td>
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<td>NOPSA issued a revised Prohibition Notice the effect of which was to only permit such proposed operations in the event of ignition (ie. for fire-fighting).</td>
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<td>NOPSA requested that PTTEPAA submit a revised safety case for the Montara Wellhead Platform facility addressing the initial investigative activities to assess the condition of the facility, activities associated with the implementation of well control barrier(s) into the H1 ST1 well and activities to verify the integrity of the facility, which revised safety case would only take effect after PTTEPAA had demonstrated at least one effective well control barrier in the H1 ST1 well.</td>
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<td>9 September 2009</td>
<td>PTTEPAA sent NTDRDPIFR an application for approval to drill the relief well Montara H1 ST1 RW1 in accordance with its drilling program entitled “Montara H1 ST1 RW1 Drilling Program Revision 1” - Document Number TM-CR-GEN-R-150-00015</td>
<td>10 September 2009</td>
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<td>NTDRDPIFR, in accordance with Regulation (17)(1)(a) of the WOMP Regulations approved PTTEPAA’s application to drill the relief well Montara H1 ST1 RW1 in accordance with its drilling program entitled “Montara H1 ST1 RW1 Drilling Program” - Document Number TM-</td>
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<td>18 September 2009</td>
<td>PTTEPAA sent NTDRDPIFR an application to continue drilling the relief well Montara H1 ST1 RW1 in accordance with its drilling program entitled “Montara H1 ST1 RW1 Drilling Program Revision 2” - Document Number TM-CR-GEN-R-150-00015.</td>
<td>21 September 2009 NTDRDPIFR, in accordance with Regulation (17)(1)(a) of the WOMP Regulations approved PTTEPAA’s application to continue drilling the relief well Montara H1 ST1 RW1 in accordance with its drilling program entitled “Montara H1 ST1 RW1 Drilling Program” - Document Number TM-CR-GEN-R-150-00015, Revision 2.</td>
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<tr>
<td>21 September 2009</td>
<td>PTTEPAA submitted a revised safety case for the Montara Wellhead Platform facility addressing the initial investigative activities to assess the condition of the facility, activities associated with the implementation of additional well control barrier(s) into the H1 ST1 well and activities to verify the integrity of the facility, which revised safety case would only take effect after PTTEPAA had demonstrated at least one effective well control barrier in the H1 ST1 well. This was in response to NOPSA’s request for same on 11 September 2009.</td>
<td>2 November 2009 NTDRDPIFR, in accordance with Regulation 17(1)(e) of the WOMP Regulations, approved PTTEPAA’s application to suspend the Montara H1 ST1 RW1 relief well by undertaking well plugging operations at the Montara wellhead platform (subject to successful ‘killing’ of the H1 well from the relief well) in accordance with its program in the document entitled “Montara H1 ST1 Well Control Operations WHP Clearing Plugging Operations on H1 ST 1”, Number TM-CR-GEN-N-090-00006.</td>
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<tr>
<td>2 October 2009</td>
<td>PTTEPAA applied to the NTDRDPIFR for approval to suspend the Montara H1 ST1 RW1 relief well by undertaking well plugging operations at the Montara wellhead platform (subject to successful ‘killing’ of the H1 well from the relief well) in accordance with its program in the document entitled “Montara H1 ST1 Well Control Operations WHP Clearing Plugging Operations on H1 ST 1”, Number TM-CR-GEN-N-090-00006.</td>
<td>7 October 2009 The NTDRDPIFR, in accordance with Regulation 17(1)(e) of the WOMP Regulations, approved PTTEPAA’s application to suspend the Montara H1 ST1 RW1 relief well by undertaking well plugging operations at the Montara wellhead platform (subsequent to the successful ‘killing’ of the H1 well from the relief well) in accordance with its program in the document entitled “Montara H1 ST1 Well Control Operations WHP Clearing Plugging Operations on H1 ST 1”, Number TM-CR-GEN-N-090-00006.</td>
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The approval was subject to NOPSA lifting its Prohibition Notice so that PTTEPAA personnel and its associated contractors were allowed to board the Montara Wellhead Platform and West Atlas rig.

6 October 2009
PTTEPAA provided the NTDRDPIFR with an application for approval to sidetrack Montara H1 ST1 RW1 ST in accordance with Regulation 17(1)(a) of the WOMP Regulations.

7 October 2009
The NTDRDPIFR, in accordance with Regulation 17(1)(e) of the WOMP Regulations, approved PTTEPAA’s application to side-track Montara H1 ST1 RW1.

14 October 2009
PTTEPAA provided the NTDRDPIFR with an application for approval to sidetrack Montara H1 ST1 RW1 ST.

14 October 2009
NTDRDPIFR provided PTTEPAA with preliminary approval to sidetrack Montara H1 ST1 RW1 in accordance with Regulation 17(1)(a) of the WOMP Regulations.

17 October 2009
PTTEPAA provided the NTDRDPIFR with an application for approval to sidetrack Montara H1 ST1 RW1 ST.

17 October 2009
NTDRDPIFR provided PTTEPAA with preliminary approval to sidetrack Montara H1 ST1 RW1 in accordance with Regulation 17(1)(a) of the WOMP Regulations.

20 October 2009
PTTEPAA provided the NTDRDPIFR with an application for approval to sidetrack Montara H1 ST1 RW1 ST.

20 October 2009
NTDRDPIFR provided PTTEPAA with preliminary approval to sidetrack Montara H1 ST1 RW1 subject to receipt of its formal application and revised well bore schematic in accordance with Regulation 17(1)(a) of the WOMP Regulations.

23 October 2009
PTTEPAA provided the NTDRDPIFR with an application for approval to sidetrack Montara H1 ST1 RW1 ST.

23 October 2009
NTDRDPIFR provided PTTEPAA with preliminary approval to sidetrack Montara H1 ST1 RW1 in accordance
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| 26 October 2009    | PTTEPAA provided the NTDRDPIFR with an application for approval to sidetrack Montara H1 ST1 RW1 ST.                                                                                                           | 26 October 2009  
The NTDRDPIFR approved PTTEPAA’s application for approval to sidetrack Montara H1 ST1 RW1 in accordance with Regulation 17(1)(a) of the WOMP Regulations |
| 20 November 2009   | PTTEPAA provided to NOPSA a further revision of its safety case for the Montara Wellhead Platform facility addressing the initial investigative activities to assess the condition of the facility, activities associated with the implementation of well control barrier(s) into the H1 ST1 well and activities to verify the integrity of the facility, which revised safety case would only take effect after PTTEPAA had demonstrated at least one effective well control barrier in the H1 ST1 well, dated 20 November 2009. | 20 November 2009
NOPSA accepted, in accordance with Regulation 38 of the MOSOF Regulations, safety case revisions by:  
- Atlas Drilling - received by letter earlier that day in response to NOPSA request on or about 2 November 2009 and being the West Atlas Safety Case, Revision 1 dated 4 July 2007 and the revision to the West Atlas safety case entitled “HSE SCR WA 11-2009, Revision 0.2”, dated 20 November 2009; and  
- PTTEPAA - received by letter dated 6 November 2009 in response to NOPSA request on or about 2 November 2009 and being the Montara Development Construction and Installation Safety Case WHP Boarding, Investigation, Integrity Inspection and H1-ST1 Well Plugging Revision, dated 6 November 2009 to reboard respectively the West Atlas and Montara well head platform facility in order to assess the condition of the facility and to conduct activities associated with the implementation of additional well control barrier(s) into the H1 ST1 well and activities to verify the integrity of the facility. |
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<tr>
<td>25 November 2009</td>
<td>PTTEPAA provided the NTDRDPIFR with an application for approval to suspend the development well Montara H1 ST1.</td>
<td>25 November 2009 NTDRDPIFR approved the application in accordance with Regulation 17(1)(d) of the WOMP Regulations.</td>
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<tr>
<td>25 November 2009</td>
<td>PTTEPAA provided the NTDRDPIFR with an application for approval to plug and abandon the relief well.</td>
<td>25 November 2009 NTDRDPIFR approved the application in accordance with Regulation 17(1)(d) of the WOMP Regulations.</td>
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G Relief Well Plan

The approach taken in performing the intercept was systematic and researched. The process involved the following:

(a) identifying an appropriate location to drill the Relief Well - a location approximately 2km from the WHP was chosen following consideration of the ocean currents, wind and the geometry of the H1 Well;

(b) applying sophisticated surveying techniques to more accurately determine the location of the H1 Well and proposed interception point (Target). The original H1 Well was drilled using a rotary steerable system and surveyed from surface to well total depth (TD) at 3,786m. A survey was run in the 340mm casing and these surveys were used as final to replace the “as drilled” surveys. Following the Uncontrolled Release, surveys were reprocessed using infield reference (IFR) modelling. The IFR data for the Montara Field was obtained from British Geological Society in the United Kingdom. Reprocessing these surveys reduced the “cone of uncertainty” at the Target from 34.1m radius to 10.9m radius. The proposal was to reprocess the Relief Well surveys during the drilling operations. Additionally a Keeper Gyro would be run in the 244mm liner to minimise the “cone of uncertainty” on the Relief Well. A Keeper Gyro is a gyroscopic survey tool that has better mechanical accuracy than the
magnetic compass in the MWD tools. Using a gyroscopic survey improves overall accuracy;

(c) using the specialist directional driller Schlumberger, who are recognised world leaders in their field;

(d) setting a 508mm conductor;

(e) setting a 340mm casing approximately 100m above the Puffin formation of sand and installing a BOP;

(f) setting a 244mm liner in the shales approximately 300-400m above the Target. The choice to run a 244mm liner was based on the results of the well kill modelling which indicated that a large volume of mud would be required to be delivered to the H1 Well initially very quickly. The large annulus created by the 244mm liner as opposed to casing allowed for the Relief Well to carry a larger volume of Mud that could be replaced quickly by pumping down the annulus. Also, additional distance was required in order to directionally drill in the 216mm hole;

(g) drilling a 216mm hole section down to approximately 5 metres above the Target, then pulling out the drilling assembly and running the milling assembly. The drilling assembly was appropriate for directional drilling but sub-optimal for the well kill process. The milling assembly was optimised for cutting a hole in the Target casing and delivering high fluid volumes quickly;

(h) drilling with the milling assembly in an attempt to intercept the H1 Well at a vertical depth of approximately 2,655m below the rotary table which equated to a measured depth of approximately 2,741m (first pass);

(i) as it is unusual to intersect the Target on the first pass, using specialist ranging tools to assist in locating and intercepting the H1 Well. Only two companies in the world perform this type of specialist work and both were consulted by PTTEPAA. PTTEPAA engaged the New York based company Vector Magnetics to operate a specialist vector magnetic tool that emits a current to charge the steel casing of the H1 Well. The casing then emits an electromagnetic field which is detected by tool
sensors. A surface computer uses the readings to calculate the distance and direction of the casing from the current location;

[j] running a Vector Magnetics ranging tool to establish a bearing and distance to the Target;

[k] cementing the first pass hole and drilling a new hole taking into account the data received from the ranging tool;

[l] several ranging runs and the drilling of further holes were expected to narrow the “cone of uncertainty”. Each successive pass sequence would take up to four days to complete;

[m] once the H1 Well was intersected, pumping Mud to overcome the flow in the H1 Well and to kill it. This would require a large quantity of Mud to be pumped quickly into the H1 Well as the initial Mud delivered is contaminated by leaking gas before sufficient density of Mud is achieved to bring the flow under control. A Mud density of 1.3sg was calculated as being heavy enough to do the job but not so heavy that it was going to cause fractures in the formations. This phase of the operation would need to be undertaken during daylight hours for safety reasons;

[n] setting two mechanical plugs in the H1 Well from the WHP; and

[o] pressure testing the mechanical plugs.
Drilling the Relief Well

31 Drilling of the Relief Well began on 14 September 2009.

32 An initial 660mm (26”) diameter hole was drilled to a depth of 149m and the Conductor was run and cemented into position on 15 September 2009.

33 The drilling of a 445mm (17 1/2”) diameter hole to a depth of 1,622m was completed on 21 September 2009.

34 The 340mm casing was inserted into the well and cemented into position on 22 September 2009.

35 At this point, the 340mm shoe was around 1000m vertically above the H1 Well.

36 On 24 September 2009, the 311mm (12 1/4”) hole was drilled to a depth of 2,300m.

37 On 30 September 2009, the 244mm liner was inserted into the Relief Well.

38 By 5 October 2009, the 216mm (8 1/2”) hole for the final section from 2,375m to 2,600m was in position approximately 5m above the H1 Well.

39 The first attempt to intersect the H1 Well was made on 6 October 2009. This attempt was unsuccessful and the Relief Well was drilled past the H1 Well.
The ranging tool was run and identified the H1 Well casing to be within a range of 4.5m ±1.0m.

Via media releases and continuous contact between the Chief Operating Officer of PTTEPAA and the regulators, principally the Commonwealth Department of Resources Energy and Tourism (DRET), PTTEPAA had informed the regulators and the public that it was anticipated it would take a number of attempts to intersect the H1 Well.

The end of the Relief Well was plugged with cement and the direction of the drilling changed based on the data received from the ranging tool.
The second attempt to intercept the H1 Well was made on 13 October 2009. This attempt was unsuccessful and the Relief Well was again drilled past the H1 Well. The ranging tool was run and identified the H1 Well casing to be within a range of 0.7m ±0.5m. The end of the Relief Well was plugged with cement and the direction of the drilling changed based on the data received from the ranging tool.

A third attempt to intercept the H1 Well was made on 17 October 2009. This attempt was unsuccessful and the Relief Well was again drilled past the H1 Well. The ranging tool was run and identified the H1 well casing to be within a range of 0.53m ±0.05m. The end of the Relief Well was plugged with cement and the direction of the drilling changed based on the data received from the ranging tool.

The next approach was to calculate where to place a whipstock in the well. A whipstock is a wedge-shaped block that was lowered into the Relief Well to divert the drill bit onto a chosen path at an angle to the originally drilled hole.

On 24 October 2009, the whipstock became stuck while it was being deployed about 30m above where it needed to be. Two attempts to recover the whipstock were unsuccessful. It was then decided to back up the hole (about 100 metres) and side track again.

On 28 October 2009 the Relief Well was drilled down again in a slightly different direction and the milling assembly was run.

The H1 Well was successfully intercepted at approximately 9.30am on 1 November 2009.
Operations to complete the well kill by pumping the heavy Mud down the Relief Well and into the H1 Well commenced on 1 November 2009. After almost all of the available Mud had been pumped, the Uncontrolled Release had been reduced considerably but the H1 Well had not been killed completely. It was necessary to stop pumping Mud and begin pumping seawater.

At approximately 12.10pm on 1 November 2009, a fire broke out on the WHP around the cantilever of the West Atlas.

After further risk assessments were conducted which indicated it would be safe to use, on 1 November 2009 it was decided to pump heavier 1.6sg Mud into the H1 Well. The mixture of heavier Mud was designed to backflow along the H1 Well, stopping the Uncontrolled Release and cutting off the fuel source for the fire at the WHP.

There was enough material available in field to build the 1.6sg Mud but there was not enough Mud chemicals available in field to have additional backup once the new 1.6sg Mud was used. In order to increase the Mud from 1.3sg to 1.6sg, it was necessary to source additional Barite from various locations. Barite is the rock dust used to add density to the Mud. Preparation of the 1.6sg Mud was completed by 3 November 2009. During this time, seawater was continuously pumped into the H1 Well to keep the Uncontrolled Release under control.

On 3 November 2009, after approximately 3,400 barrels of 1.6sg Mud had been pumped into the H1 Well, the Uncontrolled Release stopped.

Due to the increased safety risk to personnel because of the fire damage to the West Atlas and WHP, it was decided not to set two mechanical plugs in the H1 Well from the WHP as originally proposed. The alternative plan (which involved less safety risk as less people were required to be on the WHP and for less time than the mechanical plugging option) was implemented. This involved pumping cement from the West Triton down the Relief Well to cement off the H1 Well and then boarding the WHP in order to carry out a confirmatory test of the cementing.
Approximately 320 barrels of cement were pumped into the H1 Well.

Following acceptance by NOPSA of Atlas Drilling’s and PTTEPAA’s Safety Case revisions to reboard the West Atlas and WHP, an ALERT team boarded the West Atlas on 22 November 2009 and the WHP on 23 November 2009 to evaluate their condition and identify hazards so as to inform PTTEPAA’s safety and operational planning to test the cementing and further secure the H1 Well with mechanical barriers.
Subsequently on 30 November 2009 an inflatable packer was installed into the H1 Well at the WHP and activated to pressure test the H1 Well. The pressure test could not be completed due to an issue with the inflatable packer.
While the packer was being checked for faults two isolation packers (mechanical plugs) were installed. The first was fed down the H1 Well with a motion sensor and pressure sensor attached. When the packer reached the programmed depth of 2,000m, a setting sequence was initiated which completed the installation.
The second isolation packer was then fed down the H1 Well to approximately 1,800m and set. This provided a second mechanical barrier in the H1 Well.

The final step in securing the H1 Well is scheduled to occur in late December 2009. The plan is to re-install the inflatable packer to pressure test the two isolation barriers to confirm they are secure and to install a 340mm pressure containing corrosion cap.